Balkan Cyberia

Cold War Computing, Bulgarian Modernization, and the Information Age behind the Iron Curtain

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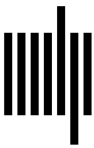

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THE CONJUNCTURE: THE ROAD TO THE BULGARIAN ELECTRONICS INDUSTRY

At the end of the 1950s, socialist Bulgaria didn't look too different from most countries that had undertaken the Stalinist path of development—a communist party sat atop the political peaks, having eliminated all its opponents, and the government presided over a rapidly urbanizing and industrializing society. In the sphere of technology and economic planning, gigantism ruled, as well as such industries as iron, coal, and power generation. But these years were also a conjuncture that paved the way for the take-off of Bulgarian electronics in the following decade, as three main events combined—a victory, a crisis, and a possibility.

As Khrushchev's Secret Speech blew open the horizons of communist orthodoxy in 1956, the Bulgarian Communist Party (BCP) started taking stock of the achievements of its first few years in power. By 1958, at the end of the second five-year plan (1953–1958), it proclaimed its seventh Congress that of "victorious socialism," a politically important watershed. At the same time, the BCP finally looked at its accounts and realized that it was facing its first and very serious debt crisis. The confidence of the victory was thus combined with the doubts of financial emergency, and the party's future had to be put on a new footing. This new path, however, would lie at least in part in the new world that the Thaw was opening up before the Eastern Bloc—a softening rhetoric toward capitalism and the possibility of contacts with the West. Closer to home, the autarkic nature

of Stalinism was making way for a move toward true cooperation within Comecon itself, as the possibilities of an international division of labor were discussed and specializations in technological areas loomed. Historians have recently finally begun to focus on the long-neglected Comecon as a field of mutual cooperation, but they largely concentrate on the later 1960s and 1970s, when it formed its main intergovernmental bodies.[1] Yet by the late 1950s and early 1960s, it was clear that this period was coming, at least to some party officials. It was at the juncture of these three factors that the surprising electronics revolution in the following decade was made thinkable.

This chapter thus highlights the 1956–1965 period as the culmination of several medium and long-term trends in Bulgarian development that constitute the prehistory of the country's computer industry. Having exhausted the benefits of Stalinist-type industrialization, the BCP faced the specter of continual peripheral status within the framework of a socialist economic world order that beckoned, as its allies sought to delegate it to the position of agricultural producer. The chapter shows how such factors combined to drive the party into an identity crisis, to which the technological solution of electronics proved an attractive solution. In this context, particular individuals could enact structural changes, and this chapter highlights the role of the father of the electronics industry in Bulgaria: Ivan Popov.

ALWAYS THE PERIPHERY?

Some of the first theories of international development used the region of Eastern Europe as their case studies of backwardness, with the Balkans figuring prominently. Paul Rosenstein-Rodan and Kurt Mandelbaum dubbed it an area of disguised rural unemployment, lacking in structural investment, and in dire need of basic infrastructure. One of the potential paths for unlocking this was the big push model which Rosenstein-Rodan advocated, stating that bit-by-bit investment, especially by the private sector, would never suffice to save South-Eastern Europe from the low-level equilibrium trap that it was in. The state would decisively have to step in and uplift multiple sectors of the economy at once. While neither economist pushed for Stalinist-style economics, in effect they had already identified some of the key characteristics of the path Bulgaria and others took after 1945 to tackle

their underdevelopment.[2] Moreover, these debates overlapped with internal Bulgarian ones on the state of the country's development, which also identified the lack of necessary investment capabilities in the local private sector and the problem of the massive surplus labor force locked to the land. Segments of the Bulgarian intelligentsia itself thus understood their country to be backward, perpetually playing catch-up but lacking the right tools to develop at the necessary pace. It saw the problems as the weak development of the market-oriented sector, too much reliance on a state (which was weak anyway), and the predominance of the small producer as the main figure in industry.[3]

In the memorable phrase of economic historian Iliiana Marcheva, Bulgaria's history of modernization after 1878 swung between industrialization and agrarianism. Liberation from the Ottoman Empire brought political independence but an economic loss—the nascent textile industry depended on state contracts from the Sultan's army, and Bulgarian traders had made their money thanks to access to the large markets of Constantinople but also those of Syria and Egypt. The paucity of available capital or raw resources, as well as the periodic losses of foreign markets, made independent Bulgaria's capitalism dependent on the state. Through both an oversized state sector and its economic policies of étatism and protectionism, the Bulgarian state was a major force in development, a path not too unlike many other newly independent countries in Europe.[4] It is too much to call the developments in Bulgaria in those years "evolution without development," as Michael Palairet did, but growth was lopsided, and industry was slow to appear.[5] By the 1940s, all results so far achieved still left Bulgaria a lagging agrarian state on the European periphery.[6] The securing of a large foreign market remained key, too—after the Ottomans, Bulgaria had fallen for a time in the sphere of German trade, but the Nazi defeat foreclosed that access as well.

During the late 1930s and the 1940s, only around 8 percent of national income was produced by industry, of which over half was in the food sector, which included the profitable tobacco industry.[7] Sectors such as metallurgy or power generation were negligible, each supplying less than 5 percent of an already meager total industrial output.[8] The sector was characterized by an almost artisanal nature in its scale and agglomeration: In 1939, there were 3,355 private enterprises with more than ten workers

or output of energy higher than 10 horsepower, accounting for 10 percent of all production in industry.[9] Hampered by the weak investment power of the Bulgarian bourgeoisie, with only around 500 joint-stock companies in the whole country, the state established some of the very high protectionist barriers, ensuring a captive market.[10] Similar to its neighbors in terms of low industrial development, the country was lagging by a factor of 10 to 30 behind its Central and Western European counterparts, to which it was aspiring, in this indicator.[11] By 1946, the rural population was still more than 80 percent of the total; less than 9 percent of people were employed in industry, and even then, around 2–3 percent of them were employed in the heavier sectors.[12] This was the proletariat that the BCP inherited.

Jan Gross was right to point out that socialist industrialization was a continuation of already existing tendencies of state economic intervention in the region, amplified by the Second World War,[13] but the transformation of agricultural Bulgaria into a modern and industrial country was the explicit aim of the newly installed BCP from the very start. The first Economic Declaration, of September 1945, stated that its aim was "accelerating all aspects of economic development in Bulgaria in such a way as to turn it, in the shortest amount of time possible, into a modern industrial and agriculturally prosperous country."[14] The first five-year plan of the BCP, started in 1949, put this into practice, earmarking over 80 percent of investment for the heavy industrial sector, with the aim of leaving the agricultural past behind. This went hand in hand with widespread nationalization, and by 1951, around 86 percent of industry was in state hands. Together with the problems of this industrialization, such as falling real wages, concrete truths were created, such as 26 power stations, the first sizeable metallurgical factories, and reservoirs. Bulgaria got its own planned city as a monument to Stalinist modernity—Dimitrovgrad—complete with gargantuan chemical works.[15]

The following five-year plan tried to rectify some of the shortfalls of this gargantuan industrial effort, mainly in goods for the wider population and agriculture. The death of Stalin in March 1953 let loose new policies but also some tremors that were caused by the intense drive of the plan—in May, tobacco workers in Plovdiv rose up against low wages and high norms, and were violently repressed by the militia. Yet the Party's lower

rates of investment in areas such as metallurgy or extraction didn't signal a retreat from the general path taken in the late 1940s, and uprisings such as those in Plovdiv did not directly threaten its power. Instead, the BCP felt confident enough to tackle the big task of building socialism—the problem of agriculture and collectivization. The peaks of this in Bulgaria came in 1955–1956, and by 1958, over 92 percent of arable land was united in the local collective farm form TKZS. This was also the year that Bulgarian agriculture finally reached and exceeded its prewar (1939) levels of production, thanks to lower fertilizer and seed costs, and higher prices paid for grains by the state. This victory was key for the party, as it seemed to prove that it had tackled successfully the agricultural issue in a country whose prewar politics often revolved around the land issue.[16] Moreover, the growth and delivery of consumer goods did not materialize as promised, and despite the temporary growth in unemployment during the mid-1950s, during that decade Bulgaria maintained one of the highest rates of economic growth in the world, at 14.8 percent (also higher than the Comecon average of 12.1 percent).[17]

Alongside the appearance of smokestacks in hitherto nonindustrial cities, or dams in remote mountain areas, there was another visual clue to the transformation that Bulgaria was going through: the streaming of people into the towns and cities. Between 1953 and 1956 alone, more than 410,000 people moved from villages to towns, accounting for two thirds of internal migrations during the period. For the 1955–1959 period, just under 69,000 people per year moved from villages to towns. Work opportunities in the towns and agricultural collectivization meant that between 1947 and 1967, a staggering 1.3 million people left the villages (with a further 440,000 leaving by 1972), completely changing the demographic landscape of bucolic Bulgaria—a process that was accelerated to gigantic proportions precisely in the 1950s.[18] Bulgaria became one of the fastest urbanizing countries in Europe, prompting the state to widen the regime of address registrations that were applied by the Tsarist government to Sofia citizenship in 1942, expanding them to other major cities in 1955. Eventually, most towns in Bulgaria would be subject to address registrations tied to workplace, which was an attempt to direct these massive migration flows. Despite this fraught urbanization, with its often shoddy

housing, this country was on the move—in temporal and spatial terms. The road from the village to the town had a sociopolitical goal, which was simple: the creation of the proletariat that a country based on its rule sorely lacked. But this was also a move to the future, as socialist modernity was the city, and its civilization could never be based on the farmhand, in ideological terms. This was social engineering on a gargantuan and crude scale, assuming that class consciousness would eventually be formed when you work in a factory and live in a city apartment (even if it wasn't yet built). The space of the factory floor and the home was the site of the future—modern industrial labor, the very thing that the electronics industry would eventually aim to modernize or even replace. The result was that between 1948 and 1960, largely during the first two five-year plans, around 63,000 people per year joined the working class by virtue of their employment. This hyper-proletarization, in human terms, was the social flipside of the hyper-industrialization of the economy during these years.

If in the 1940s the Bulgaria that BCP took over was agricultural, nonindustrial, and rural, then its early years of autarkic-minded industrialization left a very different landscape by the late 1950s. The statistical almanacs of the state, inflated and massaged as they were, still reflected a real change: In 1960, agriculture was down to contributing only 24 percent of national income, while industry was at 58 percent (with construction adding a further 9 percent). Nearly 22 percent of people worked in industry, 5 percent in construction, 4 percent in transport and a further 4 percent in trade—leaving just over 55 percent to agriculture, down from 82 percent 12 years earlier. By 1957, there were over 800,000 people classed as "material sphere workers"—the nascent proletariat of Bulgaria.[19] The growth was uneven, lopsided, lumpy; problems remained in shortages, housing, real wages. Yet there was also a sense of progress, reflected not just in the panegyrics of socialist realist art but also in perceived improvements in life. Most importantly, however, the BCP could now feel that it represented a significant part of the population and was building a country that was succeeding in demonstrating the socialist path of development. The physical landscape was transformed by cities and industries, while the political landscape was now cleared of any last vestiges of potential enemies.

THE CONGRESS OF VICTORY

Celebrating these achievements but also using them as a springboard for the future thus dominated the Seventh Congress of the BCP, held June 2–7, 1958, and named "The Congress of the Victorious Socialist Order." Virtually 100 percent of industry was state-owned, and over 92 percent of land was collectivized, so there was no longer any road back to capitalism. Todor Zhivkov's closing speech stated that the congress "notes the undeniable fact that in the People's Republic of Bulgaria socialism has won and is paramount in all areas of social-political, economic and ideological life."[20] Stating the fact of political victory was important, as despite the repressive apparatus in place or the backing of the USSR, the party had been ideologically rocked by de-Stalinization. Zhivkov himself had emerged the victor of the new "April Line" (named after the April Plenum of 1956, the Bulgarian fallout of the Secret Speech) over the Stalinist figure of Vulko Chervenkov, and the seventh Congress was key in showing that the new line was the natural heir to socialist achievement. Now that the politics were solidified, the BCP could turn toward a future of a better material-technical base and increased socialist consciousness among the populace, with the two going hand in hand.[21] The victory, however, had not been total: The Congress noted discrepancies between its programs and actual social phenomena. For example, it criticized the banning of private plots in many TKZS as being the reason for expected yields not being achieved.[22] The proclamation of victory also changed the framework of expectations—if until now shortcomings or deviations could be explained away by the struggle to solidify the new order or the presence of insidious internal enemies, 1958 was signalling a new phase where such excuses could not fly. No longer would the ends justify the means, as Kandilarov puts it, as the new system would now have to be proven to be superior to the old.[23] This was the start of "real existing socialism"—a self-proclaimed end to its revolutionary maturation and the start of attempts to square the promises with the realities.

The Congress's tone also determined the goals of the third five-year plan. The State Planning Commission was warning that the developments of the 1950s, focused as they were on agriculture and primary industries, was leaving the country further behind its Central European allies. Machine-building was being neglected, as were any kind of high-value-added

goods, condemning the country to a continued Balkan style of a natural resource exporter. At the same time, the economic experts were enamored with the Maoist model unfolding concurrently in the fraternal Chinese nation. The plan was thus colored by a "Great Leap Forward" mentality, aiming at fulfilling the industrial goals in three years and agricultural goals in four years, rather than five.[24] The mark of voluntarism was more pronounced at the November plenum, which set the goal as not mere quantitative improvements, but a qualitative developmental jump into the future.[25] Over two-thirds of investments were earmarked for heavy industries, a sector that was supposed to increase by 77 percent (against an average of 62 percent), with machine-building supposed to be a priority. Yet the gigantism continued—the giant steelworks at Kremikovtzi near Sofia (a site where iron ore proved to be of poor quality), the oil refinery at Burgas, the zinc works at Plovdiv.[26] By 1962, this Leap was officially complete. Yet the Sino-Soviet split, combined with the shortcomings of many of its goals, pushed the party to abandon such Maoist experiments and adopt the more Soviet-influenced long-term development programs that aimed to increase machine-building by a factor of 17 by 1980 (among other sectors—chemical industry output was supposed to increase 25 times!).[27] In many ways, this redirection was the real start of the Bulgarian machine-building industry after its relative neglect in the 1950s. It would be the basis for the construction of communism.

This change also raised a key problem for the BCP—how to move from extensive to intensive growth, now that the expansion of the urban labor force was plateauing and the economy had built up the basic industrial and construction projects that accounted for the hitherto impressive growth numbers. Now individual workers had to become more productive, rather than abstract sectors. Throughout the following decade, various attempts at economic reform would be made, the particulars of which are beyond this book. However, it is their minimization over the 1960s that also make the choice of electronics more understandable, as a "surrogate" sector that could offset the shortcomings of structural reform failures. The period between 1963 and 1968 was marked by attempts to introduce a new system of planning, away from the "leap" and toward steady acceleration. In April 1964, some enterprises started applying the principles of profitability and sales, and they achieved good results—the Bulgarian reforms

were, in some views, a testbed for the Soviet Premier Kosygin's reforms in the USSR itself the following year.[28] These attempts, however, met with serious opposition among members of the Central Committee at plenums in both 1965 and 1966, so that the final decisions made at the July Plenum of 1968 contained a minimalist version of the reform. This was not a radical break with planning, and remained largely within the central-administrative confines of the party-state logic. In many ways it was was stillborn even before it was implemented, and yet it remained the formative economic document over the next 20 years.[29] There were thus heated debates in the party about the very structure of the economy, and the choice of electronics should be seen as an attempt to find a politically neutral solution, or surrogate, for the inability to reach a consensus on the future of economic reform. Of course, this technology and the sector it spawned would have a bearing on subsequent debates and could never have remained "neutral."

But just as the party was turning toward these problems and announcing its victories in socialist construction, it had to face a concrete problem: financing. For unsurprisingly, this solution cost money, and much of that came from outside the country.

BANKRUPTCY

Rapid industrialization demanded machines as well as know-how from abroad. Much of this trade expansion was not only within Comecon, but also with the West: Trade with Western countries increased from $45 million to $200 million between 1954 and 1959.[30] But the export profile of 1950s Bulgaria was poor, and after 1956, its trade balances with both East and West were in the red. Tobacco, grain, vegetables, fruits, seeds, some ores—this was what Bulgaria could export. Agricultural growth was still relatively sluggish, not enough to finance technological imports. Yet import reductions were out of the question, because industrial expansion was paramount and was resource-hungry. Comecon allies often fell short of providing the needed technology, leading Bulgarian enterprises to make up the shortfall in Western markets in pursuit of fulfilling the plan at all costs—and besides, the best-quality goods and machines were available in the Western market.[31]

The regime's foreign trade organizations (VTOs) were poor at their job, too.[32] They underestimated the importance of aesthetic design and were woefully ignorant of local markets. Quota fulfilments also meant that often there were rushes of production toward the end of the year, leading to the dumping of Bulgarian goods onto markets with no regard for local needs. Conversely, the VTOs often bought the wrong technology or ones that enterprises could not implement for years—machines gathered dust in warehouses until they were obsolete. VTOs ended every year with large numbers of unfulfilled aims in both the import and export lines. The years 1956 and 1959 were particularly bad, contributing to a debt in Western currency amounting to 872 million Bulgarian levs by 1959. This equaled $115 million according to official conversion rates, a sum that was significant, given the poor export prognosis.[33]

These loans were Western in a strange way—as they were in fact Soviet. Yet Bulgaria owed Soviet banks based in Paris and London, both branches of Gosbank—the Banque Commerciale pour l'Europe de Nord and Moscow Narodny Bank. Those banks were thus following Western banking laws, and besides, political solutions were less likely, because the USSR was growing impatient after providing further loans in 1957, staving off the worst of the crisis just before the Congress of Victory. By 1959, the financial situation was dire once again, and no more loans were forthcoming.

In early 1960, a delegation made up of the Bulgarian trade representative in Paris, the deputy director of BNB, and the head of a section in the bank, undertook a whirlwind tour of the UK, France, the Federal Republic of Germany, and Italy in a desperate bid for new extensions or credits.[34] Societe Generale, Midland Bank, Westminster Bank, Bank of England, Deutsche Bundesbank, Banca Nazionale del Lavoro: Everywhere the reception was frosty. Even the sympathetic Soviet banks made it clear that the country should build up currency reserves rather than relying on short-term credits. Yet by the middle of the year, the trade balance was a negative 100 million levs and falling rapidly, with no end in sight. Bulgaria was simply producing goods that were uncompetitive even in the Soviet market. In such desperate times, desperate measures were proposed by Kiril Nestorov, the director of national bank BNB: the selling off of Bulgaria's gold reserve of about 21 tons. On May 7, 1960, Nestorov wrote to the President of Gosbank, Alexander Korovushkin, raising the issue as a possibility.[35] The Soviet replied on

the same day, saying it was an option. In fact, the gold itself was already in the USSR, sent there in the 1950s because the BNB did not yet have a nuclear-proof vault, and the gold had been reduced by 14 kilograms after refining in Novosibirsk.[36] The sale was, of course, an extreme step, delaying the ministerial decision until 1961, when BNB had to declare that it had other gold reserves in order to circumvent the law that protected the sale of the state reserve. By the end of the year, more than 20 million levs had been raised by these deposits, with a further delivery of nearly 4 tons of gold in bars and 2 tons in coins to the Moscow Narodny Bank in London in 1963, guaranteeing a further credit of $6 million that year.[37] These were still envisioned as deposits for further loans, but by 1964, Nesterov wrote to Zhivkov asking for the sale of at least 4 tons—in fact, 9 tons were sold on the Zurich gold market by the end of the year, according to Khristo Khristov.[38] Over 30 years later, Zhivkov's memoirs would deny that any such sales happened and stated that he had actually increased the gold reserves to tens of tons.[39]

This drastic step would not be the ultimate solution that the regime sought, and political decisions had to be applied: In 1965, Moscow agreed to forgive Bulgarian debts to its two Gosbank branches, as well as to delivering goods that Bulgaria would otherwise have to buy on the world market. Five thousand tons of cotton, hundreds of tons of key chemicals (such as phenol), 150 tons of nickel—all on top of the normal Soviet contingents for the year—were delivered, easing the problems of Bulgarian industry. Flowing the other way were thousands of tons of sugar, cheese, poultry, and more than 20 million eggs, which the Soviets were to buy at world prices.[40] Despite its industrialization, first following the precepts of orthodox Stalinism and then attempting to emulate Maoism, Bulgaria was still dependent on agriculture in its exports and political negotiation in its finances for the solution of its economic problems. The financial crisis had laid bare to both the BNB and the Politburo the shortcomings of its economy, which needed to radically change its profile. No quantity of eggs or canned tomatoes would ever be able to provide the convertible currency needed to finance the machine-building factories or consumer goods that were part of the long-term development plan (to say nothing of the humiliation of selling off the family gold).

The debt crisis can also be seen as a symptom of increasing participation in world trade. The deep changes in Bulgarian economic structures

during this and subsequent periods were realized with the help of outside resources, whether Soviet or Western credits.[41] Despite being part of a longer history of Bulgarian debt, in which loans were always preferred to foreign investment in the post-1878 period, the scale of economic change and thus indebtedness during the 1950s was unprecedented. Simultaneously enabling modernization and disturbing the state, this entanglement with the international market brought into sharp relief the need for a different structure for Bulgarian exports. What that nature would be was heavily dependent on Comecon, where countries with an industrial pedigree (such as Czechoslovakia) were positioning themselves as suppliers of the latest technologies. If Bulgaria were to avoid remaining the perennial basket-case and breadbasket, it had to utilize the emerging socialist division of labor within the Eastern Bloc to its own advantage.

TOGETHER AGAINST CAPITALISM

Comecon was formed as a reaction to the Marshall Plan in 1949, yet during Stalin's life, it had existed more on paper than in reality. The organization always had a primarily political goal of shoring up Soviet influence in the East and orienting the countries toward Moscow through economic ties. Developmental goals to bring agricultural states like Bulgaria to the same level as advanced industrial countries, such as the GDR, were secondary.[42] Yet the concept of a division of labor was inbuilt in this community from the very start, with member states expected to coordinate on the basis of a general economic plan, which would ensure that the states would complement one another rather than compete in the same sectors. But until the later 1950s, its main success had been in doing its part in solidifying the division of Europe into two competing politico-economic blocs. The blanket application of Stalinist autarkic planning in the early years of industrialization also ran counter to socialist unity, as it encouraged parallel rather than complementary development. Trade continued to be done on a bilateral basis rather than through a common framework.

Stalin's death was a watershed for Comecon as much as it was for most other things. Intra-bloc trade would now be a part of the wider program of finding an economic victory over capitalism.[43] East of the Iron Curtain, the 1955 Warsaw Pact Treaty had already committed the countries to closer

integration in geopolitical matters; to the West, the 1957 Treaty of Rome gave the real start to a European integration that Comecon would both compete with and wish to emulate in some ways.[44] Comecon got its charter in 1959, setting out an organizational structure as well as annual council sessions, an executive council, and permanent commissions on various economic issues. As early as 1956, however, the issues of socialist nations' specialization had been raised, with 600 products earmarked for such treatment. The vast majority of these went to the developed industrial states, contradicting the interests of states such as Bulgaria and highlighting the problem of uneven development.[45] Despite getting some pan-bloc responsibilities in the fields of copper, cement, and certain chemicals (to be developed with allies' machines and plans), the main sectors that fell to Bulgaria were grain and other primary resources.[46] More advanced states argued strongly against Bulgaria getting any machine-building specializations, correctly pointing out its low technological capacities. As Marcheva has stated, these biases remained throughout the late 50s and up until at least 1965.[47] Khrushchev himself supported such a focus for the country and provided loans earmarked for Bulgarian agriculture, light industry, and extractive sectors, after 1955.[48] All these were sectors where profits were low and adding value was difficult. Developmental leaps were not easily built on such exports, and neither were loan repayments.

Yet Comecon itself was changing to become a real multilateral body. In 1962, a Central Dispatching Board was created to unify electrical power systems; in 1963, an International Bank for Economic Cooperation (IBEC) was set up, followed in 1964 by a Bulgarian Foreign Trade Bank, facilitating financial exchange and settlement among member states.[49] Joint institutes were created, such as the Dubna Institute of Nuclear Research (although established in 1956, it became much more active in the early 1960s). This encouraged growth among member states, helping Bulgarian foreign trade blossom to be 2.5 times bigger in the 1958–1962 period, largely within Comecon.[50] Slowly but surely, the organization was growing more ambitious, culminating in the fifteenth Council Session in 1962, where the Basic Principles of the International Socialist Division of Labour were adopted. Bulgaria was one of the countries that saw the dangers of this document, which would concentrate production in developed countries, such as Czechoslovakia. Khrushchev waxed lyrical about a "socialist

commonwealth" under the auspices of a central Comecon planning committee, but this only increased the fears of the poorer members: Unless they could quickly demonstrate machine-building capacities in this new world, they would be doomed to perennial catch-up. Which was precisely what the BCP had been trying to avoid throughout the 1950s.

Zhivkov made promises that Western licenses and know-how would be purchased, and the country would reach new levels in structure-defining sectors. The national jostling within the organization meant that as the GDR and Czechoslovakia defended their positions, Bulgaria was pushed closer toward the USSR in seeking technical assistance. In the short term, this would deliver the industrial capacities it sorely needed but would tie the country to an increasingly less innovative economy in the long run.[51] Throughout 1964, the country cooperated closely with the Soviets, ensuring support for the Kremikovtt͡si steelworks; chemical plants; and new specializations, such as electrocars. Most importantly, it secured a 400 million rouble loan for its economic plan, larger than all the credits envisioned for the period up to 1970. Moreover, Bulgaria was playing a wily political game to garner Soviet favor in distributing the Comecon specialization pie. The most controversial but politically useful move was to suggest to Khrushchev that Bulgaria could become the USSR's sixteenth republic. Patently infeasible, not least due to the international implications, the suggestion demonstrated to Moscow that Sofia was doggedly loyal and interested in closer integration. The benefits, economically, were real, as Bulgaria pulled away from its agricultural role within the socialist family thanks also to Soviet aid.

However, the move toward dividing labor among countries was opposed more vocally by Romania. The 1962 Principle had already been protested by Bucharest on grounds of national sovereignty, which it held to be a key pillar of Comecon. Gheorgiu-Dej railed against the plans, insisting that every country had the right to determine its own road. As countries such as the GDR raised the issue that the 1962 Principles were not being acted on as they required unanimous agreement even when projects did not concern all countries,[52] there were calls for institutional reform to allow groups of countries to move ahead and cooperate. In April 1964, the Romanian party issued a declaration stating that talks of economic integration were "withdrawing the economic activity and decision-making from under the

national authority."[53] The declaration had the desired effect, torpedoing the reforms and ensuring that post-1964 talks were not of integration but of coordination of plans. While Romania was the most vocal, the ideas faced passive resistance from others, including the Bulgarians. A compromise institution—the Bureau for Integrated Planning—limped on as an advisor to the Executive Committee.

The fall of Khrushchev in that year focused the USSR on internal matters, while Hungary and Poland pushed for a convertible currency within Comecon to allow some market relations to emerge in inter-country trade. The "transferable rouble" had already been set up in 1963 with the creation of IBEC, but it was meant for inter-country trade accounts and was not freely convertible into national currencies. The Polish-Hungarian proposals would further the creation of a true supranational credit system and transfer some of the market liberalizations of "goulash communism" to Comecon as a whole.[54] Despite conservativism on the part of many parties, debate continued in specialized journals, where the champions of market mechanisms clashed with those who preferred supranational solutions to socialist development. These debates were helped by increasing East-West meetings, as econometrics, linear programming, and other ideas unified economists on both sides.[55] Although the issue was clearly not being resolved, any intelligent observer could see that the discussions meant that Comecon was perceived to be a vital part of the future, and when Moscow focused on it again, some sort of reorganization would follow.

A less astute observer would have still noted that even in its current form, the organization offered immense possibilities and lifelines. As Randall Stone noted critically, Soviet Bloc trade operated according to complex calculations that underpriced commodities, especially oil, and overpriced machines, which were considered to meet Western standards. Any trade would incur a cost either for the seller or buyer, as world prices could be obtained in Zurich or London. East European satellites tailored their negotiation positions accordingly, taking advantage of highly distorted prices.[56] Stone's influential analysis rings true for the realities of Comecon dealings, where satellites minimized contributions, defended national interests, and extracted the maximum possible from a Soviet partner hampered by its own bureaucratic intransigence that prevented it from enforcing trade commitments. Moscow was politically unwilling to translate

its obvious preponderance into a real integrative project, allowing the socialist division of labor to be hampered by weaker states, such as Romania. At the same time, it was increasing its subsidies to satellites every year, sold them oil at below-market prices, and took more and more goods from them at inflated values. The satellites did not become a real burden, as they offset Soviet costs by other contributions—not least in a military sense, where a full third of European-theater forces were non-Soviet.[57] And so trade was both mismanaged and unbalanced. The satellites could look at the USSR and see a captive market ready to be tapped. If you found a niche in Comecon, your machines would equip enterprises from Berlin to Vladivostok. But that niche had to be new, as it would be suicidal to compete with the GDR in optics or Czechoslovaks in cars, for example. A clever country would find a new sector in which to get a head start, with an eye to the obviously upcoming decisions over the ideas of socialist integration.

Indirectly, Bulgaria benefited from a geopolitical reality that helped it garner more favor and resources. It was the only Warsaw Pact state bordered by two NATO members, and increasingly it was the only reliable member on the Southern Front. The original maverick was Yugoslavia, and Albania became one by 1961. Romania's obstinacy in Comecon was reflected in similar moves in the military sphere—by 1964, it had adopted the policy of nonintervention in other countries' affairs and became the first country to remove KGB supervisors from its intelligence.[58] In 1966, it blocked pretty much every structural change aimed at creating a multilateral military council, culminating famously in their condemnation of the crushing of the Prague Spring.[59] By the 1960s, Bulgaria had assumed an oversized importance to the Warsaw Pact, despite the secondary importance of the Southern Front. Zhivkov used this fact to offset military costs by securing gifts worth hundreds of millions in rubles by both Khrushchev in 1963 and Brezhnev in 1965.[60] Domestic investment could thus be focused on the civilian economy, while tying Moscow to even more aid commitments. Sofia had many tentacles wrapped around its giant patron.

FATHERING BULGARIAN ELECTRONICS

But of all the goods a country could specialize in, why choose electronics? This question can only be answered by the addition of historical

contingency. Bulgaria's turn toward the sphere was driven by a highly connected actor at the peak of political power and the man who every veteran of the future computer industry would name if asked about its genesis. Professor Ivan Popov was, in the words of Vasil Nedev, "[Bulgaria's] biggest scientific industrialist in its whole history . . . the patriarch of its modern industry."[61] Popov is indispensable to the story of Bulgarian socialist modernization as a whole and of electronics in particular. His rare combination of international education, experience, political connections, clout, managerial skills, and personal contact came together in one of those actors who forms one of the sides of historical conjuncture, allowing a single individual to become the main conduit of ideas that could shape entire structures and put them on new paths. As Stoi͡an Markov notes, "he knew that Bulgaria was poor in resources [and] . . . he knew electronics was a profitable area that did not depend on raw resources that Bulgaria lacked."[62] Popov was thus the man who offered solutions to the problems and possibilities outlined in this chapter, championing electronics as the way out of the regime's predicaments and the best way to capture the Comecon and Soviet markets.

Ivan Popov was born in 1907 in the medieval capital of Veliko Tŭrnovo.[63] His parents were socialist schoolteachers who encouraged his studies, which he continued in Sofia in 1921, where he also became a member of the Communist Youth Union, aligned with the "narrow socialists." This was followed by his arrest in the wide anti-communist sweeps after the 1925 Sveta Nedeli͡a terrorist act, for which he was sentenced to two years in prison. After eight months, he was amnestied and continued his studies in the Mathematical Faculty of Sofia University. He showed great aptitude as a student, graduating with distinction and working as an assistant in the Faculty of Higher Analysis in 1930–1931. His first scientific work dates from this time, helping him secure a stipend to Toulouse University in France, from which he graduated in 1933 with a gold medal, specializing in electrical technology and hydrology. He stayed on in Paris to work on the practical applications of his thesis on neutral currents, which he managed to patent. In 1934, he returned to Bulgaria, opening Electrotherma, a private firm that produced heating elements and medical instruments, which proved to be sufficiently successful in the local market to expand in 1939–1941. Political events, however, caught

up with him. He was not a member of the workers' party at this time, but his brother and son-in-law were involved in some capacity, leading to their arrest in 1941 and subsequent execution by firing squad. Understanding his position to be precarious, he left for Budapest, where he worked as a researcher in the Agrolux factory up to 1943 and then as a designer for the German electric equipment producer AEG up to 1945. The end of the war found him as the director of the factory, where he worked hard to prevent its technical equipment from being carted off by the retreating Germans, and he resumed its production lines under Soviet occupation. During this period in Hungary, he traveled widely in Germany, Austria, Czechoslovakia, and France, forging business and personal links with people in the electrical industry throughout Europe. In 1949–1950, he came back to Bulgaria, becoming the director of the power engineering factory "Kliment Voroshilov," which was to become a key school for Bulgarian engineers. During these postwar years, he also bolstered his professional profile with political memberships in line with his youthful convictions—a member of the Hungarian Workers Party between 1945 and 1949, he joined the BCP in 1950. Here, his history as a repressed communist youth combined with his technical experience—in short supply among party members—to facilitate his quick rise through the ranks: head of District Committee, and then member of the Central Committee from 1961. His final position would be the highest—a Politburo membership between 1966 and 1976—concurrent with his apogee as the strategist of the Bulgarian economy.

His economic clout grew more gradually—director of the newly created State Union Elprom, putting him in charge of the growing Bulgarian power industry. At the same time, since 1949, he had resumed his academic career as the head of the Faculty of Electrical Engineering at the State Polytechnic (later the Higher Machine Electrical Institute "Lenin"—VMEI—the premier technical university in the country). His style of work was often authoritarian, and people remember him as an exacting, workaholic, somewhat humorless but always extremely professional, competent, and fair boss.[64] He was always demanding, expecting quick and accurate work by his subordinates, and in return, he championed them in ministries and the party. Because of such methods, he was the subject of a 1952 article in *Rabotnichesko Delo,* titled "Short Circuits," which accused him of authoritarian and dictatorial work in Elprom.[65] Despite a

subsequent rebuttal in the same pages and a disciplinary action against the article's author, in 1952 Popov was moved to a permanent position in the State Polytechnic and dismissed from his managerial positions. In his academic capacity, he developed new programs in engineering education as well as designing electrical engines and regulators that found applications in the industry. His clout meant that between 1954 and 1958, he was deputy rector of VMEI, during which he worked on more than 20 scientific projects and monographs, some published in both Germanies, the USSR, and France. His academic star was shining bright, and after 1958, he spent four years at the prestigious Scientific Research Institute of Electrical Technology Testing in East Berlin, where he was made the head of the section dealing with transformers. Every year he would spend up to four months lecturing in Bulgaria. He was still, however, a relative political unknown. In the apocryphal story, it was during a Zhivkov visit to the GDR that Walter Ulbricht joked that he was thinking of appointing a Bulgarian scientist to the post of deputy minister of the electrical industry—Popov was indeed a member of SED, GDR's ruling Socialist Unity Party, since 1958, continuing his astuteness for the political climate. The more prosaic and likely story is that he came to the attention of Zhivkov in 1961, when he won a prize and doctorate from the Higher Technical School in Ilmenau, and he was recalled to Bulgaria, to become a member of the Central Committee and rector of VMEI in 1962, as well as a member-correspondent of the Bulgarian Academy of Sciences (BAS). This post, however, lasted for only four months, as he was being groomed for the much higher position—head of the newly founded State Committee of Science and Technical Progress (CSTP), the successor to the Technical Progress Committee founded in 1959. This organization and position, the importance of which will be seen in chapter 2, gave Popov the commanding heights over the strategic direction in Bulgaria of research, innovation and its implementation into industry, and power over the universities and BAS. In party economic terms, he was now one of the most powerful people in the country; in terms of party science policy, he was unquestionably the most dominant. It was during this quick rise that he also became one of Zhivkov's favorites, who saw in him a capable and innovative professional.

At the start of this pivotal moment for Bulgarian policy in the early 1960s, Popov was almost unique among high-ranking BCP members—he

had an internationally tested and recognized expertise in a technological field. He was also fluent in Hungarian, Russian, German, and French (skills bolstered, as he joked, by marriages to both a French and a German wife), unheard of among the mostly monolingual BCP functionaries and, together with his contacts cultivated in the 1930s and 1940s, giving him unprecedented access to foreign ideas and industrial trends. His own expertise in power and electrical engineering kept him interested in the latest global trends in this field, and it was only logical that he noted the ideas in the parallel field of electronics that arose during the Second World War. He also experienced the GDR's scientific climate, which convinced him that if Bulgaria tried to compete with such countries in established fields of industry, it would inevitably lose. He expressed these ideas in the many personal meetings he had with Zhivkov in the first months after his return to Bulgaria. In touch with the first Bulgarian doctoral students who studied in the nascent field of electronics in the USSR and the GDR, he advised Zhivkov that "cybernetics, computer technology, fine mechanics. Here is our strength."[66]

Popov is the father of Bulgarian electronics not because of his innovations or his scientific work, as he was an academic in a very different field. But he had the intellectual tools to recognize the importance and possibilities of the nascent sector, as well as to understand the general trends of specific research and production, and what would be the avant-garde in the sector. His scientific network was wide, both beyond and behind the Iron Curtain, bolstered especially by the time he spent as the head of a laboratory in East Berlin. But his key characteristic was his managerial style, which contemporaries described as "American-style." The 1970s electronics minister Ĭordan Mladenov describes him as "more like an organiser in the American sense of the word 'manager'": finding and mobilizing financial resources for projects, organizing cohesive design teams, attracting the best cadres, and having a general awareness of the industry and market.[67] His iron working discipline, often from 6 a.m. to midnight, helped his productivity during these years. Once he moved away from his academic work, he became a supreme organizer of science, utilizing his languages, experience as an academic administrator, and political connections (which stretched to Moscow, where he was colleagues with similar party-engineering cadres in the radio industry). Unlike many other sectors of the

1.1 Ivan Popov (right) meeting Konstantin Rudnev, the Soviet Minister of Automation, 1972. (*Source*: Central State Archive, Sofia.)

socialist economy, his personal clout and desire for accurate reports helped instil a more internally accountable, if stressful, working atmosphere. He kept abreast of electronics by reading the newest dissertations published by the emerging cohorts of students. An anecdote illustrates this—a student, sure his committee would not read the thesis in full,[68] promised the reader a full case of beer if he had reached this particular page. Months after his defence, Popov called him at home, asking for his beer.

Popov's claim to "fathering" this field in Bulgaria is in championing electronics as a profitable area and organizing a productive, well-financed

environment that would allow an emerging group of scientific and engineering cadres to make this field a possibility. After 1962, he was in the halls of power that he needed to push through his project of a high-technology, low-resource but high-yield sector and make it a success. But one man alone, responding to the problems of Bulgarian industrialization and the possibilities of the Comecon market, could not be enough to create something from scratch. He could develop, however, some existing capacities and emerging scientific potential.

THE EXISTING CAPACITIES

This chapter has made it clear that the country had little tradition in most high-technology sectors, but there were cores of expertise available from which to start. These were tied to the preceding decade's industrialization, with the biggest school of many of the new specialists being the electrical factory Kliment Voroshilov in Sofia, specializing in communications equipment and since 1949, uniting all smaller companies and enterprises of the sector in the capital. Built with Soviet help, it blossomed into a large site for telephone and radio production but also a veritable school for engineers.[69] It was also Popov's first industrial appointment once he was back in Bulgaria. In the early 1950s, Soviet engineers used the plans of a Rostov factory to organize the shop floor and also delivered numerous manuals and blueprints. Within a few years, the factory was producing serial runs of telephones and phone exchanges, ultra high frequency stations for civilian and military use, and it was developing the first Bulgarian TV, the Opera-1. Groups of up to 40 engineers at a time were sent to the GDR and Czechoslovakia to train, quickly building up a core of experienced technicians.[70] To make sure this knowledge diffused to those who stayed behind, the factory also became a field school. Those who knew English, German, or French were assigned foreign journals to follow, with the task of submitting commentaries on two articles at the end of each month. These were collated together in publishable form, so that the factory quickly built up a library of the latest Western developments.[71]

Such moves allowed the Bulgarian workers to start their own research and development efforts, rather than slavishly following the Soviet licenses

(such as that for a military field radio, which was proving unreliable). A team lead by a military engineer, Stoi͡an Dzhamiĭkov, set out to produce a better radio for the Bulgarian and also the Warsaw Pact armies. Together with the development of the Opera TV, this project became the factory's first foray into its own research and development, as well as a testing ground for the next engineering generation. The improved radio would enter serial production in 1964 and equip the Bulgarian, Hungarian, and Polish armies, securing the factory's reputation.[72] At the same time, the production of TVs would make it the country's first factory with some degree of automation, installing two mechanical conveyor belts in 1962.[73] Throughout these years, the factory possessed the best-trained engineers in electronics and communications, and its staff were used to set up the newly differentiated factories that split off. The Kliment Voroshilov factory would retain radio relay and long-distance communication duties, having made its mark on Bulgarian industry.

Future electronics specialists got their first taste of modern technology here. Li͡ubomir Antonov, part of the team that designed the first electronic calculator (as we will see in chapter 2), started off in the television laboratory there.[74] When given the chance to join BAS's Institute of Communication, he decided to stay, as the factory remained the best-equipped place in the field into the early 1960s.[75] Often the work still had to be improvised and depended on the young engineers' creativity, as blueprints were lacking. Antonov created the first Bulgarian digital measurement instrument, scrapped together from sensors given to him by friends in various institutes, when a Romanian delegation visited in 1958 and talked to him about the future of electronics. At other times, all he had to go on was the basic idea that a particular machine existed, for example, an analog computer after reading an English book in Russian translation. To create it, he had to go back to basics, speaking with his university lecturers in mathematics, or emulating transistor technology he had seen in a Phillips catalog.[76] This machine was delayed by the lack of silicon transistors, leading him to replace them with radio lamps, which made the machine obsolete the instant it was created (the elements base for socialist electronics would plague its whole history). Yet the Voroshilov factory was an invaluable school for young engineers, pushing them to find solutions in a veritable information desert.

The bloc's cutting-edge electronics research in those years remained outside Bulgaria, in the USSR and the GDR. In 1956, as Soviet science "thawed," and the maligned field of cybernetics was rehabilitated,[77] the first theoretical work on computational machines in Sofia was done by Prof. Bozhorov and Prof. Nedi͡alkov. Around same time, Prof. Li͡ubomir Iliev of Sofia University attended a Moscow conference on the "Development of Soviet Mathematical Machine-Building."[78] On his return, he pushed the university to send students to Moscow to complete undergraduate degrees in the field. By 1957–1958, there was at least one student studying electronic engineering there (Stoĭcho Chamarov),[79] while the first larger group of students and teaching assistants was dispatched from Sofia University's "Digital Methods" course in 1959—among them future luminaries of the field, such as Blagovest Sendov. The first doctoral student in the field, Racho Danchev, also started work at Moscow State University that year.[80] Others were sent to the GDR, the other preeminent center, with Antonov specializing in Berlin in 1960[81] and Petŭr Petrov (who would go on to work at the Institute of Technical Cybernetics and Robotics, ITCR) specializing in electronic automation there in 1962.[82] Others, such as the future director of the ITCR, Angel Angelov, started off with semiconductor specializations in Moscow in 1956 and continued to work on joint East German–Bulgarian projects on the bloc's first digital telephone exchanges in 1960.[83]

A critical mass of intellectual interest and cadres was thus being created before Popov came to head Bulgarian science in 1962. A Council of Ministers order from April 1961 created the country's first electronic Calculation Centre at the Institute of Mathematics at BAS, as well as the Faculty of Higher Analysis at Sofia University.[84] Iliev became the deputy-director of the Mathematical Institute (renamed Mathematical Institute with Calculation Centre), under the director Academician Nikola Obreshkov; the main engineer was Ilko I͡Ulzari. This center would be the core that took the first steps in domestic computing development, as I describe in chapter 2. Iliev, the true champion of the field at the time, organized a summer school for his most promising mathematics students at Dubna, the bloc's Joint Institute for Nuclear Research and home to a powerful computer center.[85]

There were other nuclei of potential, situated in industry itself. The regime's awareness of the coming need for more specialists in research and

1.2 Radio production in the Kliment Voroshilov factory, 1962. (*Source*: Sandacite.bg).

development than academia could provide led to the creation of a network of Bases for Technical Development (BTD) in various enterprises in 1961. Some would eventually become independent institutes due to their importance, the paramount being the "Instrumental Industry" BTD.[86] ITCR's predecessor, building on a small foundation in 1959, also became a fully fledged electronics and automation site in those years.[87] The first batch of engineers also took existing institutes in new directions after the completion of their studies abroad, such as Angel Angelov, who returned from specialization in Berlin in 1963 to set up an Industrial Electronics section in the Research Institute for Electrical Industry.[88]

At the start of the 1960s, Bulgaria found itself with various sites of expertise in radio, communication, and television (the Voroshilov factory), and electronics and automation due to the first generation trained in the USSR and the GDR. This potential was recognized by the BCP, which supported both BAS and industrial sectors in their development of research and development centers in the field. Popov's emergence would serve to unite these many areas under one coordinated and centralized vision, which was sorely needed in a field where other states were also taking their first steps.

THE STATE OF SOCIALIST COMPUTING AND CYBERNETICS

Computing in the Eastern Bloc was a perpetual game of catch-up throughout its history. In 1950, the head of the Institute of Precise Mechanics in Moscow stated that the country was fifteen years behind the US in the field and would have to make this good in five to keep the USSR from losing the arms race.[89] At the same time, this was to be done without copying any of the philosophical ideas that came with the field, which were seen as idealistic and metaphysical deviancy. Cybernetics was a reactionary, bourgeois pseudo-science, as articles in 1952–1953 dubbed it. Under the pen name of "Materialist" (the author's pseudonym), criticisms of Norbert Wiener and Claude Shannon abounded, taking them to task for repeating eighteenth-century routes that were anachronistic and had failed.[90] In 1954, the *Short Philosophical Dictionary* solidified this official reputation, pushing Soviet science even further behind the trends.[91] Yet this inertia from the Stalinist period was about to be displaced as restrictions eased,

and by 1955, the existence of Soviet computers was declassified. Cybernetics, too, was rehabilitated.

This famous word denoted a multidisciplinary field that explores systems' structures and restraints, applicable to computing and maths but also increasingly to social engineering. It posited that a system with a goal can take action to achieve that goal, and in the process can also be self-correcting through "feedback" (a concept that originates in cybernetics) at all levels of the system. This is applicable not just to simple organisms but also to the whole universe. Norbert Wiener, who is credited as cybernetics' originator through his 1948 book *Cybernetics: Or Control and Communication in the Animal and Machine,* defined it as "the scientific study of control and communication in the animal and the machine." He expanded on its social implications in his 1950 work *The Human Use of Human Beings*. Since its inception, the discipline has lost its preeminence as a standalone field, but it lies at the core of or has informed multiple important fields of study, such as game theory, system theory, neuroscience and cognitive psychology, and organizational theory in business management. In the Eastern Bloc, it held people's fascination for much longer than it did in the West.

By 1958 the first book aimed at the general public, Igor Poletaev's *Signal,* encapsulated the discipline's promise:

> The laws of existence and transformation of information are objective and accessible for study. The determination of these laws, their precise description, and the use of information-processing algorithms, especially control algorithms, together constitute the content of cybernetics.[92]

The *Short Bulgarian Encyclopedia,* a five-volume set that could be found in many Bulgarian homes, was published in 1966 just as the industry was being born in the country. Quoting the field's founder, Wiener, the encyclopedia defines cybernetics as "the science of connections, governance, and control in the animal and machine." It highlights the importance of feedback loops (*obratna vrŭzka*), where a system receives information about the results of its processes and can thus regulate its behavior. The short article states that this science affects a wide variety of areas, from machine translation to mathematics, but thanks to the advancement of computing, it also impacts the automatic control and governance in the economy and beyond.[93] Unleashed, cybernetics became a dominant language for Soviet

scientists, who sought in it everything from a confirmation of Marxism to the "cyberspeak" of Slava Gerovitch's argument: a precise and objective language of science and methodology, where the precision of the algorithm was opposed to the regime's unverifiable slogans.[94] The computer and cybernetics combined became the superstar of Soviet science, which was searching for a "panacea for Soviet economic woes."[95] By December 1957, the Soviet Academy was telling the Politburo that the use of computers in planning was of exceptional importance to efficiency, inaugurating a long-lasting effect of cybernetics on the bloc's economic thinking. Planning was a cybernetic feedback system of control of enormous proportions, and the Soviet economy was potentially a fully controllable system with multiple information flows.[96] Mathematical modeling of the economy through computing was discussed in 1960, and the cybernetic utopian mantra was incorporated in the CPSU's congress of 1962. The party had embraced the new world and was ready even to incorporate Western management techniques if they proved useful. Khrushchev's words of November 1962 envisioned society functioning like an automated assembly line, just as Sofia's Voroshilov factory was installing its first such line:

> In our time, the time of the atom, electronics, cybernetics, automation, and assembly lines, what is needed is clarity, ideal coordination and organization of all links in the social system both in material production and in spiritual life.[97]

The imperial center's embracement of the field changed the trajectories of the satellites' science, but it also called into question the material base. Computers did of course exist in the bloc by the late 1950s, spurred on by the military arms race and then economic needs. While Stalinism rejected Western cybernetics, it fully understood the need for computers in the arms and nuclear race. The first Soviet stored-program computer appeared in Kiev in December 1951, the MESM (from the Russian abbreviation for "Small Electronic Calculating Machine," which was of course anything but small), which was also the first such machine in Europe. The Automatic Computing Machine M-1 appeared early in 1952, built by a Moscow team. Both computers were quickly harnessed to the needs of nuclear physics, jet propulsion, radio location, and aviation.[98] In 1955, the BESM (Large Electronic Calculating Machine, the name now closer to the reality) equipped the first purpose-created computer center in the Soviet Academy, yet again harnessed for military matters. It remained the

fastest machine in Europe for at least two years and spawned a full range of machines, culminating in the BESM-6 in the mid-1960s, a mainstay of Soviet computer centers.[99] The first serially produced computer, the Strela series, started appearing in 1953, and most of the machine time went to missile defence. The Strela's design team was also tasked with creating the heart of the first antiballistic missile defence of Moscow, the specialized M-40 and M-50 in 1958–1959.[100]

The Soviets were not alone. The GDR's tech prowess produced the first non-Soviet machine in 1955. The Oprema was created by the Carl Zeiss firm and became a testing ground for the ZRA-1 in 1958, a much more advanced machine. Dresden Technical University developed its own machine in parallel, the D-1, in 1956.[101] In Czechoslovakia, the pioneering Antonin Svoboda had already designed his first machine in 1951 but could only complete the project in 1957, when his SAPO started calculating in the Academy of Sciences. It burned down in 1959, but by then Svoboda's team had produced the EPOS-1 and EPOS-2.[102] In Romania, Victor Toma created the first digital computer in the form of the CIFA-1, at the Institute of Atomic Physics.[103] It was his visit to Sofia that inspired Antonov to turn toward digital machines. Next door, the Hungarians built the MESZ-1, an experimental machine, in Budapest's Technical University.[104] The Polish ODRA series was probably the most innovative, starting in 1959 and inspired and compatible with the famous British ICL series.[105] Only two socialist countries in Europe had no domestic machine by 1960—Albania and Bulgaria.

Yet these machines were almost unique—none were ever placed in serial production. Even the Strela existed in a run of only seven machines, while the BESM would enter true serial production 10 years after the first machine. The early ODRAs were single models, for training purposes; the SAPO and CIFA were literally unique. Even the GDR managed to produce only 32 ZRA-1s, over a number of years.[106] Soviet machines were used for military, nuclear, and space-race calculations; those for satellites were products of scientific visionaries who waited years for institutional backing. Almost all of these machines emerged from the national academies or universities, as not even the GDR or the USSR had the necessary infrastructure and organization to mass produce them. These were artisanal rather than industrial computers, unable to solve the grand

tasks Khrushchev had set them rhetorically by 1962. The Cold War tensions had locked them behind blast-proof doors, with military-specific software, a far cry from being applicable to civilian life. Comecon had a market gap, and specialization contracts were looming.

In Bulgaria, there was a party scrambling for a golden export, an emerging cadre of bright engineers, and a patron in the figure of Ivan Popov. Starting far behind its allies-cum-competitors, the country could now take advantage of one of the boons of economic backwardness: borrowing and adapting the latest technology developed elsewhere, under the auspices of a centrally led, capital investment process.[107] Electronics demanded little in the way of nonexistent natural resources, was high-profit, and existed nowhere in the East in a serial fashion. Whispering in Zhivkov's ear, Popov could drive this point home to the Politburo, paving the way for the creation of a true computer industry that could reap the enormous benefits that the BCP wanted.

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