A Cyber-Socialism at Home and Abroad: Bulgarian Modernisation, Computers, and the World, 1967-1989

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ABSTRACT

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The history of the Cold War has rarely been looked at through the eyes of the smaller powers, especially ones in the Balkans. Works have also often ignored the actual workings of the international socialist market, and the possibilities it created for some of these small countries. The conventional wisdom has also prevailed that the Eastern Bloc was irreversably lagging technologically, and its societies had failed to enter the information age after the 1970s, one among a myriad of reasons for the failure of socialism.

Using the prism of a commodity history of the Bulgarian computer and an ethnography of the professional class that built it and worked with it, this dissertation argues that such narratives obscure the role of small states and the importance of technology to the socialist project. The backward Bulgarian economy exploited the international socialist division of labour and COMECON's mechanisms to set itself up as the "Silicon Valley" of the Eastern Bloc, garnering huge profits for the economy. To do so, it did not hue a politically maverick road but exploited its political orthodoxy and Soviet alliance to the full, securing huge markets.

Importantly, this work also shows that the state facilitated massive transfers of knowledge and technology through both legal and illicit means, using its state security and economic organisations to look to the West. This made the Iron Curtain much more porous for a growing cadre of technical intellectuals who were trusted by the regime in order to create the golden exports of the country. This transfer and mobility helped create an internationally plugged-in and fluent class of engineers and managers, at odds with most of the rest of the economy.

At the same time, the Global South became an important area of exchange where these specialists competed with both nascent protectionist regimes and international firms. Using India as a case study, this dissertation shows how Bulgarian met the First World on the grounds of the Third and learned to market, negotiate, advertise, and service customers – a skillset that was then applied to its socialist dealings.

Finally, the dissertation examines the domestic impact of such policies. The regime wished to use cybernetics and computing to solve the problems of its lagging economic growth, as well as usher in communism. It introduced both the widespread discourse of technological revolutions to its population, and robots and automation to some of its factories. This created both anxieties and hopes among workers, as well as vibrant philosophical debates about the future roles of humans in the information society, among both technical and humanistic intellectuals. Ultimately, however, the economic inefficiency undermined the promise and this failure was utilised by some technical managers to call for reforms, playing a hand in the end of the regime. They managed to negotiate the transfer to capitalism better than most, utilising their financial and business links, while thousands of engineers also found a better life than the vast majority of Bulgarian workers, through emigration or their possession of cutting edge skills.

Using Bulgarian, Russian, Indian archives as well as interviews with living actors, the dissertation thus intervenes in both the view of the Iron Curtain as an impenetrable barrier for ideas, and 1989 as a convenient end point for communism's legacies. It shows both the creation of new professional classes and how they were plugged into global developments, arguing that *some* people in the socialist bloc did enter the information age, and it is by paying attention to their actions and interests that we can get a better understanding of the developments of late socialism and its end.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

ASU	Automated System of Governance
BAS	Bulgarian Academy of Sciences
BCP	Bulgarian Communist Party
BNB	Bulgarian National Bank
CICT	Central Institute for Computer Technology
COCOM	Coordinating Committee for Export Controls
COMECON	Council for Mutual Economic Assistance
CPSU	Communist Party of the Soviet Union
CSTP	Committee for Scientific and Technical Progress (Bulgaria)
DKMS	Dimitrov Komsomol Youth Union
DS	Bulgarian State Security
DSO	State Economic Union
ES	Unified System (of Computers)
ESGRAON	Unified System for Civilian Registration and Administrative Services for the Population
ESSI	Unified System of Social Information
GKNT	Committee for Scientific and Technical Progress (USSR)
ICCT	Intergovernmental Commission on Computer Technology
ITCR	Institute for Technical Cybernetics and Robotics
IZOT	Computational, Recording and Organisational Technology
KESSI	Committee for the Unified System of Social Information
RB	Robot series (Bulgaria)
SM	System of Minicomputers
STI	Scientific-Technical Intelligence
SPC	State Planning Commission
TITz	Territorial Computer Centre
VTO	Foreign Trade Organisation

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Introduction

In the early afternoon of the 7th August 1981 a Soviet Vostok-2M rocket took off from the Plesetsk Cosmodrome in northern Russia, about eight hundred kilometres north of Moscow. It carried a satellite called “Interkosmos-22-Bulgaria-1300”, a part of the Interkosmos program of socialist space co-operation, towards a near-Polar orbit, which it continues to hold to this day. This completely Bulgarian-designed and built satellite provided and still provides information about the extra-terrestrial environment over the Earth’s polar regions, but was also launched to coincide with the country’s massive celebrations of its 1300th anniversary, as the name suggests. It carried highly sophisticated electronic equipment such as optical laser reflective systems for geodynamic measurements, while the country was also producing other equipment for the Soviet space program such as the “Proton-1”, which studied particle streams in magnetic fields, or the “Emo-5”, used for observations of the aurora borealis. The satellite’s launch and flight path itself was controlled by computers that were in some part Bulgarian, while the data beamed back to Earth from these instruments were recorded on Bulgarian-made disc drives.

This seems an incredible achievement given that when the communist party seized power in September 1944, it inherited an agricultural and rural country. Over 80% of the population and GDP were locked to the land, and Bulgaria was one of the perennial cases of underdevelopment in Europe, studied by Western economists in the 1930s and 1940s. In just a generation, the country’s industry was equipping the Soviet space program, as well as laboratories and factories throughout the world, with high-technology computer products. Having undergone its own breakneck Stalinist-style heavy industrialisation, by the 1970s and 1980s it was pursuing sophisticated, technological, high-profit and high-prestige sectors, paramount among which was the computer industry. In short, that is what this dissertation is about – how and why did a small state such as Bulgaria create this economic sector. Once this story unfolds, the experience of the socialist state becomes truly global, with technology becoming a channel for experiences and ideas to flow more freely across the Iron Curtain than previously thought.

An image from the early 1970s, taken at the Plovdiv International Fair, encapsulates the story succinctly. The fair itself, a space where the world came to Bulgaria and presented the latest in its fashions and science, was also where the incongruous story of this industry became best visualised. An old man, probably a performer of some sort as evidenced by his traditional Bulgarian peasant garb, looks bemusedly at the keyboard of a computer, while disc drive drums hang behind him, with the blurry name of the Bulgarian foreign trade firm in the sphere, Izotimpex, in the background. This was Bulgarian socialist modernisation, uneven and lumpy, where the newest machines could live alongside an irregularly developed country.

Pic. 1: Old meets new. (Source: Plovdiv International Trade Fair Archive)

The computer industry's surprising existence in Bulgaria is worth the story alone, but novelty and uniqueness do not necessarily constitute relevance. This story is worth telling because it reveals the Cold War to be a much more free space than is commonly imagined before, a sphere of possibilities for small states. Small and loyal, Bulgaria has been often overlooked in favour of larger or "maverick" neighbours, most notably Yugoslavia. The non-aligned socialist state had swagger on the international stage, not least thanks to its charismatic Marshall Tito, and its shops were much fuller than Bulgaria's – it was seen, almost instinctively, to be different from any of the other European socialist states. To the north was Ceausescu's Romania, which opposed the 1968 invasion of Czechoslovakia, prepared plans for all-out national defence against a potential Soviet attack, hosted a visit by an American president, and by the 1980s was seen as a basket-case of shortages and totalitarianism. Even the small and poorer Albania had its time in the limelight after it sided with China after the Sino-Soviet split and hued its own path towards communist utopia under Hoxha. Bulgaria, in contrast, was the one sure Warsaw Pact ally in the Balkans. Its party – the BCP – was dominated in its early days in power by the "Moscow" communists, men like Georgi Dimitrov who had spent decades under Stalin's shadow. With de-Stalinization, its new leader, Todor Zhivkov, was also beholden to Moscow as he emerged triumphant in the power struggles of the mid-1950s. Surely a man and a party like that were mere copies of their Soviet backers.

Yet political orthodoxy can mask real economic and intellectual divergence. The choice of the computer industry as Bulgaria's focus was down to domestic responses to financial problems and international opportunities. It was domestic, Bulgarian elites who decided that this sector was the way forward, and developed it into the powerhouse that it became. While doing so, they spawned a large debate based around the ideas of cybernetics and the implications of thinking machines on both the individual human and society and governance as a whole. Bulgarian responses to the information age shared much with the Soviet and other socialist debates, but had their own contours too.

Orthodoxy and loyalty proved beneficial. As the socialist bloc sought to integrate economically in order to defeat capitalism and maximise its own limited resources, Bulgarian loyalty to Moscow played a part in helping it set up this high-technology industry. At the highest level, close links between Zhivkov and Khrushchev and then Brezhnev helped Bulgarian technological products to access the Soviet market more easily. The industry grew and became extremely relevant to the story of the socialist economies and technology, as it provided up to 45% of all computer goods produced in the Bloc by the mid-1980s. Small states could thus exploit larger superpower backers as well as the geopolitical possibilities created by the Cold War for their own interests, which were not always the same as their larger, more powerful allies.

The story also makes little sense if we don't consider the Eastern Bloc and its economic organisation, the COMECON, as a real space of exchange and an attempt at genuine integration. The specialisations that were up for grabs in the 1960s allowed countries to create high technology industries with guaranteed markets. The organisation also created the framework for multilateral planning and co-operation, setting a policy for all states and facilitating the exchange of ideas and items between countries. While in political terms the Second World was often politically disunited (not just in 1956 or 1968, but also in terms such as the failure of multilateral military leadership in the Warsaw Pact), it emerges as a much more integrated and mutually dependent sphere if we look at industrial policy and trade, and it was also a world that was an alternative to capitalist modernity. Scientific co-operation and industrial trade created a flurry of blueprints, models and specifications that were common among all states, not least the ES series of computers that all states participated in. Bulgarian computers were a part of creating a self-fashioned socialist modernity which created common tropes, scientific dialogues and material experience of this period from the Baltic to the Black Seas and from the Inner German Border to Vladivostok. The Bulgarian computer's circulation is thus a window into the way the Eastern Bloc constituted itself as a techno-economic space distinct from its capitalist opponent.

Yet the history of computing does not start in Bulgaria. To leapfrog into the information age, the Bulgarian state trained and financed cadres of engineers, scientists, but also spies and trade representatives. A concerted intelligence effort flourished alongside legal licensing and intellectual exchange across the Iron Curtain, all in the service of the civilian economy and largely, the computer sector itself. The massive transfer of items, information, and expertise across the embargo lines must be seen not only as a story of industrial espionage, but also one of real engagement with the West's ideas and technology. Spies transferred not just models but ideas and business plans, and were themselves involved in a complex symbiosis with the civilian sector. Through them, Bulgarian scientists were much more plugged into global trends than previously thought. Increasingly, licenses and foreign enterprises and companies became important too, widening the way that Bulgaria experienced the world of computing, but also business.

At the same time, the world was changing not just technologically, but politically. De-colonisation brought dozens of new countries into existence, areas which the socialist camp targeted as both allies against imperialism and spaces where to prove its modernity was superior. Yet, these were also markets, and the largest of them, such as India, were also areas where a small state could meet the First world on the ground of the Third. Bulgarian engineers, technicians and traders sought to expand the Bulgarian computer industry beyond the socialist world in pursuit of both embargo technologies and hard cash, and they had to learn to operate in environments where COMECON-sanctioned pricing policy was absent. Marketing, negotiating, specialist brochures and fast responses to clients, were concepts that were learned on the ground in the Global South, where Bulgarians had to carve a space for their unknown products. The fast-paced world of computing technology was a crucible for Bulgarian business.

The story concerns people and commodities. Their lives' trajectories are not as constrained by the chronological conventions that historians like to use in order to tame the flow of history through periodization. The Cold War is one such convention, with the revolutions of 1989 as the usual end point. Bulgaria's computer industry, however, had an afterlife. This was not just a curiosity as it was connected to future developments in both the domestic economy and political landscape. Thousands of engineers and scientists prospered because of their globally-relevant skills, or set up new and thriving IT companies within a country which suffered economically and de-industrialized in the 1990s and 2000s. Their managers, however, had already been part of international business networks, while holding financial levers of power, which allowed them to participate in the post-1989 world of both politics and, potentially, crime. Skills learned during the socialist period, together with money made by this industry, did not cease to exist in 1989, but were reconfigured in a variety of ways, shaping aspects of post-socialist life. The Cold War may have ended, but the technological legacy of socialism became a political factor which is still shaping Bulgaria's seemingly endless transition to capitalism and democracy.

As the Bulgarian computers shows, the Iron Curtain was more porous than previously thought, while 1989 is not a convenient end point. Despite being "Bulgarian", the computer also makes this a global story which reveals how the information age and economy spread throughout the globe but was reconfigured by local actors. It shows how small states can utilise flows of commodities and exchanges to learn new things and position themselves in novel ways. The story's protagonists are myriad, and differing. The Bulgarian computer was utilised for different ends by different groups. For the state and its leaders, it was a good that provided hard cash, prestige, and a possibility to reboot an economy that was stagnating. For the industry's managers, it was a way to meet the West, amass power, defend their interests, but also to seek a way forward for Bulgarian industry. For the majority of engineers, it was a labour of love, of interest, of novelty, a tool that helped their research and brought them into modernity. For trade representatives it was a good to be sold, for spies – a good to be stolen. For many workers, it was an ambiguous novelty that imperfectly entered their lives, automating workplaces and easing menial labour but also creating anxieties about job safety. For some intellectuals, it was the harbinger of a new age, of the intellectual labourer who was to be highly creative. For a generation of children, it was an exciting new toy that could do a lot more than most other toys, but also a glimpse into the future. Nothing would be the same after its introduction to Bulgarian life.

Such a myriad of claims drives the methodology of this study.[1] The dissertation employs a commodity history of the computer in order to keep such disparate threads united through the materiality of the product that was being created and circulated. Computers are special commodities in that they are not just items of exchange and use, but tools to do new things such as mechanise and automate labour or allow for prognosis and prediction based on the processing of huge sets of data. Thus, the commodity history allows us to trace the circulation of ideas, technology and money that were embodied in the final item, but in this guise, it also shifts the debate to what it was used for and what hopes were placed in it. It opens up the vistas of intellectual history and the cultural ramifications of this new tool alongside a history of innovation, technological creation, and exchange.

Secondly, it utilises a sort of ethnography of the people who were involved with this industry. It focuses most on those who directed the industry and thus thought about it strategically, and the lower echelons intellectuals and technicians who created it but also used

[1] For a discussion of the methodological works that influence this study, please see the historiographical overview in the next section

it in day-to-day life. To them one can add increasing numbers of philosophers, pedagogues, psychologists and other specialists who wondered about the new information age and its effects. These men (and less often, women) developed a rich culture of debate around the computer and its applications, and in their efforts to reform the economy and implement the new technology in factories and offices, revealed the limits of technological solutions to deep economic problems or labour resistance. By concentrating on the people alongside the commodity, the dissertation shows how a technology which has been discussed almost exclusively with respect to the Western experience and idea of the information age, could be harnessed to very different ends, as well as become a conduit for those new ideas. The landscape and aims of the Bulgarian information age, which emerged at the conflux of this commodity and the people around it, are not identical to to iAmerican, capitalist European, or Japanese coutnerparts. People and tools combined are the only way to address the issues that range from technological innovation and copying, to global connections and exchanges, to the political and social possibilities opened up by the late twentieth century.

Historiography

The work situates itself in a number of hitherto disparate historiographies, ranging from the national and chronologically-bounded ones of Bulgaria and state socialism in general, to the thematic and methodologically-oriented ones of global and transnational, technological, computer, and economic historiographies. It also brings into focus the works of both local and Western historians, who often do not interact with each other intellectually. The small but growing number of historians working on the issues of socialism and Bulgaria in the world inside the country itself are producing work rich in archival research, which is often overlooked by those in the West. Shining a light on these historiographical developments, the dissertation also thus serves as a bridge between the two sides.

The historiography of socialist Bulgaria had long suffered from journalistic and politically-coloured approaches, especially in the difficult years of the 1990s. Only more recently has a more scholarly and archive-based approach been taken to the period, illuminating a growing number of its aspects. The group of researchers around the Institute for Studies of the Recent Past (founded in 2005) has been one of the most prominent in producing such works. The studies range widely over issues such as the labour camps, personal memories, socialist literature, ethnic minority policy and others, yet it is the general histories and the specific ones dealing with the economy that are most relevant.[2] Two edited volumes serve currently as introductory overviews of the period, taking a specific line that is somewhat limited.[3] In the first work's introductory remarks, the institute's director Znepolski states that de-Stalinisation in Bulgaria didn't bring a weakening in totalitarianism but just a slightly changed style in leadership. The state underwent a transformation from a revolutionary to a traditional regime, with no future-centric ideological goal, instead retreating into a pastoral and passive vision of the nation.[4] This vision is born out of the focus on the political orthodoxy of the Bulgarian party, as well as an overall focus on the social policies of late socialism such as increased national rhetoric and rising ethnic minority tensions. These general works ignore the economic and technocratic visions inherent in every developed state's institutions, and search for the ideological goals in the usual party proclamations, ignoring the more in-depth programs of the congresses and plenums where the scientific-technological revolution became an increasing presence in the party's rhetoric. This blind spot in Znepolski's (and other's) view is precisely down to the lack of attention to

[2] Hristo Hristov's *Todor Zhivkov. Biografiya* (Sofia: Ciela 2009) should also be added to the list, as the (currently) only archival-based and serious biography of the communist leader.

[3] These are Ivailo Znepolski (ed), *Istorya na Narodna Republika Bulgariya: Rezhimut I Obshestvoto* (Sofia: Ciela 2009) and Ivailo Znepolski (ed), *Istoriya na NRB: Ot Nachaloto do Kraya* (Sofia: Ciela 2011)

[4] Ivailo Znepolski (ed), *Istoriya na Narodna Republika Bulgariya*, pp. 74-78

Bulgarian technological history, as well as an involved discussion of the inter-bureaucratic stakes and arguments. Znepolski himself, in his monograph on the trajectories of Bulgarian communism, posits it as a Soviet-backed project that fed on traditional Russophilia mong the populace.[5] While this is largely true, such broad brushstrokes obscure the specific, local characteristics of the Sofia regime, which had its own agency in its internal – and indeed, to a certain extent, external – policies. Furthermore, a cultural historical-based approach to the regime drives the author to see a marked anti-technical nature in the late socialist period, where the physical labour of the Bulgarian worker was upheld as virtuous against the negative, educated work of professors or administrators.[6] Again, it is due to paying overall attention to the fields of culture and official proclamations that the nuances of late socialist Bulgaria are missed.

There is richer work in the field of economic histories of the regime. Work by Hristo Hristov on the bankruptcies of the socialist economy highlighted the shortcomings of the early industrialisation and the deep financial connections that the seemingly isolated regime developed with Western and Soviet banks. It is a somewhat polemical work, however, that sets out to prove that the economy itself was in essence an illusion, arguing against popular memories of a secure life.[7] Other work on the growing Bulgarian debt can be found in Vachkov and Ivanov's in-depth study from 2008, which also draws attention to the huge changes wrought in the economy thanks to outside economic help. This book, however, shows the conflict of interests and interpretations of the economy and reform between the various party and state functionaries, bringing in the necessary nuance to investigate the late

[5] Ivailo Znepolski, *Bulgarskiya Komunizum: Sotsiokulturni Cherti I Vlastova Traektoriya* (Sofia: Ciela 2008), p. 82

[6] Ibid., p. 207

[7] Hristo Hristov, *Tainite Faliti na Komunizma: Istinata za Kraha na Bulgarskiya Sotsializum* (Sofia: Ciela 2007), p. 9

socialist state as a site of plural worldviews, which were sometimes at odds. The authors also place the Bulgarian economic predicament in the wider world trends of the 1970s onwards, such as the global energy crisis and the turn towards a service and knowledge-based economy, a key innovation in the country's historiography that this work expands on. The authors argue that it is precisely the 1970s that were a crucial moment, where the previous speedy and extensive economic growth failed to transform itself into intensive scientific innovation, due to both the different geopolitical world Bulgaria was drawn into (COMECON) and internal failures. Taking the decade as a serious changing point in the economics of the country, as well as showing that there was discrepancy between the party and state elites, shows the late socialist period to be a time of opportunity and discussion rather than staid conformism.[8]

Parallel to this work it is important to mention Roumen Avramov's research on monetary policy in the country. It also moves the focus away from party decisions and towards state institutions such as the national banks as repositories of both expert knowledge and competing interests. It concerns itself with the mechanisms of internal and external credit, exposing the limits of possibility in radical monetary or financial reform within the confines of Marxist economic policy. Limited by the party, state functionaries could only go so far in market reforms. There was another operative plan for economic reform thus possible, present in a different set of state actors, which did not think in banking or financial terms.[9]

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[8] Daniel Vachkov & Martin Ivanov, *Bulgarskiyat Vunshen Dulg 1944-1989: Bankruptut na Komunisticheskata Ikonomika* (Sofia: Ciela 2009); to place the debt history of Bulgaria in a longer narrative, the 3-volume collection *Istoriya na Vunshniya Durzhaven Dulg na Bulgariay 1878-1990* (Sofia: Bulgarska Narodna Banka 2009) is invalvuable, especially the last volume, edited by Daniel Vachkov and Martin Ivanov

[9] Roumen Avramov, *Pari I De/Stabilizatsiya v Bulgariya 1948-1989* (Sofia: Ciela 2008); Avramov's magnum opus, the 3-volume history of the Bulgarian economy up to 1944, is also an invaluable source on exploring the longer duree history of the interests and institutions of the national economy – *Komunalniyat Kapitalizum* (Sofia: Bulgarska Nauka I Izkustvo 2007)

The historiography of Bulgarian science and technology is very sparse, especially in the field of computers. A notable exception is Ivan Chalakov's anthropological study of the BAS Institute of Optical Recording, which studies a small community of scientists who worked on holographic and other optic-based memory devices.[10] The work was carried out in the 1990s but covers the working practices and history of a team that was largely unchanged since its inception during the late socialist period. The monograph provides a deep insight into the sociology of knowledge in Bulgarian science, and is the only such study in the country, even if it is tangential to the topic at hand. Chalakov, however, forcefully shows the importance of state-led support for the project, which flourished in the 1980s when Zhivkov had been quoted as saying that he was willing to give one million levs to ten different ideas as long as one turned out to be profitable. This is contrasted to the chaotic period after 1989 when state support for science collapsed, something paralleled in the computer industry. There are a number of works written by engineers and scientists who were involved in the sector. They are invaluable sources of information about the setting up of the teams and institutes, their training, the chronology of developments and the technical aspects of what items were created and how this was done. Kiril Boyanov's[11] and Dimitar Shishkov's[12] works are treasure troves of technological narrative and personal stories from the period, and their insights are woven throughout the work. Boyanov's narrative is more historically minded, due to his position at the higher echelons of the sector, and he makes a historical argument regarding the importance of state investment in the sector, and the role of Professor Ivan Popov, commonly seen as the father of the industry. These insights are important – and true –

[10] Ivan Chalakov, *Da Napravish Holograma: Kniga za Uchenite, Svetlinata I Vsichko Ostanalo* (Sofia: IK Marin Drinov 1998)

[11] Kiril Boyanov, *Shtrihi ot Razvitieto na Izcheslitelnata Tehnika v Bulgariya* (Sofia: IA Prof Marin Drinov 2010)

[12] Dimitar Shishkov, *Zvezdnite Migove na Bulgarskata Kompyuturna Tehnika I Kompyuturna Informatika 1956-1966* (Sofia: IK Tangra 2002)

yet they do not go far enough into either the international situation or the reasons behind the decisions made at the highest leadership levels. There is also a need to verify the numbers cited for production and export of the machinery, key to the argument about the success of the industry, as they are not footnoted and do not appear to come from available archival sources. Thus, the utility of such works is limited in their historiographical aspect, but they do serve as primary sources for the professional life of these intellectual workers. A key work in this vein is Milena Dimitrova's compendium of interviews with many of the leading luminaries of the field, which is a veritable primary source in its own right. The authorial voice here also seeks to aggrandize the sector, presenting it as a "golden" peak in the national economy, unproblematically treating assertions of state-led investment and the role of the leadership.[13] Thus, once again, in terms of historiography, the precise topic of this dissertation is not explored in a scholarly way, with the notable exception of Evgeniy Kandilarov's panoramic article-length overview of the electronic industry's genesis and development in the context of state economic policy. A deeply researched work and important jumping off point for further investigation, it accentuates the early investment and role of Ivan Popov, but also the inability to catch up to the West due to embargoes and the structure of socialist science.[14]

Scholarship has barely treated the socialist regime's foreign affairs better. Sofia's policy is seen usually as just an extension of Moscow's, the label of "most loyal ally" all too easily obscuring the regime's own adventures abroad. Kandilarov has blazed a trail here too, with a deeply involved study of post-1945 Bulgarian-Japanese relations in the spheres of

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[13] Milena Dimitrova *Zlatnite Desiteletiya na Bulgarskata Elektronika* (Sofia: IK Trud 2008); we must also mention other works by actors in the industry such as Yordan Mladenov & Ognemir Genchev's *Panorama na Elektronnat Promishlenost na Bulgariya* (Published online, 2003; Yordan Trenkov's 4-volume *Entsiklopediya na Elektronikata* (Sofia: IK Tehnika 2010) is a technical reference encyclopaedia on electronics, but due to its Bulgarian authorship it also includes information about various domestic electronic developments from the period, proving invaluable when chasing up obscure disc drives etc.

[14] Evgeniy Kandilarov, "Elektronikata v Ikonomicheskata Politika na Bulgariya prez 60te-80te Godini na XX Vek" in *GSU-IF,* vol. 96/7 (2003/4), pp. 431-503

diplomacy, economics, and culture, showing how the state could use its foreign policy to open a window to the world of technology and new economic ideas. Japan became a key source of Western know-how and a veritable model for the party leadership, who admired its economic miracle. Kandilarov pays close attention to the trade and economic exchange between the two nations, and provides crucial light on the 1960s developments that kick-started the Bulgarian computer industry. The research is one of the few that treat Bulgaria's economic affairs abroad as more than just a cash grab but also a potential channel to transfer new practices.[15] Another historian who has treated such issues is Violina Atanasova, who has studied Bulgarian-Indian interactions widely, producing a number of key works. Her interests lie in the cultural and intellectual links between the two countries from the 19th century onwards, and the growing importance of the image of India to Bulgarian ideas – and from the 1970s, vice versa. Despite not touching much on the economic and trade issues that concern this work, Atanasova's research is invaluable as both an overview of the increasing diplomatic and foreign policy links between the two states, and the thickening of cultural exchange during socialism, which was paralleled by a corresponding rise in technological exchange.[16] Hristov has also delved in this sphere, but in a different direction. He traces the rise of the Bulgarian joint enterprises abroad from the early 1960s onwards, showing how the country created hundreds of technological firms in third countries, often with Western partners.[17] Their aim was to gain as much embargoed technology as possible, but also served as portals for Western knowledge and business expertise. They deeply involved Bulgarian

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[15] Evgeniy Kandilarov, *Bulgariya I Yaponiya. Ot Studenata Voina kum XXI Vek* (Sofia: IK Damyan Yankov 2009)

[16] Violina Atanasova *Bulgarskoto Ogledalo: Obrazut na Indiya v Bulgariya – Krayat na XIX Vek-Krayat na XX Vek* (Sofia: Institut za Istoricheski Izsledvaniya – BAN 2015); and "Aktzenti na Bulgarskata Kulturna Politika Po Otnoshenie na Indiya (60-te I 70-te Godini na XX Vek)" in *Istoricheski Pregled,* vol. LXVII, no. 1-2 (2011), pp. 174-193); also "Bulgarskiya Kulturno-Informatsionen Centur v Delhi – Istoriya I Deynost" in *Svetilnik,* vol. 14 (2012), pp. 30-33

[17] Hristo Hristov, *Imperiyata na Zadgranichnite Firmi: Suzdavane, Deynost, I Iztochvane na Druzhestvata s Bulgarsko Uchastie zad Granitsa 1961-2007* (Sofia: Ciela 2009)

actors in global financial exchange, and became conduits for corrupt practices at the end of the regime. This work reveals a different avenue of foreign entanglement and policy, away from official diplomatic channels, drawing this work's attention to Bulgarian enterprises' business and investment minutiae.

Apart from locally-produced, national historiography, the dissertation also converses with broader themes. The study of science in the socialist bloc has often concentrated on the period of Stalinism, with various discussions on whether there was such a thing as "Stalinist science", driven by aberrations such as Lysenkoism.[18] That is not to say that this earlier period does not provide useful tools for analysing the later history of socialist science, especially its failings. Loren Graham's criticism of early Soviet industrialisation through the biography of an engineer executed in the 1930s, Peter Palchinsky, highlights the centralisation of decisions and overriding belief in the centrality of a plan to overcome every problem. Nature would be mastered by a grand blueprint, no matter what, while Palchinsky championed a decentralisation of solutions, with local actors being able to address local problems as they had the most immediate knowledge of the realities on the ground.[19] This was a recurring problem for later science in the socialist bloc too, and highlights the Stalinist strains that continued to permeate party thinking right down to 1989.

The history of later socialist science is scarcer, but the field of socialist computer history has expanded in recent years. The key work on Soviet cybernetics continues to be Slava Gerovitch, who sees in the cybernetic discourse as a precise language employed by a variety of specialists after Stalin's death, in opposition to the meaningless, rhetorical and

[18] Key studies include Alexander Vucinich, *Empire of Knowledge: The Academy of Sciences of the USSR (1917-1970)* (Berkeley: University of California Press 1984) and Loren Graham, *Science, Philosophy, and Human Behaviour in the Soviet Union* (New York: Columbia University Press 1987); for an overview of more recent literature on early Soviet science, see Michael Gordin, "Was There a 'Stalinist Science'? in *Kritika: Explorations in Russian and Eurasian History*, vol. 9, no. 3 (2008), pp. 625-639

[19] Loren Graham, *The Ghost of the Executed Engineer: Technology and the Fall of the Soviet Union* (New York: Cambridge University Press 1997)

empty of any precision language of official Marxism-Leninism. For Gerovitch, cybernetics – which was seen as a bourgeois science in the early post-war years and thus proscribed – was an attractive "dissident" language, allowing the engineers and mathematicians to create a "cyberspeak" that was novel and all-encompassing, a rival language to official socialist rhetoric, one with definite rules and provable claims. Eventually, this began being subsumed within "newspeak" as it emptied of its original provocativeness and became a part of the official discourse. Gerovitch's work delves deep into discursive analysis of cybernetics, and is not as interested in the later years, where it was incorporated into official discourses.[20] Actors across the Iron Curtain, however, continued to use cybernetics as a tool to communicate and used its methodologies and assumptions in their future work, even as the discipline itself lost its name and power. Thus, cybernetics as used by the historical actors in the socialist world, and as a language across the barriers of geopolitics, continued to be important even under late socialism.

Ksenia Tatarchenko's dissertation work on Akademgorodok, the Siberian "science city", draws these connections out, showing how computing and cybernetics became an international language that allowed meaningful professional and intellectual exchange even at the height of the Cold War and in such a sensitive area for both superpowers.[21] She traces how computing became a universal language among historical actors on both sides of the Iron Curtain, allowing for discussions of their own universality (in terms of human commonality), as they interacted with a universal machine. Tatarchenko also draws attention to the protean nature of the computer, which burst out of any disciplinary institutions and boundaries, not

[20] Slava Gerovitch, *From Cyberspeak to Newspeak: A History of Soviet Cybernetics* (Cambridge, Mass: MIT Press 2002). See also his "Mathematical Machines of the Cold War: Soviet Computing, American Cybernetics and Ideological Disputes in the Early 1950s" in *Social Studies of Science*, vol. 31, no. 2 (April 2001), pp. 253-287; and "Russian Scandals: Soviet Readings of American Cybernetics in the Early Years of the Cold War" in *The Russian Review*, 60 (October 2001), pp. 545-568

[21] Ksenia Tatarchenko, *A House with the Window to the West: The Akademgorodok Computer Center (1958-1993)* (PhD Dissertation, Princeton University 2013)

contained by any political or intellectual fields, as it entered almost all aspects of science. Thus, the circulations of knowledge it entailed and the types of professionals it brought together were also disparate. She accentuates the dreams and dialogues inherent in trying to make sense of this new world of computer-human interactions and computer-computer technologies. Tatarchenko's work thus innovatively calls for the researcher to look at the computer as a locus of many competing fields of knowledge, discussions of technology, and a geography-collapsing tool for framing international exchange independent of the political boundaries and rivalries of the period.

Recent work has shown to what ends these computers could be harnessed in the USSR. This has concentrated on the issues of networking and the usage of computing power in grand visions of the state economy. Gerovitch had kicked such discussions off with an article on the inability of the USSR to create a true version of an Internet-type network.[22] However, Benjamin Peters has advanced a more nuanced approach to this question, showing that while the failure was real, the visions were truly astounding.[23] He argues that between 1959 and 1989 various Soviet scientists advanced projects for the computer networking of society, with pro-civilian purposes. The central theme is that of Glushkov's OGAS project, which envisioned tens of thousands of computers linked together to allow user access to any other part of the network while at the same time allowing a central Moscow computer to have an eagle's eye view of the economy – which it was designed to help automate. Local knowledge would be leveraged in the design of the network, and would help inch the country closer to the plenty of the next stage of socialism. Future plans included an electronic currency that predates current trends in our economy, such as Bitcoin. Peters also delves into

[22] Slava Gerovitch, "InterNyet: Why the Soviet Union Did Not Build a Nationwide Computer Network" in *History and Technology*, vol. 24, no. 4 (December 2008), pp. 335-350

[23] Benjamin Peters, *How Not To Network a Nation: The Uneasy History of the Soviet Internet* (Cambridge, Mass: MIT Press 2016)

the world of these scientists, who dreamed of an economy and society networked akin to the neural patterns in a human brain. He reveals how cybernetic visions permeated even their institutional humour and parties, highlighting the creative nature of technical work. The failure of these network projects hinged as much on political backing as material and production failures. Peters argues that it was the absence of two chief Politburo backers in a single meeting that doomed Glushkov's project. Thus, his work is not just the most wide-ranging account of a socialist modernisation project based on computing, taking seriously the possibilities inherent in the technology, but also a history of the alliances between political patrons and scientific prowess. No state project, however perfect, can be brought to fruition without the concerted backing of a political actor. The failure in the USSR contrasts to the Bulgarian case, where powerful political backers existed for the industry and its visionaries. Peters' work is thus also useful in showing the difference between the superpower and its ally.

Moving beyond the Bloc itself, there were other innovative cybernetic projects. The paramount of these was to be found in Allende's Chile, and was named Cybersyn. Eden Medina's masterful study of this fortuitous overlap between political and technological visions helps displace the usual histories of technology to the peripheries of the usual geography.[24] Despite possessing just over fifty computers in the early 1970s, the new socialist government aimed to create a nationwide industrial control network and harness the computer to a different version of socialism, a more democratic one than the USSR. The Cybersyn project itself involved a control room in Santiago, with seven futuristic chairs (based on Star Trek sets!) that were "armed" with a variety of controls that could bring up vital data about the national economy on screens around the room. Partially completed, it managed to fulfil its tasks by re-routing logistical lines during a truckers' strike, preventing

[24] Eden Medina, *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile* (Cambridge, Mass: MIT Press 2011)

an economic paralysis. The 1973 coup might have brought the project to a close, yet it showed another version of socialist modernity and one that could be realised in a smaller economy, and a country lacking the vast computing powers of the Western states. More so, this project was designed by a British cybernetic thinker in conjunction with Chilean students and economists, showing the transnational life of such technologies. Medina's work is thus both a powerful reminder to move the geographic focus in computing history, and a model for transnational historical writing.[25]

If we are to continue our zoom out from Bulgarian through socialist science historiography, we come to the wider context of the history of post-war science in general and cybernetics and computing in particular. The central piece of such histories is Paul Edwards' work in *The Closed World,* which posits the computer as both a tool and a model for the Cold War.[26] Born within the logics of superpower nuclear confrontation, the computer became a part of the American military-industrial complex and its logics. It was harnessed to particular types of calculations and models, such as those in the Semi-Automatic Ground Environment (SAGE) project of the early 1960s. However, Edwards carries out an interesting turn, showing how the computer engendered a mentality of the "closed world" among those who used it. It became a self-contained set of logics, models and techniques. It also hinged on the political divisions of the world into two separate "closed worlds". While Edwards' work is a masterful blending of the technological and political history of the Cold War, and its cultural ramifications, it is an American-centric story. The computer in socialism was indeed also part of the military complex in the USSR, but there was little "seepage" between that sector and the civilian one. This was even truer for Bulgaria, where computers were an

[25] Another work that informs this approach is Gabrielle Hecht (ed) *Entangled Geographies: Empire and Technopolitics in the Global Cold War* (Cambridge, Mass.: MIT Press 2011)

[26] Paul Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, Mass: MIT Press 1997)

almost entirely civilian affair. More so, the metaphor of the "closed world" melts away once you move away from the capitals of the superpowers. The Cold War as seen from Sofia and the Bulgarian computer industry was a world as much of opportunity as it was of borders and restrictions.

The literature on the rise of computing is increasingly wide and deep, albeit almost exclusively (as noted) on the Western origins and developments.[27] It has often been linked to the studies of Big Science, and the role of the American and British military-industrial complexes to the machines' birth, or their entanglement with the military aspects of strategy and rocketry during the Cold War.[28] Even though concerning this different scientific space, and often other sciences, some of these studies are valuable in framing the questions of this study. Galison's work on physics introduces the concept of the "trading zone" where different scientific fields can meet and trade knowledge. He especially draws attention to the computer as becoming an important zone of this kind, especially through its ability to simulate outcomes. The computer integrated other sciences and discourses by being able to create new realities through simulation, and thus imposed itself as the new language for many different forms of science.[29] Bulgarian science also became dominated by this new computer discourse, which became a tool for a variety of professionals to converse. The ability to simulate was useful to mathematicians and physicists but also sociologists and political administrators. The computer – everywhere – was an important "trading zone" and a lingua franca. Galison's intervention is thus key when uniting different strands of the Bulgarian socialist and international story through this single lens.

[27] The standard general history remains Paul E Ceruzzi's *History of Modern Computing* (Cambridge, Mass: MIT Press 2003)

[28] A primer on "Big Science" is Peter Galison & Bruce Hevly (eds), *Big Science: The Growth of Large-Scale Research* (Stanford, CA: Stanford University Press 1992)

[29] Peter Galison, *Image and Logic: A Material Culture of Microphysics* (Chicago: University of Chicago Press 1997)

Another important “trading zone” was Europe. Studies of American influence in Cold War European science have shown how this could be an extension of superpower imperial ambitions but also a wholesale transfer of intellectual ideas and training, especially in organisational terms. The demands of the Cold War led to a certain homogeneity among Western scientific establishments, influenced by the demands of creating “Big Science” on both sides of the Atlantic.[30] However, European political ideas and organisational forms had an impact on these American scientific transplants, changing them to their own ends, often creating more open spaces where Eastern European scientists could meet world science more freely than in the USA. Not only was Western Europe going its own way, it was a key place for Bulgarian scientists to meet the artificial realities of Galison’s work. European computing laboratories, including those of American companies that were operated by Europeans, were key places for educating many socialist experts. This flow into Europe of both American “Big Science” concepts and socialist students or specialists complicates our understanding of the Cold War as two “closed worlds” with little interaction between each other, especially in sensitive fields such as computing.[31]

The history of cybernetics, the looming concept in earlier paragraphs too, is increasingly well developed. A multi-discipline field that explores systems’ structures and restraints, it was applicable to computing and maths but also increasingly social engineering. It posits that a system with a goal can take action to achieve that goal, and in the process 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 even the whole universe.

[30] Most important on this transatlantic science transfer is John Krige, *American Hegemony and the Postwar Reconstruction of Science in Europe* (Cambridge, Mass: MIT Press 2006). Also important is the more recent work by Corinna Schlombs in *Productivity Machines: Transatlantic Transfers of Computing Technology and Culture in the Cold War* (PhD Dissertation, University of Pennsylvania 2010)

[31] An article that takes up such concepts is Petri Peju & Helena Durnova’s “Computing Close to the Iron Curtain: Inter/national Computing Practices in Czechoslovakia and Finland” in *Comparative Technology Transfer and Society*, vol. 7, no. 3 (December 2009), pp. 303-322

Norbert Wiener, who is credited as its 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 pre-eminence as a recognised name, but it lies at the core or has informed multiple important fields of study such as game theory, system theory, neuroscience and cognitive psychology, and organizational theory in business management.[32]

Cybernetics is thus key when exploring the intellectual contours of computing discourse and what it offered to engineers but also politicians, sociologists, philosophers and others. Born in the Second World War, and in particular anti-aircraft gunnery, the concept was another “trading zone” for politicians, engineers, computer specialists, mathematicians and other specialists. Its heyday in the West was in the 1950s and into the 1960s – when the torch was taken over by the socialist experts and parties, who incorporated cybernetics into their party programs for future development. Socialist cybernetics was not just a re-hash of old Western debates, and by looking into these discussions in Bulgaria into the 1970s and 1980s, this work expands on existing discussions which are primarily anchored in the West and in the earlier decades, showing how cybernetics could be harnessed to Marxist ends too. Apart from Gerovitch’s already mentioned work, with its Soviet particularities, there are a few works that trace the earlier history of cybernetics in the West which help anchor this research into existing trends and discussions, allowing Bulgarian particularities to be compared and contrasted.[33] Kevin Baker has expanded on this in the East German case,

[32] Ronald R. Kline, *The Cybernetic Moment: Or Why We Call Our Age the Information Age* (Baltimore: The John Hopkins University Press 2015), p. 4

[33] For a longer-duree history of the concepts of feedback and control, see David Mindell, *Between Human and Machine: Feedback, Control, and Computing Before Cybernetics* (Baltimore: The John Hopkins University Press 2002). For a more general history of the intellectual movement in particular, see Ronald Kline’s *The Cybernetic Moment*

showing how cybernetic modelling influenced economic policy and reform ideas in the 1960s, providing a key contrast to the Bulgarian case where cybernetics was more important on the levels of industrial organisation and philosophical debate.[34] Gerovitch has also made an important cybernetic contribution even outside the purview of his general history – namely, in his history of the Soviet space program.[35] He points out that Soviet engineers reigned supreme over the demands of space flights, despite the heroic image of the cosmonauts that was presented to the public. Technological decisions in fact reduced cosmonauts to mere cogs in the complex machines, where automation was at a much higher level than American spacecraft. The cosmonaut's place was that of a figurehead, a propaganda icon, and a failsafe in many cases (such as when Tereshkova had to make adjustments to flight orbits after the automatic programs failed). The reduction of Man to a small role within the complex Machine is thus something that is already inherent in socialist cybernetic thinking, and is also evident in many of the anxieties expressed in Bulgarian intellectual discourse on the same issue. Zubok's recent exploration of the "Thaw" generation of intellectuals in the USSR also draws attention to the importance of cybernetics as a language of anxiety and dissent during the period, showing the incorporation of the history of science into cultural history too.[36]

A complex contribution to the debates on the impact of cybernetics is Mirowski's *Machine Dreams.* Wide-ranging and intricate, it argues that post-war American economic thinking was deeply rooted in the military-industrial complex that emerged in the 1940s, with ideas following money to link the creation of military command and communication doctrine

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[34] Kevin Baker, *Red Helmsman: Cybernetics, Economics, and Philosophy in the German Democratic Republic* (MA Thesis, Georgia State University 2011)

[35] Slava Gerovitch, *Soviet Space Mythologies: Public Images, Private Memories, and the Making of a Cultural Identity* (Pittsburgh: University of Pittsburgh Press 2015)

[36] Vladislav Zubok, *Zhivago's Children: The Last Russian Intelligentsia* (Cambridge, Mass: Belknap Press 2012)

to economic ideas. He also highlights the importance of the computer as a paradigm object for the rise of the "cyborg science" of the late twentieth century – computer science, operations research, game theory, socio-biology and others – and "information" as a concept that can be applied to physical sciences. He argues that the period between 1940 and 1990 was one of attempting to integrate cyborg themes such information-processing and simulation into a general equilibrium view of the world. For him, this left many gaps in microeconomics.[37] His critique of economic theory is not the most important part for this research, but his insistence on re-instating cybernetics in the histories of economics and governance are key to historical work on the post-war period. Despite the very different world they were operating in, Bulgarian economists and political actors were operating under a cyborg sign too.

Other recent work has also shown avenues into deeper research on the interaction of computing and professionals. Ensmenger's history of the US software industry shows how these specialists became the links between computers and societies, vested with much power as intermediaries. Computers were "black boxes" to much of the population, tangles of codes and complex ideas. Society needed interpreters of this new arcana, and in Ensmenger's case these are the new software specialists who were not just scientists and technicians but also doubled up as business experts – constituting yet another "trading zone" of ideas, vested in a single professional class. Ensmenger is key in making us focus on the social context of the machine as much as the machine itself, moving beyond traditional history of technology to show how the technical experts themselves became part of social discussion and power relations.[38] This attention to the technical intelligentsia is key in the history of modern

[37] Phillip Mirowski, *Machine Dreams: Economics Becomes a Cyborg Science* (Cambridge: Cambridge University Press 2002)

[38] Nathan Ensmenger, *The Computer Boys Take Over: Computers, Programmers, and the Politics of Technical Expertise* (Cambridge, Mass: MIT Press 2010)

societies, where the contributions of philosophers, economists, writers, sociologists and others is privileged above those of engineers and the people who *built* modernity in a literal sense. The earlier work of Jeffrey Herf is thus also useful in bringing attention to the political ideas that technical intellectuals could have. In his history of the Weimar and Nazi period, he draws attention to the combination of great enthusiasm and embracement of high technology and the rejection of Enlightenment principles among some engineers in Germany. Modern technology is a value-neutral tool that can be imbued with social meanings, including totalitarian ones. Herf's work is thus still influential in both drawing attention to the engineers as a creative class, and in the ways that modern technology could serve extreme political ideologies.[39]

To situate this work only within the histories of science in general and computing in particular would however miss out on the other debates that this Bulgarian story impacts. "Modernisation" is part of the subtitle, and it is there for a reason. This dominant theory of the 1950s and 1960s set out a path which underdeveloped societies were to take to modernity. It has often been criticised, rightly, for its universalisation of Western experience, but at its core it provides a useful framework of how many other societies *did* go about emulating the development path of the dominant powers. Modernity was the application of modern practices, above all new technology and the rational organisations of society and labour. The application of science to production and governance was thus at the heart of modernisation, including socialist one, which in many ways put an even bigger premium on turning science into a productive force.[40] Bulgarian "modernisation", with its emphasis on automation and computing, thus follows in the footsteps of the general trend of scientific application to the

[39] Jeffrey Herf, *Reactionary Modernism: Technology, Culture and Politics in Weimar and the Third Reich* (Cambridge: Cambridge University Press 1984)

[40] The literature and debates around modernisation are, understandably, vast. A good starting point can be David C. Engerman & Corinna R. Unger "Introduction: Towards a Global History of Modernization" in *Diplomatic History*, vol. 33, no. 3 (June 2009), pp. 375-385

problems of underdevelopment, but it is in the particularities of the local story that one can find the divergence and illumination. Socialist modernisation has largely been left out of the general trend of writing about modernisation, which is so often confined to the West and developments in the Third World where the theories were applied.

To talk of the specifics of a Bulgarian modernisation means to take the socialist world as a serious attempt to create an alternative modernity to the capitalist model. The Second World as a space of shared ideological worldviews but also a distinct area of practices and exchange is a concept which will be employed in this work. It is by far the most neglected of the Cold War worlds, in favour of the developed West or the traditional and backward Third which was to be uplifted. Yet the Second World was unified by ideology, shared institutions, and a lively exchange of goods, practices, and knowledge.[41] The computer industry could not thrive without its particularities and shared markets. Bulgarian computers existed within it and without one particular institution above all they would not be able to exist. This was the COMECON, which has been a neglected field of study. The attempt at a socialist division of labour in order to challenge the West might have failed, but for decades it was an overriding fact of socialist states' economic policy. The co-operation and integration within the Bloc did bind states together whether they wanted to or not.[42] Recent work by Suvi Kinsikas excellently integrates COMECON history into global economic developments after the war, pointing out how it constituted itself increasingly as it saw the challenge of the European Community. Processes of integration in this closed economic bloc were, paradoxically,

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[41] For more on the Second World, see Parag Khanna, *The Second World: Empires and Influences in the New Global Order* (New York: Random House 2008). A highly influential work for this research has been Elidor Mehilli's *Building the Second World: Postwar Socialism in Albania and the Eastern Bloc* (PhD Dissertation, Princeton University 2011)

[42] Work on COMECON is limited. Dated but useful examples include Adam Zwass, *The Council for Mutual Economic Assistance: The Thorny Path from Political to Economic Integration* (New York: M E Sharpe Inc 1989); William Butler (ed) *A Source Book on Socialist International Organizations* (Alphen aan den Rijn: Sijthoff & Noordhoff 1978); László Csaba, *Eastern Europe in the World Economy* (Cambridge: Cambridge University Press 1990); Michael C. Kaser, *Comecon: Integration Problems of the Planned Economies*, (London: Oxford University Press 1967)

spurred by the need to approach the Western European countries in a more unified manner. The Second World constituted itself, economically, in relation to the First.[43]

By paying attention to these post-Stalinist developments in the international history of socialism, as well as the domestic developments of novel technological sectors with their own impact on politics and society, this study also turns attention to the more dynamic developments of the late Cold War. It particularly takes issue with Zubok's claim that this was a "senile Cold War", characterised by the Brezhnev to Chernenko period. These men had not been forged in the fire of revolution and thus did not conduct foreign policy like Stalin, who combined Russian messianism with Marxist ideology to forge a novel and important approach to foreign relations. The later period was supposedly one of techno-bureaucracy, of management rather than advancement.[44] Yet technocratic management is all too often taken to be staid. By bringing the historiographies of cybernetics and technology to bear on the later Cold War, domestic developments in the Second World take on a more novel hue, as they were sites of debate and experimentation. More so, the Cold War exchanges and conflicts over this new technology corresponded to a different world set of relations, paralleling the world of "détente" in foreign relations. Edwards' "closed worlds" were more apparent in the early Cold War than the Brezhnevite period, as becomes apparent by a history of computing during this period. This might have been obscured if one is to take a superpower view, but by taking up the challenge that Tony Smith posed to historians of the Cold War in 2000, one can see the novel possibilities opened up during these years if you shift the lens away from Washington and Moscow.[45] By bringing the Bulgarian example in conversation with the

[43] Suvi Kinsikas, *Socialist Countries Face the European Community: Soviet-Bloc Controversies over East-West Trade* (Frankfurt am Mein: Peter Lang 2014)

[44] Vladislav Zubok & Constantine Pleshkov, *Inside the Kremlin's Cold War: From Stalin to Khrushchev* (Cambridge, Mass: Harvard University Press 1997)

[45] Tony Smith, "New Bottles for New Wine: A Pericentric Framework for the Study of the Cold War" in *Diplomatic History,* vo. 24, no. 4 (Fall 2000), pp. 567-591

socialist world in general, this work also addresses Kotkin's lament that Russian and Eastern European history have drifted further apart since the fall of the USSR, often studied in isolation, which carries on into work done on the period nowadays – the large superpower itself is often studied with reference to its internal policies and realities alone.[46] The Bulgarian computer industry, deeply entangled with Soviet markets and users, shows that Moscow was often at the mercy of even its smallest allies.

This all necessitates taking both "modernity" as a serious concept, and transnationalism as an angle into the debate. Modernities can be multiple and competing, as already stated.[47] They borrowed freely from each other in practices and technologies, but this does not mean that liberal and illiberal modernities looked the same. By taking seriously the projects of the Second World, including Bulgaria, one can thus see the interaction between transnational exchanges (which do not privilege the locality) and actual, on-the-ground realities. Transnational approaches lose their power if actors are taken to be part only of international exchanges and networks, without regards to local context. What Bulgarians borrowed and learnt abroad was to be applied to particular realities in a socialist society and a one-party state. To focus just on circulation is to miss out the centrality of the project that this technology was to build, a powerful national economy and automated socialist society. Transnationalism can be useful as an approach if it is kept in parallel to the reality of locality and place, where the modernity was being built. It allows this study to push back the state when dealing with international relations and exchanges (focusing on the level of scientists and professionals), but foregrounds that same state when the local story is being affected by

46 Stephen Kotkin, "Mongol Commonwealth? Exchange and Governance Across the Post-Mongol Space" in *Kritika,* vol. 8, no. 3 (Summer 2007), pp. 487-541

47 For the concept of multiple modernities, see S N Eisenstadt, "Multiple Modernities" in *Daedalus,* vol. 129, no. 1 (Winter 2000), pp. 1-29 as a primer, and his edited volume *Multiple Modernities* (New Brunswick: Transaction Publishers 2002). The go-to piece on Soviet modernity in particular remains Stephen Kotkin's "Modern Times," *Kritika,* vol. 2, no. 1 (2001), pp. 111-164.

these returning specialists. This constant interplay allows for this study to intervene in the ceaseless discussions on modernity by showcasing how technologies were points of contact between different modern regimes but were also useful for illiberal and liberal regimes alike.[48]

One way this study breaks down the barriers between the two modernities is by using the state security apparatus as a genuine channel for knowledge and technology transfer rather than just espionage. The peculiarities of the Bulgarian spy program during this period, with its civilian control and harnessing to the economic needs of the country, make it an innovative way to do just the move advocated in the previous paragraph. Bulgarian spies were transnational actors par excellence, parts of circuits and networks; at the same time they were state servants and actors by the dint of their profession. The global connections they made were in service of a locale, and were tied to state economic plans. This methodological approach allows to utilise yet another historiography – that of the intelligence services – to illuminate global connections and questions of modernity. By taking the spies seriously as agents of exchange, and the actions they were carrying out as intellectual transfers rather than just industrial espionage, this hitherto separate history becomes an integrative part of the global story of the late twentieth century. The "closed worlds" formed by the Iron Curtain, the COCOM embargo, and the self-definitions of both blocs, were increasingly porous as regimes sought the tools of modernity for their own, local needs. Intelligence work was directed by civilians and integrated into civilian science in the Bulgarian case, showcasing a military-industrial complex that is more akin to the American than the Soviet example.[49] The

[48] Two articles from the *American Historical Review* are useful for an eagle eye's view of both these debates: "AHR Conversation: On Transnational History" in *The American Historical Review,* vol. 111, no.5 (December 2006) pp. 1441-1464; and "AHR Roundtable: Historians and the Question of Modernity" in *The American Historical Review,* vol. 116, no. 3 (June 2011), pp. 631-751. On science as a way to do transnational history in Eastern Europe, see Susan S. Gross, "Circulation of Knowledge and the Russian Locale" in *Kritika,* vol. 9, no. 1 (2008), pp. 9-26

[49] For the history of COCOM, see Yoko Yasuhara, "The Myth of Free Trade: The Origins of COCOM 1945-1950" in *Japanese Journal of American Studies,* 4 (1991), pp. 127-148 and Michael Mastanduno, *Economic*

interplay between the civilian needs of the Bulgarian scientists and planners and the state-led, secret work is in stark contrast to the USSR, which was often criticised as suffering from its deep separation of military and civilian sectors, with little technology passing between the two.

Another international link that is explored is that with the developing world, and above all India. The history of development and the impact of modernisation drives in newly independent states is rich and varied, emphasizing the continuities between colonial and development practices. Often, the emphasis has been on the attempts by Western powers and thinkers to apply particular models, and the resistance to this or the failures of such actions.[50] As Cullather argues forcefully in his global history of the Green Revolution, development approaches were consciously created as models that could produce statistical data as proof of the viability and ultimate "truth" of that particular model over any other.[51] While the socialist bloc's development approach has been understudied, there have been moves to rectify this,[52]

Containment: COCOM and the Politics of East-West Trade (Ithaca, NY: Cornell University Press 1992). For the history of Bulgarian State Security, the go-to work is Momchil Metodiev, *Mashina za Legitimnost: Rolyata na Durzhavna Sigurnost v Komunisticheskata Durzhava* (Sofia: Ciela 2008). On the co-operation with the KGB and its relation to the DS, see Jordan Baev *KGB v Bulgariya* (Sofia: Voenno Izdatelstvo 2009). Key to tracing the spies' trajectories in their professions and postings abroad, the 47 biographies published in Momchil Metodiev & Mariya Dermendzhieva, *Durzhavna Sigurnost – Predimstvo Po Nasledstvo: Profesionalni Biografii na Vodeshti Ofitseri* (Sofia: Ciela 2015) are absolutely invaluable. A primer in intelligence studies is Loch K. Johnson's edited volume *Handbook of Intelligence Studies* (Abingdon: Routledge 2007).

[50] There are many avenues into the history of international development: Frederick Cooper, "Writing the History of Development" in *Journal of Modern European History,* vol. 8, no. 1 (January 2010), pp. 5-23; Frederick Cooper & Randall Packard (eds.) *International Development and the Social Sciences: Essays on the History and the Politics of Knowledge.* (Berkeley: University of California Press 1998). More critical approaches can be found in Arturo Escobar's *Encountering Development: The Making and Unmaking of the Third World*. (Princeton: Princeton University Press 2011). A good study of the continuities between colonial and development practices is Joseph Morgan Hodge's *Triumph of the Expert: Agrarian Doctrines of Development and the Legacies of British Colonialism* (Athens: Ohio University Press 2007)

[51] Nick Cullather, *The Hungry World: America's Cold War Battle Against Poverty in Asia* (Cambridge, Mass: Harvard University Press 2010)

[52] David C. Engerman, "The Second World's Third World" in *Kritika,* vol. 12, no. 1 (Winter 2011), pp. 183-211

including for non-Soviet states, especially East Germany.[53] India in particular has been the purview of Engerman's studies, showing how the Soviets met this self-fashioned protectionist state with its own interests.[54] Attempts to impose socialist planning onto the Indians met with many problems and pushback, as the newly independent state was following its own path to modernity. To be sure, planning and statistical analysis was to play a huge part in it, and computing became a paradigm for development and the application of rational science to governance in India as it did in other places.[55] India was thus not a passive player in the development game, but an active participant with its own local applications of the transnational paradigms of computing, modernisation, and Big Science.

If we are to move the lens away from the development game, however, India and the Global South become the places of entanglement for the foreign actors on the ground. A state such as Bulgaria did have a developmental aspect to its approach to India, but it was primarily interested in trade and economic benefit, and increasingly – technology transfer. The Indian market was open to all world developments, produced innovative domestic products, and was free of the embargo operating in Europe and the USA. Thus it is useful to look to more traditional aspects of inter-state relations, such as trade, but from a different angle. The Bulgarians entangled with Western experts who they were competing with, as well as Indian counterparts who were commercially savvy. To compete in an open market,

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[53] Massimiliano Trentin *Engineers of Modern Development: East German Experts in Ba'thist Syria: 1965-1972* (Padova: CLEUP 2010); and "Modernization as State Building: The Two Germanies in Syria, 1963-1972" in *Diplomatic History*, vol. 33 no. 3 (2009), pp. 487-505

[54] David C. Engerman, "Learning from the East: Soviet Experts and India in the Era of Competitive Coexistence" in *Comparative Studies in South Asia, Africa, and the Middle East*, vol. 33, no. 2 (2013), pp.227-238; and "Solidarity, Development, and Non-Alignment: Foreign Economic Advisors and Indian Planning in the 1950s and 1960s" in Unfried Berhold (ed) *Practices of International Solidarity and International Development* (Vienna: ITH 2012)

[55] For some of these aspects, see Arunabh Ghosh, "Accepting Difference, Seeking Common Ground: Sino-Indian Statistical Exchanges 1951-1959" in *BJHS Themes* (March 2016), pp. 1-22; Nikhil Menon is currently completing a dissertation on the topic at Princeton, titled *Planned Democracy: Citizenship, Development, and the Process of Planning in Independent India 1947-1966*. I thank him for sharing some of his work and insights with me.

Bulgarians had to learn rules that were not present in the politically-driven COMECON trade game. Transnational exchanges in India could thus manifest not just in the material transfer of technology, but in learning new skills such as business negotiation, user responsiveness, and marketing. The Cold War was truly global in all aspects, and a socialist state did not always behave very socialistically in all areas of the world and in all interactions.[56] By looking at the way these experts operated on the ground in India, this study reveals how the Third World was a space to meet the First, as well as a veritable school of how to practice capitalism.

It is the community of Bulgarian experts of various kinds that lies at the core of this research. They are all united by the framework of the computer. As we have already seen, the computer became a paradigm and a trading zone between different fields. It was also an opportunity to sell and meet the world, or to steal – and again meet that world. The experts in this research are thus all professionals who had a bearing on the industry. They include the Politburo and party members who patronised and directed the industry; the scientific directors of institutes and economic managers of the production enterprises; the thousands of engineers and scientific workers who created the machines but also implemented them into economic and social life; trading executives who sold it; spies who stole the critical information; philosophers, mathematicians, educators, psychologists and myriad other specialists who thought with and about computers, employing "cyborg science" to make sense of the world. By anchoring the history of computing in this milieu, the research shows how this technology enabled other sorts of thoughts and visions than those in the West. Narratives of the experts who created the computer revolution abound, from the military-industrial context already explored, to a history of counter-cultural innovation. These were the wizards and hackers

[56] The work of Odd Arne Westad in *The Global Cold War: Third World Interventions and the Making of Our Times* (Cambridge: Cambridge University Press 2005) is still invaluable in showing the agency of the Third World actors.

who rejected the grey post-war culture of conformism and sought freedom and creativity in the possibilities of electronic reality.[57] This narrative usually sees the 1990s internet as a culmination of these 1960s radical dreams, or as Fred Turner puts it, this is the road from counterculture to cyberculture.[58]

The information age that these narratives advance is very different to the socialist one in Bulgaria. The experts in this study did not seek to rebel using the computer, and Bulgarian network developments did not tend towards the development of a hacker-based cyberculture in the same way. There is something to be rescued from these studies which is applicable to the later chapters of this work, namely the rejection of the established order and the search for freedom in the creativity of the machines – but this rejection often came as a result of the shortage of computers which were desired by younger people rather than as a particular countercultural rejection of the political order. The vast majority of experts under study here, however, did not employ the computer to reach the "freedom" of the internet – they were the bureaucrats rather than the wizards. However, they too were part of the information age. What their aims were, and what they hoped to achieve, can thus illuminate the multi-faceted nature of what information wrought on societies and economies after the 1970s. Despite not producing wholly new technology, these experts sought to configure the information technology to novel ends, serving socialism and rational organisation. They were not techno-rebels but connected to state interests – something that the usually triumphant history of the

[57] See Roy Rosenzweig "Wizards, Bureaucrats, Warriors, and Hackers: Writing the History of the Internet" in *The American Historical Review*, vol. 103, no. 5 (December 1998), pp. 1530-1552 for a blending of both stories, from Big Science to the hacker.

[58] Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, The Whole Earth Network, and the Rise of Digital Utopianism* (Chicago: University of Chicago Press 2008). For a critical view of the techno-utopianism that comes with the rise of information technologies and knowledge work, see the captivating work by Alan Liu in *The Laws of Cool: Knowledge Work and the Culture of Information* (Chicago: University of Chicago Press 2004)

Silicon Valley misses out in a drive to glorify individual genius.[59] There was innovation and entrepreneurship, especially as the enterprises gathered steam and became the most profitable aspects of the national economy.[60] Often these were in how to apply technology to social governance and the new worker. Computing was thus mostly in the service of the state, and in service of a Marxist ideology that is a far cry from the largely libertarian views that it began to be associated with under the Silicon Valley champions.

In the pursuit of a complete history of this industry, then, we have to restore power as a central concept of the study. The experts who engaged in the "trading zone" of the computer paradigm exercised power in various ways and to various degrees. But the computer itself was an embodiment of power, and a tool for it. It was the perfect machine to make nature and society completely legible, that ultimate dream of high modernism. The various databases developed during the socialist period were part of a grand dream by the state to see all that it could.[61] The centrally planned economy was to be overseen by computers, while social administration was to demand ever increasing amounts of information about the citizens. The computer was a tool of power for the party that desired to be omniscient. This, too, was an aspect of the information age as much as counterculture. Apart from Scott's work, it is instructive to mention Timothy Mitchell's ground-breaking work on techno-politics in Egypt.[62] This work follows his fruitful case studies of the practices that produced both the power of science and the power of states, rather than (by his own

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[59] This has been particularly noted in commissioned histories of companies, who often refuse access to archives. For a cogent argument, however, on the longer history and state support that made the Silicon Valley boom possible, see Christophe Lecuyer *Making Silicon Valley: Innovation and the Growth of High Tech. 1930-1970* (Cambridge, Mass: The MIT Press 2007)

[60] On the concept of socialist entrepreneurs, see Jouko Nikula & Ivan Tchalakov, *Innovations and Entrepreneurs in Socialist and Post-Socialist Societies* (Newcastle: Cambridge Scholars Publishing 2013)

[61] James C Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press 1999)

[62] Timothy Mitchell, *Rule of Experts: Egypt, Techno-Politics, Modernity* (Berkeley: University of California Press 2002)

admission) more opaque introduction and theory. He demonstrates how social categories that are taken for granted are actually constructed, where the supposed dichotomy between reason and the real world collapse once science is harnessed to the project of expanding state or techno-political power. Both human and non-human ingredients are needed for techno-politics, and this story thus follows the amalgam of experts armed with cybernetic tools such as the computer. The bending of the supposed rationality of computing science in service of the socialist state is thus indicative of the ways the information age can proceed, a timely reminder if it was needed.

A discussion of power naturally brings in Foucault's work. A careful deliberation could bloat to encompass this whole work, so a few key concepts will be highlighted. The idea of pastoral power is useful when thinking about what the socialist state was trying to do, creating a set of techniques, rationalities, and practices designed to govern the conduct of the population, organising them as a political collective. The party did desire to create socialist citizens, and computers were the most useful shepherd's stick for this pastoral state.[63] These activities produced certain kinds of knowledge that collected information on people's activities, reinforcing this power. The governmentality of the pastoral state, which was central to Foucault's later years, aimed at organizing and producing citizens; but the power-knowledge that is the focus of earlier work is de-centralised and unstable.[64] The strength of his approach is precisely that he doesn't offer us power as a thing (and thus no real theory of power) but as a relation, ever-shifting, and able to reside in various parts of society. Apart from the state, thus, there were other ways that power could operate in socialist society. The computer is a tool of discipline par excellence, a perfect Panopticon that Foucault was

[63] For more on pastoral power, see Michel Foucault's *Security, Territory, Population: Lectures at the College de France 1977-1978* (New York: Palgrave Macmillan 2007)

[64] For power-knowledge, see his seminal *History of Sexuality, Vol. 1: An Introduction* (New York: Pantheon Books 1978)

concerned with. Discipline does not strike down the subject the way that a state sovereign does, but works subtly by coaxing subjected citizens (or inmates) to what the new "normal" is. Docility and obedience are the aim of discipline.[65] The automation and computerisation of the workplace in Bulgaria was aimed at least partly at removing "the subjective factor" – worker mistakes, but also thus worker independence. Information was both a tool of governmentality, producing knowledge about the population, and a way to discipline, by keeping eye on quotas, wastage, shirking of responsibilities.

At the same time, Foucault's power could reside outside the state too. Some experts were producing their own knowledge in their exercise of state-sanctioned power while building up the computer industry. These encompassed financial and business contacts across the Iron Curtain, practices that were at odds with state socialism. An alternative power relation existed in late socialist Bulgaria, not necessarily flowing from the Politburo. It was embodied in a certain strata of computer technocrats who were increasingly at odds with official party policy and the practices of the older members of the elite. Their agency had a role to play in the downfall of socialism and the transition to a free market and pluralistic politics. The computer industry has been used by Maier as an example of the failure of the socialist economies to respond to the challenges of the 1970s and the shift to knowledge economies in the wake of the oil crisis. [66] Sustained by credits and, for a time, Soviet oil, the socialist bloc did not reform or enter the information age truly. This forceful argument is at the heart of Manuel Castells' trilogy on the information age and economy, which sees the USSR and its allies as never making the jump from industrial to informational organisation.

[65] Needless to say, see *Discipline and Punish: The Birth of the Prison* (New York: Random House 1975)

[66] See Charles Maier, *Dissolution: The Crisis of Communism and the End of East Germany* (Princeton: Princeton University Press 1997)

Imperfectly reformed, such societies were doomed in the new world.[67] This is the conventional narrative of the computer revolution's failure in the East.

Yet Maier's Western loans were part of the networks of the global information economy that Castells writes about. These works contain the tools to analyse these emerging power elites, who had their own forms of knowledge which could be used to transform society. Castells writes about nodes of power which are geographically disparate but linked by common interests and practices. Maier talks of Western banks keeping socialism afloat. The Bulgarian technocrats who steered the computer industry became entangled with such banks, while at the same time participating in the global information economy. They became nodes of power within Bulgaria, with different interests and capabilities than the state itself. What they sought to do with such power was reform, and when the regime fell, transform this capital into new forms of power, both economic and political. The issue is thus not so much that the socialist bloc did not enter the information age, but that it did so imperfectly. Some nodes were already there, practicing an international language of new power, while other parts of society were subject to different forces, lacking the same capabilities.[68]

Finally, a note must be made on another aspect of the methodology. Apart from the above-discussed experts who worked under the computer paradigm, the research uses the lens of the computer itself. As a commodity it was sold and traded, while as a tool it was used both for state and professional purposes. The usefulness of commodity history is that it helps transcend political and national boundaries as the goods circulate around the globe. From inception of the idea to production to sale, any commodity can thus be followed through

[67] The argument first appeared in essay-form in Manuel Castells and Emma Kiselyova, *The Collapse of Soviet Communism: A View from the Information Society* (Berkeley: International and Area Studies, University of California 1995). It was then integrated in *The Information Age: Economy, Society and Culture*, consisting of three volumes: *The Rise of the Network Society* (1996), *The Power of Identity* (1997), and *End of Millennium* (1998).

[68] The concept of nodes and network power can be found in Manuel Castells, *Communications Power* (Oxford: Oxford University Press 2009)

space but also time, encompassing a variety of experts and workers. The commodity itself allows one to talk about the scientist in the institute, the spy in the West, the worker on the production line, the labourer in the office, the student in the classroom, the philosopher who thinks about it and the author who worries about it. It is a key methodological tool to unite disparate geographies but also politics and economics with culture. The historiographies of political, cultural, business, economic, science, and development history also collapse within the confines of the computer. The very discussion over the last few pages is made possible by the materiality of the item under study. At the same time, superficiality has to be avoided, as commodity history may either elevate its importance or tend towards the anecdotal – or even worse, miss the importance by trying to take on too much.[69] Thus this research concentrates on a short span of time, from 1967 (when the state economic union creating computers was created) to 1989 (the fall of the Zhivkov regime), and on a commodity that impacted society directly. While the chronological span does extend a few years either way, to cover the pre-history of the industry and the implications of its power into democratic Bulgaria, it is short enough to allow a wide variety of issues pertaining to its effect on thought and life to be explored. In this, it takes inspiration from another commodity history of Bulgaria, which masterfully does this over a longer period – Mary Neuburger's work on tobacco.[70] The computer is also, though, a tool and lends itself to different analysis. Using it, this research analyses the interactions of global and local actors and trends, as well as politics and technical intellectuals, through a single material site where ideas were traded and through which power operated.

[69] A good primer on commodity history is Arjun Appadurai (ed) *The Social Life of Things: Commodities in Cultural Perspective* (Cambridge: Cambridge University Press 1988)

[70] Mary C Neuburger *Balkan Smoke: Tobacco and the Making of Modern Bulgaria* (Ithaca: Cornell University Press 2012)

Structure

The goal structures the work by first presenting the causes for the rise of this industry and its development, before looking at its implications for society and politics in the country. Plentiful sources which have been underutilised or never seen before are to be found in Bulgarian, Russian, and Indian archives. Combined with personal interviews, the print runs of journals, popular magazines on computing, literary works of science fiction, they present a possibility to write both stories of international exchange and deeply involved local cases. There is a certain level of zooming in and out, as well as switches between modes of history – from that of the industry in the context of international socialist economics, to intelligence services, to East-South interactions, cybernetic applications, intellectual history, and business class formation. It is difficult to pinpoint a centre for the story, as each adds a different colour to the story of Bulgarian socialist modernisation, and the global information age.

Chapter 1 looks at the pre-history of the industry. It provides a brief history of Bulgarian underdevelopment and its breakneck Stalinist-style industrialisation and urbanisation during the 1950s. It introduces the problems that were facing the Bulgarian economy, the ideological turn towards building the next stage of socialism, and the contingent factors that allowed the Politburo to think about electronics as a possible future avenue. The chapter argues that it was the confluence of a debt crisis, a self-confident party that was securely in power, the need to specialise in a profitable area, and a high-placed engineer, that led Bulgaria down the road to computers.

Chapter 2 is the longest and narrates the development of the industry. It provides the necessary background to understand why this sector deserves the attention, and how it came to dominate the party's economic fortunes. At the same time, it traces how this technology was created in Bulgaria, how the scientific teams were formed, and how this operated within the logics of socialist economic integration and the COMECON. It also gives a brief overview of the types of machines that were being created, helping the reader orient themselves within the nomenclature of socialist computing. Its central arguments blend economic with technological history to show how a socialist state created the organisational framework for turning science into a productive force, and how it responded to and utilised the pressures of COMECON.

Chapter 3 turns towards the intelligence services. It combines the transnational history of spying which made the Iron Curtain porous with the local story of the how this technology was harnessed to the needs of the civilian sector. By employing de-classified state security files, it demonstrates the extensive amount of know-how that Bulgarian scientists could gain about supposedly banned goods through the network of spies that the country developed. The chapter argues that this was a true channel for knowledge transfer, as the spies worked under the auspices of civilian planners and used scientists as both spies themselves and analysers of the goods gained. The intelligence services emerge as a powerful and under-studied tool for transnational historical research, as well as a servant of state power for non-military needs. Thus the Bulgarian case, the chapter demonstrates, is more akin to the seep-through of technology between the military and civilian sector in the West than the strictly divided case of Soviet science.

Chapter 4 is the case study of Bulgarian experiences in India. It shows how Bulgarians turned to the Global South as both a source of hard currency and a place to encounter the newest trends in science. Tracing the particularities of penetrating the Indian market, the chapter demonstrates the learning curve Bulgarian actors had to go through in order to become competitive in this crowded sphere. The Indian state wanted to foster a domestic industry, and could always buy American or Japanese computers instead of the unknown items of the Bulgarians. By learning to market themselves, to negotiate, to respond to user requests in a timely and professional manner, Bulgarian electronic experts and merchants became modern capitalists. India was a space of exchange of ideas and not just goods. The chapter shows that the Global South should be studied as such rather than mostly as a site of development if we are to uncover the vitality of these markets. It also demonstrates how Bulgarians could meet the West through its ideas, practices, and items, in different parts of the globe, circumventing the embargo.

Chapter 5 is a study of the way that computers and automation were harnessed to the party goals from the 1960s onwards. Cybernetic models and terms entered official discourse, and the machines steadily encroached on the workspaces of many Bulgarians. The chapter argues that the party vested much hope in cybernetics and computing, and that its progressive vision for the future was increasingly taken over by the hopes of the scientific-technical revolution, a credo that was to be the panacea of the command economy. By tracing the rise of Bulgarian automation in both industrial and informational settings, through robots and networks, this section demonstrates the state-led projects that the information age can be used for. The party desired to have total information over society, introducing a variety of tools and databases that could be used to record and discipline. At the same time, it met a reaction amongst some of the workers, and increasingly found out that computers do not necessarily equal a rational organisation of society, and did not guarantee an objective view of the world.

Chapter 6 is an intellectual history of the ideas that developed around cybernetics and computing amongst the professionals who worked under this paradigm. It starts with showing how computers increasingly entered education, ensuring the creation of a new generation of people and eventual workers, who would labour in the true information age. Ideas about what it was to be a man in this new age thus abounded, as experts of all kinds, including the social sciences, argued in this “trading space”. The chapter includes an in-depth study of the main cybernetic institute of the country, demonstrating how its projects of applying cybernetics to society and industry could give surprising intellectual results. It also highlights how the debates that raged over the future of the human in this new age could be very different, with some seeking to use computers to create the new creative personality of a truly New Socialist Man, while others criticised the party for not truly grasping the possibilities of this new technology. The chapter ends with a demonstration of how these arguments and anxieties spilled over into popular culture through literature, as the information age and Man-Machine debates became current beyond the pages of journals.

Chapter 7 is a discussion of the rise of the dual professional classes that laboured under the computer paradigm. It shows how the thousands of scientists and engineers formed into an internationally-minded and well-trained strata, with its own interests and professional pride. At the same time, a technocratic management class emerged that was plugged into the post-1970s knowledge economy through finances, firms, and practices. The chapter looks at the rise of socialist firms abroad, licenses, and circulation of experts, to argue for the rise of powerful new groups. The technocratic managers instrumentalised some of the technological-based criticisms of the party to participate in the downfall of communism, while holding onto levers of power that helped them into the 1990s and 2000s. Thousands of experts, too, used knowledge and skills to negotiate the transition to capitalism better. The chapter also argues that the rise of Bulgarian virus factories, hackers, and a new, post-socialist, IT sector, demonstrate the successes of the socialist industry, measured in human rather than material capital.

In the conclusion, these threads are brought back together. Questions of mobility versus space, transnational and local history, the chronologies of socialism, the porousness of the Iron Curtain, the global possibilities of exchange, and the multi-faceted nature of the information age, are brought back and discussed in light of the evidence presented. It argues for the utility of such a commodity history together with its human actors in uncovering the intersection between technology and policy as well as circuits of exchange and state power.

Method and narrative united to show how the computer is the “trading zone” that enables the modern age’s multifaceted power relations to be seen most clearly, a tool and paradigm that allows transnational contacts in an age where power is still exercised most successfully within state boundaries. Created by a socialist state to raise cash, the Bulgarian computer became a way to also meet the world, participate in the latest science, and ultimately bring back the seeds of regime change.

Chapter 1. A Victory, a Crisis, a Possibility: The Pre-History of Bulgaria's Electronic Industry

The story of the computer industry in Bulgaria starts a full ten years before its take-off in the later 1960s. While 1956 is the famous watershed of late socialism, signalling the move to liberalisation after Stalin's death through Khrushchev's Secret Speech and its Bulgarian equivalent, the April Line,[1] the financial and socio-economic consequences of the first decade of industrialisation and communism came to a head in Bulgaria in in the years 1958-1965. This period saw a victory, a problem, and a possibility. The end of second Five-Year Plan (1953-8) was a watershed moment for the party as important as the start of its de-Stalinization two years earlier, and a moment when it could take stock of what it had achieved and failed in during the years of break-neck industrialisation, urbanisation, and growth while following the precepts of Stalinist economic development. Domestically, it was the moment when the Bulgarian Communist Party (BCP) named its 7th Congress that of "victorious socialism", while at the same time facing the regime first – and very serious – financial debt crisis. At the same time, the party looked outwards, at a global world where international contacts were growing as the two camps softened their rhetoric and looked for dialogue. But the real possibility lay in the immediate sphere of socialist regimes, rather than the world as a whole – with the Council of Mutual Economic Assistance (COMECON) discussing the possibility of specialisation and a division of labour. The congruence of these three factors brought together a moment of crisis but also re-thinking of economic priorities and plans, which paved the way for the otherwise surprising electronic revolution in the following decade. But the 1956-65 period, and especially the 1958-9 conjuncture, was the culmination of several medium and long-term trends in Bulgarian development.

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[1] The April Plenum of the Central Committee of the Party was held on 2-6th April 1956 and was almost a direct replica of the 20th Congress of the CPSU. It was both the starting point of Bulgarian de-Stalinization and Todor Zhivkov's (who read the report) climb to absolute power within the party.

Perennial Backwardness

The Bulgaria of the late 1950s looked very different to the one that the BCP had inherited after taking power on the 8-9th September 1944, thanks to their efforts at breakneck, Stalinist-style, autarkic industrialisation. They had taken power in a country which was one of the perennial backward states of the continent, part of the South East Europe that economists Paul Rosenstein-Rodan and Kurt Mandelbaum had seen as an area of disguised rural unemployment, in dire need of infrastructure and structural investment – one of the original case studies of what was eventually to become development economics.[2] Its transformation from an agricultural basket case into a modern society would be one of the victories that the BCP would proclaim in 1958.

During the late 1930s and 1940s, only around 8% of national income was produced by industry, of which over half (58%) was in the food sector, which included tobacco. Sectors such as metal works, electrical energy, or chemicals, were negligible, each under 5% of an already meagre total industrial output.[3] The sector was characterised by an almost artisanal nature in its scale and agglomeration: in 1939 there were 3355 private enterprises with more than ten workers or output of energy higher than ten horsepower, giving around 10% of all production in industry.[4] Hampered by the weak investment power of the Bulgarian bourgeoisie, with only around 500 joint-stock companies in the whole country, the state put up some of the highest protectionist barriers, ensuring a captive market.[5] The state tried to

[2] Their ideas can be found in Rosensten-Rodan's article "Problems of Industrialization of Eastern and South-Eastern Europe" in *Economic Journal* v.53 no. 210/211 (1943), pp. 202-11; while Kurt Mandelbaum's thoughts are found in the short but influential *The Industrialization of Backward Areas* (Oxford: Blackwell 1945)

[3] Figures from Berov, L & Co *Razvitie na Industriyata v Bulgariya 1834-1947-1989* (Sofia: Nauka I Izkustvo 1990), p. 144

[4] Ibid.m pp. 139-140

[5] Iliyana Marcheva, "Problemi na Modernizatsiyata pri Sotsializma: Industrializatsiyata v Bulgariya" in Kandilarov, E & Turlakova, T (eds) *Izsledvaniya po Istoriya na Socializma v Bulgariya 1944-1989* (Sofia: Grafimaks 2010), pp. 179-180

encourage some investment in key sectors by the late 1930s, but industrial growth remained sluggish. Despite not being too different to its Balkan neighbours, where industrial production per head was similarly low, the country was lagging 10 to 30 times behind its Central and Western European counterparts, to which it was aspiring, in this indicator.[6] By 1946 the rural population was still over 80% of the total; less than 9% of people were employed in industry, and even then, around 2-3% in the heavier sectors. [7] This was the proletariat which the BCP inherited.

While Jan Gross is right to point out that socialist industrialisation was a continuation of already existing tendencies of state economic intervention in the region, amplified by the Second World War,[8] the transformation of agricultural Bulgaria into a modern and industrial country was the explicit aim of the newly installed BCP from the very start. Its Economic Declaration of September 1945 stated the party's aim as "easing and 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".[9] The first Five-Year Plan, started in 1949, aimed at creating the basic industries that the party felt no country could do without: extractive, metallurgy, chemicals, energy production. Around 83% of all investment was earmarked for the heavy industrial sector, the aim being to bring down agriculture's share in economic output down to 55%.[10] Bulgaria was to leave its rural past behind. This, of course, meant that the state was paramount: by 1951 nearly 7000 enterprises

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[6] Berov, *Razvitie na Industriyata,* p. 149

[7] Marcheva, "Problemi na Modernizatsiyata", p. 182

[8] Jan T Gross, "Social Consequences of War: Preliminaries to the Study of Imposition of Communist Regimes in East Central Europe" in *East European Politics and Societies,* Vol. 3-2 (March 1989), pp. 201-2

[9] Quoted in Marcheva, p. 184

[10] Daniel Vatchkov, "Ikonomikata na Komunisticheska Bulgariya (1944-1962)" in Ivailo Znepolski (ed), *Istoriya na Narodna Republika Bulgariya: Rezhimut I Obshestvoto* (Sofia: Ciela 2009), p. 279

had been nationalised, and 85.9% of industry was in state hands.[11] Despite many problems, including falling wages in real terms, the plan created literal concrete truth in its claim to have changed the face of the country: over 26 power stations were created; large reservoirs appeared; colour metallurgy received its first sizeable site in the lead-zinc factory in Kurdzhali; chemical plants of national importance were built in Dimitrovgrad (Bulgarian socialism's planned city, a chemical Magnitogorsk) and Devnya.[12]

The second five year plan, concurrent with the period after Stalin's death, aimed at easing some of the shortfalls of the first – including the lack of any goods for the wider population, and agriculture. While heavy industrial investment continued, especially in resource extraction and metallurgy, it was at a lower rate than before. This was spurred both by the Bloc-wide turn to consumer production under Khrushchev and as a response to social unrest, the most striking for Bulgaria being the Plovdiv tobacco workers' uprising in late April 1953, driven by lower wages and higher norms after nationalization. Changes in industrial investment went hand in hand with the agricultural change. The peaks of Bulgarian collectivization came in 1955-6, ensuring that by 1958 over 92% of arable land was in the TKZS network, the Bulgarian collective farm form. This was also the year when, thanks to lower fertilizer and seed costs, together with higher grain prices paid by the state, Bulgarian agriculture reached its 1939 levels of production after the disturbances of the war and industrialisation, starting to provide the population with more adequate levels of foodstuffs.[13] While the growth and delivery of consumer goods or lighter industry did not materialise as promised, and despite the temporary growth in unemployment during the mid-50s, during the

[11] Berov, *Razvitie na Industriyata,* p. 272

[12] Marcheva, "Problemi na Modernizatsiyata", pp. 194-5

[13] Iliyana Marcheva, "Sotsialisticheskiya Eksperiment v Selskoto Stopanstvo" in Kandilarov & Turlakova, *Izsledvaniya,* p. 401

1950s Bulgaria maintained one of the highest economic growths in the world, at 14.8% (higher than the COMECON average of 12.1% too).[14]

Apart from the appearance of smokestacks in hitherto non-industrial 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 over 410 thousand people moved from villages to towns, accounting for two thirds of internal migrations during the period (the population circa 1955 was just under 7.5 million). For the 1955-1959 period just under 69 thousand people per year moved from villages to towns. Work opportunities in the towns and agricultural collectivisation meant that between 1947 and 1967 a staggering 1.3 million people left the villages (with a further 440 thousand by 1972), completely changing the demographic landscape of bucolic Bulgaria – a process that was accelerated to gigantic proportions precisely in the 1950s.[15] These numbers made Bulgaria one of the countries with the fastest urbanization processes in Eastern Europe.[16] To control such flows, the regime had to expand the address registration restrictions applied to Sofia in 1942 to other major cities in 1955, gradually increasing them to cover most towns in Bulgaria. A process fraught with its own problems, not least an acute housing crisis, Bulgarian urbanization also had a socio-political goal: the creation of the proletariat that was so sorely lacking in a country based on its rule. Modernity was tied to the city, and socialist modernity could only be tied to the worker, not the farmhand. This was social engineering on a grand and crude scale, working from the assumption that class consciousness would be formed if a man worked in a factory and lived in the city. The result was that between 1948

[14] Marcheva, “Problemi na Modernizatsiyata”, p. 204

[15] All figures are from Ulf Brunnbauer’s *‘Sotsialisticheskiyat Nachin na Zhivot’: Ideologiya, Obshestvo, Semeistvo I Politika v Bulgariya (1944-1989)* (Ruse: MD Elias Kaneti 2010), pp, 188-9

[16] Cyril E Black “The Process of Modernization: The Bulgarian Case” in Thomas Butler (ed) *Bulgaria: Past and Present* (Columbus, OH: AAASS 1976) pp. 111-131

and 1960, largely during the first two five-year plans, around 63 thousand 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, non-industrial, and rural, then its early years of autarkic-aimed industrialisation 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 creating 24% of national income, while industry was at 58% (with construction adding a further 9%). Nearly 22% of people worked in industry, 5% in construction, 4% in transport and a further 4% in trade – leaving just over 55% to agriculture (compared to around 82% in 1948). By 1957 there were over 800 thousand people classed as "material sphere workers" – the nascent proletariat of Bulgaria.[17] While still not majority urban or proletarian, the 1950s had been a time of tremendous change in socio-economic terms. In social terms there were problems of wages, housing, unemployment. In the economy there was lopsided growth, overdue projects, and shortages. However, progress had been real and felt. It instilled the BCP with a sense of representing a large segment of the population, presiding over a collectivised land and booming industry, and a political landscape cleared of class enemies by the now denounced Stalinism. As the party geared up for its 7th Congress, it had a lot to celebrate in this recent past, but also a lot to plan for in its immediate future.

The Congress of Victory

Between the 2nd and 7th of June 1958 the BCP convened its 7th Congress, "the congress of the victorious socialist order". With 92% of land collectivised and 99.9% of industry now state property, there was no road back towards capitalism. As Zhivkov's closing

[17] All figures are from Brunnbauer, *Sotsialisticheskiyat Nachin na Zhivot*, pp. 208-9

speech stated, 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.”[18] With the political victory now a fact, socialism’s future lay in creating a better material-technical base for society, raising the socialist consciousness of the population, and fulfilling their material and cultural needs.[19] The victory, however, was qualified: the party also noted some discrepancies between its hitherto programmes and social phenomena, borne out of too much zeal. For example, noting the continued general inability of collectivised agriculture to deliver expected yields, it criticized the ban of private plots in some TKZS areas as going too far.[20] Overall, however, the Congress’s proclamation of victory had the effect of creating an expectation that the BCP would now deliver on its ideological and socio-economic promises. If until now the BCP’s deviations, the shortages, the discrepancies between words and realities, could be explained by the struggle to establish the new order, or by the insidious existence of older, bourgeois norms and strata, after 1958 a new phase was starting. No longer would the ends justify the means, as Kandilarov puts it, the new system would now have to be proven to be superior to the old.[21] In many ways, this was the start of “real existing socialism” – a self-proclaimed end to its revolutionary maturation, and a start of trying to square the promises with the realities.

[18] Taken from recordings of his closing speech accessible online at the Bulgarian National Radio’s website: http://bnr.bg/radiobulgaria/post/100483520/1958-sedmiat-kongres-na-bkp-obavava-pobedata-na-socializma (Last accessed: 19th Oct 2016)

[19] Todor Zhivkov, *Izbrani Sucheneniya* Vol.4 (Sofia: Partizdat 1975), p. 52

[20] Collectivisation was also at the root of the “Goryani” armed resistance movement of dissatisfied peasants and military officers which was widespread throughout the early 50s. Most armed resistance was put down by 1956, but the movement’s illegal radio station continued broadcasting until 1962. In some ways, then, the 1958 Congress also celebrated a real victory against interior enemies. The movement is little studied yet, the best start being the two volumes of documents by the State Archive Agency, *Goryanite* vol. 1 (2001) and vol. 2 (2010)

[21] For a good discussion of the Congress, see Evgeniy Kandilarov’s “Ot ‘Realen’ kum ‘Demokratichen’ Sotsializum: Iz Zig-Zagite na Ideynoto I Programnoto Razvitie na BKP sled Vtorata Svetovna Voina” in Kandilarov & Turlakova, *Izsledvaniya*, pp. 97-9

In economic terms, the Congress also discussed the third five-year plan, setting out its goals. The State Planning Commission had noted that due to its focus on agriculture and primary industries, to the neglect of machine-building, Bulgaria was developing in a similar way to its Balkan neighbours and lagging further behind its Central European allies. Industrial goals were to be fulfilled in 3 years, agricultural in just over 4,[22] in what was to become the short-lived infatuation with Mao-influenced "great leaps". The focus on voluntarism became even more noted in a plenum in November, when the goal was not just to increase the tempo but to bring about a qualitative jump in Bulgarian development.[23] National income was to rise by 34%, industrial investments were to be concentrated in machine-building in order to start changing the structure of the economy. Over two thirds of investments were earmarked for heavy industry, which was supposed to rise by 77% alone (against an average across all industries of 62%). Despite machine-building being identified as a weak spot, gargantuan heavy projects were still the rule of the day – the giant steelworks at Kremikovtzi near Sofia (at a site where iron ore was proven to be of poor quality); the oil refinery at Burgas; a zinc factory in Plovdiv.[24]

By 1962, thanks to manipulation of numbers, the Great Leap was officially complete. However, the Sino-Soviet split and the objective shortcomings of many of its goals pushed the party into a more moderate, Soviet-influenced program for a twenty-year long development process that by 1980 would increase industrial production by up to seven times, chemical by twenty-five, and – finally - machine building by a factor of seventeen.[25] This

[22] Marcheva, "Problemi na Modernizatsiyata", p. 200

[23] On the little-researched topic of Chinese influence on late 50s Bulgarian development, I have to thank Jan Zofka and his presentation "A Transnational History of Socialist Industrialisation – the Bulgarian 'Economic Leap' (1956/58-1960)" (paper presented at the Fellow Seminar Series at Centre for Advanced Study, Sofia, 16th June 2016)

[24] Brunnbauer, *Sotsialisticheskiyat Nachin na Zhivot*, pp. 139-140

[25] Marcheva, "Problemi na Modernizatsiyata", p. 201

marked the real start of the Bulgarian machine-building industry, after its relative neglect in the 1950s and the failure of voluntarism in the third five-year plan. It would, in its vision, create the material base for Bulgarian communism. It would also raise the issue of a key problem that the party started to grapple with - the move from extensive to intensive growth, now that the expansion of the urban labour force was reaching its plateau and the economy could no longer count on the rapid expansion of industrial enterprises and construction in order to boost its numbers. Human labour would now have to be more productive. But before the party could think how to do that, just as it was announcing its victory, it had to face a pressing and concrete fact: that of financing. Preceding industrialisation had counted not just on the internal loans it raised from its population (400 million levs each in 1951 and 1952).[26]

Socialist Bulgaria's First Bankruptcy

By the mid-1950s, Bulgarian trade was opening up to the West and East, as its post-war financial matters such as reparations were settled. The rapid industrialisation itself demanded imports of machines as well as resources for the chemical and metal industry. The expansion of trade was not just within COMECON, but with Western countries too, increasing fivefold between 1954 and 1959 ($45 million to $200 million).[27] After 1956, however, the trade balances with both East and West were decidedly negative. The export profile of 1950s Bulgaria was poor, concentrated in non-processed agricultural goods such as tobacco, grains, vegetables, fruits, seeds, animal products, and some ores. Agriculture, expected to grow in order to finance imports, remained sluggish. Its COMECON obligations, too, were in the sphere of agriculture, leading to major shortfalls vis-à-vis the socialist countries too. Import reduction was out of the question. Industry was resource and energy-

[26] Ibid., p. 192

[27] Tsentralen Durzhaven Arhiv (Central State Archive, Sofia, Bulgaria – henceforth TsDA) f. 132 op. 1 a.e. 19 l. 79-88

hungry, and Bulgaria could not yet provide it with the technology it needed. Socialist countries themselves often had troubles in delivering the planned resources that were promised within COMECON, leading to Bulgarian enterprises making up the shortfall on Western markets in pursuit of fulfilling the plan at all costs - and besides, the most high quality goods and machines were on the Western market.[28]

The shortfalls in export were made worse by the poor quality work of the Foreign Trade Organisations (*Vunshno Turgovski Organizatsii* – VTO) of the regime.[29] Often they underestimated the importance of things such as packaging, or still demonstrated poor knowledge of local markets. Combined with the rushes to complete the plan at the end of each year, it led to the piecemeal dumping of Bulgarian goods on markets with no view of the specificities or the needs of each place. Similarly, in importing, they sometimes bought the wrong machines or ones that enterprises could not implement for years, leading to them being wasted in storage until they became obsolete. All this conspired to make the VTOs end each year with large numbers of leftover goods both in the export and import lines, and a worsening financial situation. Each year after 1955 saw tens or even hundreds of millions of levs in the red (the worst being 1956 and 1959), leading to an indebtedness in Western currency of nearly 872 million levs by 1959. At the official exchange rate of the Bulgarian National Bank (BNB), this equalled $115 million, a significant sum given the poor prognosis for future Bulgarian export expansion.[30] The short-term credits that covered these negative balances throughout the late 50s were mostly rendered by two Soviet banks, branches of Gosbank, based in Paris and London – the Banque Commerciale pour l'Europe de Nord and

[28] Janos Kornai, *The Socialist System: The Political Economy of Communism* (Princeton: Princeton University Press 1992), p. 346

[29] Martin Ivanov & Daniel Vatchkov *Istoriya na Vunshniya Durzhaven Dulg na Bulgariya 1878-1990* Vol. 3 (Sofia: Pechatni Izdaniya na BNB 2007) p. 114; chapter 12 in the book, on which much of this section is based, is a great overview of the late 50s debt crisis

[30] Ibid., p. 115

Moscow Narodny Bank. Despite giving Bulgaria access to loans that standard Western banks would not, they still had to follow banking law in the countries they were based, limiting the political leeway that could alleviate similar problems within the socialist world. Soviet government loans in 1957 helped stave off the worst of the crisis before the 7th Congress, but this just postponed the inevitable. By the end of 1959 the financial situation was dire once again.

Between the 20th January and 15th February 1960, a Bulgarian delegation made up of the trade representative in Paris, the deputy director of BNB and a head of a section of the bank, set off on a whirlwind tour of France, the UK, West Germany and Italy in search of extension to debt repayments as well as possible new credits.[31] Meetings with the Soviet banks were accompanied by ones with Societe Generale, Midland Bank, Westminster Bank, Bank of England, Deutsche Bundesbank, Banca Nazionale del Lavoro, and everywhere the news were grim. Even the sympathetic Soviets made it clear that short-term credits could not be a continuous solution for the Bulgarians, and they should build up their currency reserves. However, by the middle of the year, the trade balance was at negative hundred million levs and falling, and there was seemingly nothing that could be done – Bulgarian manufactured goods were proving to be of too low quality even for the captive Soviet market, let alone for the West. It was in such conditions that a radical suggestion was made for the first time by Kiril Nesterov, the head of BNB: the selling off of Bulgaria's gold reserve of around 21 tonnes. On the 7th May 1960 Nesterov wrote to the President of Gosbank, Alexander Korovushkin, raising the issue as a possibility.[32] 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 as the BNB did not yet have a nuclear-proof vault, and had been reduced by fourteen kilograms

[31] For more details on the "grand tour", see Ivanov & Vatchkov, *Istoriya na vunshniya dulg,* Vol. 3, pp. 116-118

[32] Hristo Hristov, *Tainite Failiti na Komunizma: Istinata za Kraha na Bulgarskiya Sotsializum v Sekretnite Arhivi na Delo N 4/1990 za Ikonomicheskata Katastrofa* (Sofia: Ciela 2007), p. 54

after refining in Novosibirsk.[33] 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 over 20 million levs were raised by these deposits, with a further delivery of nearly four tons of gold in bars and two tons in coins to the Moscow Narodny Bank in London in 1963 guaranteeing a further credit of $6 million that year.[34] At the time, these were still envisioned as deposits to guarantee further loans, but in 1964 the sale was finally contemplated, as the liquidity crisis continued. In March, Nesterov addressed Zhivkov in a letter stating that the gold was not generating any interest in the vaults, and asking for the sale of at least four tons. In fact, nine tons disappeared from the vaults that year,[35] sold on the Zurich gold market, according to Hristov.[36] Over thirty years later, in his memoirs, Zhivkov would deny that he had allowed any such sales to go through and had in fact increased the gold reserves to tens of tons, after returning it to Sofia from the USSR.[37]

In fact, the drastic step would not be the ultimate solution that the regime sought. In 1965 Moscow agreed to forgive Bulgarian debts to its two Gosbank branches in France and the UK, as well as to expand export of key industrial resources to Bulgaria in order to save it from the need to buy them on the world market. Five thousand tons of cotton, hundreds of tons of key chemicals such as phenol, a hundred and fifty tons of nickel – all in addition 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 over

[33] Ibid.

[34] Ivanov & Vatchkov, *Istoriya na vunshniya dulg,* Vol. 3, p. 129

[35] Ibid., p. 130

[36] Hristov, *Tainite Faliti,* p. 54

[37] Todor Zhivkov, *Memoari* (Sofia: IK Trud I Pravo 2006), p. 213

twenty million eggs, which the Soviets were to buy at world prices.[38] Despite its prolonged industrialisation, firstly 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 the Bulgarian economy, which would have to find a way to change its profile in order to garner profits on the world markets. No amount of eggs or tinned tomatoes would ever be able to provide the convertible currency needed to finance the machine-building factories or consumer goods which were both part of the post-1962 long-term development plan.

On the other hand, the debt crisis was also a symptom of increasing participation in world trade on both sides of the Iron Curtain. The deep changes in Bulgarian economic structures during this and subsequent periods were realised with the help of outside resources, whether Soviet or Western credits.[39] Despite being part of a longer history of Bulgarian debt, where 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 modernisation and disturbing the state, this entanglement with the international market brought into sharp relief the need for a different structure of Bulgarian export. Whatever it would be, however, depended heavily on Bulgaria's position within COMECON, where countries with long industrial pedigrees such as the GDR or Czechoslovakia were positioning themselves as the suppliers of the socialist bloc's cutting-edge and thus high profit technologies. To get away from its position as a socialist breadbasket Bulgaria would have to challenge the emerging socialist division of labour within Eastern Europe.

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[38] TsDA f. 132 op. 5 a.e. 1 l. 23

[39] Daniel Vatchkov & Martin Ivanov, *Bulgarskiya Vunshen Dulg 1944-1989: Bankruptut na Komunisticheskata Ikonomika* (Sofia: Ciela 2008), p. 247. The book is the best in-depth account of the regime's indebtedness; for another excellent but more outright critical view, based on the 1990 judicial case against Zhivkov for bringing about the economic failure of the state, see Hristo Hristov's *Tainite Failiti*, quoted in footnote 31.

The Socialist Division of Labour: An Obstacle and a Possibility

COMECON was formed as a reaction to Marshall Aid in 1949, but throughout the Stalin years it convened on an ad hoc basis, with its biggest effects being the redirection of member state trade to each other and encouraging self-sufficiency in certain economic spheres. It has to be remembered that primarily the organisation had a political, rather than economic goal – shoring up the Soviet sphere of influence in the East. Even its economic goals, in leading agricultural states to the same level of development as the advanced industrial countries such as East Germany, were secondary.[40] From the very start, a socialist division of labour was in-built into the idea of the community, with member states set to coordinate on the basis of a general economic plan, which would also ensure that countries would complement rather than compete in various economic sectors. But until the mid-50s, despite contributing to the division of the continent into two competing political and economic blocs by putting up barriers (often in response to Western ones such as COCOM, more on which in chapter 3), it remained a neglected part of socialist unity. The first years of Eastern industrialisation, including Bulgaria, encouraged parallel rather than complimentary development. Stalin's distrust of multilateral bodies also meant that most Soviet trade with the COMECON states was done on the basis of bilateral treaties.[41]

Stalin's death changed things for the COMECON as much as they changed everything else in the Bloc. A search for new solutions in trade were sought as Khrushchev committed the socialist world to an economic victory over capitalism.[42] The Warsaw Treaty of 1955 had already shown a commitment to real bloc coordination in the military and geopolitical sphere,

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[40] Andre Steiner "The Council of Mutual Economic Assistance – An Example of Failed Economic Integration?" in *Geschichte und Gesellschaft* 39-2 (April-June 2013), p. 241

[41] Glenn E Curtis (ed) *Czechoslovakia: A Country Study* (Washington, DC: Federal Research Division of the Library of Congress 1992)

[42] Steiner, "The Council of Mutual Economic Assistance", p. 242

while the 1957 Treaty of Rome gave shape to a Western integration which COMECON would both compete against and emulate in some ways.[43] In 1959 the organisation finally got its charter, which also created an organisational structure of the annual council session, an executive council, and standing commissions on various economic focuses. As early as 1956, however, the first issues of a "socialist division of labour" were being raised, with over 600 products being earmarked for specialisation. However, this was also the start of problems for the organisation, as they were to be concentrated in the highly industrialised states, contradicting the interests of countries such as Bulgaria.[44] The country was to receive some pan-Bloc industrial responsibilities, such as copper, chemical and cement factories, the plans and equipment being delivered by other COMECON states, above all else the USSR – many of these would be built through the 1970s.[45] However, Bulgaria was in general directed to be a supplier of grain and some resources. Other countries were strongly against any Bulgarian machine-building specialisations, with the (mostly correct) argument that it was at a low technological level. As Marcheva points out, such a bias existed in COMECON plans up to 1965 in some sectors.[46] This focus – on agriculture, light industrial products and extractive industries – was supported by Khrushchev too in talks with the Bulgarians in autumn 1955, which he supported with specific loans.[47] The goods that Bulgaria was to specialise in, however, remained low cost, in sectors with low productivity and high costs. Great industrial leaps were not easily built on the back of such exports, and neither were loan repayments.

[43] Curtis, *Czechoslovakia*

[44] Steiner, "The Council of Mutual Economic Assistance", p. 243

[45] Iliyana Marcheva, *Todor Zhivkov – Putyat kum Vlastta. Politika I Ikonomika v Bulgariya 1953-1964* (Sofia: IK Kota 2000), p. 116

[46] Marcheva, "Problemi na Modernizatsiyata", p. 200

[47] Ibid., p. 197

Meanwhile, COMECON was developing its structures, aiming to become a real body with multilateral capabilities. In 1962 a Central Dispatching Board was created to unify electrical power systems;[48] 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 also created in science, such as the Institute of Nuclear Research, established in 1956 but seeing more activity in the early 60s. All this encouraged growth among member states, helping Bulgarian foreign trade grow by two and a half times in the 1958-1962 period, largely within COMECON.[50] Slowly but surely, the organisation was growing more ambitious. This culminated in the 15th 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 more production in developed countries such as Czechoslovakia. Subsequent speeches by Khrushchev, waxing with enthusiasm about a "socialist commonwealth" that would come about by a central COMECON planning committee, furthered the political misgivings states had about such a division of labour. Unless a country could ensure its machine-building role in this new division of labour, it would be doomed to perennial catch-up – something the BCP had spent the entire 1950s trying to do. Zhivkov realised this too, and made promises that through the purchase of Western licenses and know-how, the country would reach the highest levels in structure-defining sectors, meaning it was also deserving of a non-agricultural role in this new division of labour. GDR and Czechoslovakia wanted to defend their positions, pushing Bulgaria into closer reliance on Soviet technical assistance, which in the short-run would ensure the machine-building

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[48] Curtis, *Czechoslovakia*

[49] Vatchkov & Ivanov, *Bulgarsiyat Vunshen Dulg*, p. 127

[50] Ibid., p. 131

capacity that the country desperately desired, but would hamper its development in the longer run.[51] By 1964 Bulgaria was growing increasingly closer to the Soviets in economic matters, ensuring support for the large steelworks in Kremikovtzi and huge chemical plants but also machine specialisations such as the building of electro-cars. In February, it also managed to secure extra Soviet credits for the next five year plan – a further 400 million roubles, larger than the originally envisioned 300 million loan for the whole period up to 1970. To ensure COMECON niches, Bulgaria was growing closer to the USSR through political means. This was the period when Todor Zhivkov made one of his most controversial but politically useful moves, writing to Khrushchev to suggest that Bulgaria become the 16th republic of the USSR. This patently unfeasible suggestion (not least for its international implications), nevertheless, curried favour in Moscow in the right way by demonstrating the Bulgarian leader's political loyalty and desire for closer economic integration. The benefits, as shown above, were real, allowing Bulgaria to start breaking down its agricultural role within COMECON through Soviet aid.

However, the move towards a division of labour was not unopposed. The 1962 Principles had already faced opposition by Romania, citing the right to national sovereignty that was in-built into COMECON. Every country had the right to determine its own road, Gheorgiu-Dej argued. As countries such as GDR raised the issue that the 1962 Principles were not being acted upon 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 go ahead and cooperate. In April 1964, the Romanian Central Committee issued a declaration stating that such talks of economic integration were "withdrawing the economic

[51] Marcheva, "Problemi na Modernizatsiyata", p. 202

[52] Steiner, "The Council of Mutual Economic Assistance", p. 244

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 had been facing passive resistance from other countries, including the Bulgarians. A weakened, compromise institution – the Bureau for Integrated Planning – limped on as an advisor to the Executive Committee.

The lull after 1964 was also helped by the fall of Khrushchev, which focused the USSR on internal matters. Meanwhile, countries such as Hungary and Poland pushed for a convertible currency within the Bloc in order to allow a semblance of market relations between the states to emerge. 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 the COMECON as a whole.[54] Conservativism among certain parties, again including Bulgaria, sunk these proposals too. However, the debates about the future of COMECON continued apace in specialised journals, where the champions of market mechanisms and the need for management in the domestic economy clashed with those who preferred supranational integration that would eventually lead to the loss of national control over domestic investment.[55] Many of these discussions were helped by increasing East-West meetings of economists, where econometrics, linear programming and

[53] Maria Mursean, "Romania's Integration into COMECON. The Analysis of a Failure" in *The Romanian Economic Journal* 11 (2008), p. 46; the whole article is a great overview of Romanian-COMECON relations.

[54] Steiner, "The Council of Mutual Economic Assistance", p. 244;

[55] Curtis, *Czechoslovakia*

other ideas became a common language.[56] After 1964 it was becoming clear that the issue was yet to be resolved, but to any intelligent observer it was obvious that once Moscow became interested in COMECON co-operation again, a re-organization on some grounds would happen.

Even a not-so-intelligent observer would have noted the huge possibilities that the organisation offered, as well as its key characteristics that were lifelines for an economy struggling to build up a modern economy. As Randall Stone noted critically, Soviet bloc trade operated according to complex calculations that under-priced commodities, especially oil, and overpriced machines, which were considered equal to 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.[57] Stone's influential analysis rings true with 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. What is notable is the political unwillingness of the Soviets to translate their obviously preponderant power within the Bloc into a real integrative project, allowing the socialist division of labour to be defied by weaker states such as Romania. At the same time, their subsidy of its satellites was increasing year by year as it took in more and more East European machine products at highly inflated prices and sold raw resources and commodities at under market-value. Even though the satellites never became a real "burden" to the USSR, offsetting costs by other

[56] Johanna Bockman & Gil Eyal "Eastern Europe as a Laboratory for Economic Knowledge: The Transnational Roots of Neoliberalism" *American Journal of Sociology* Vol. 108 no. 2 (Sep 2002), pp. 324-8

[57] Randall W Stone, *Satellites and Commissars: Strategy and Conflict in the Politics of Soviet-Bloc Trade* (Princeton: Princeton University Press 1996), p. 5

contributions – not least a military one,[58] the trade was both mismanaged and unbalanced. It did, however, create huge possibilities in the shape of a captive market which was there to be tapped if a niche was to be found. Bulgarian machines would, through COMECON logic, find their place in enterprises from Berlin to Vladivostok, but it was hardly feasible to compete in industries where others had a huge head-start such as East German optics or Czech cars. Throughout the 60s the future of socialist integration was still undecided, too, but always in the background as an issue that would have to be resolved. A country would be clever to put itself in a strong position for the inevitable restructuring of COMECON plans and priorities.

Indirectly, another geopolitical reality was working to help Bulgaria garner more Soviet finances and support. It was the only Warsaw Pact state that bordered two NATO countries, and it was increasingly the only reliable member on the Southern Front of the organisation. Yugoslavia was the original maverick, and Albania became one in 1961. Romania's obstinacy in the COMECON was reflected by similar moves in the Warsaw Pact. In 1964 it adopted the policy of non-intervention in the domestic affairs of other countries and removed the Soviet supervisors from its intelligence apparatus, becoming the first country to do so.[59] In a Moscow meeting in February 1966, the Romanians blocked pretty much every structural change that aimed at consolidating a multilateral military council, again based on the defence of national sovereignty,[60] culminating in their condemnation of the 1968 invasion of Czechoslovakia. Throughout the 1960s Bulgaria thus took on an oversized geopolitical importance in the Warsaw Pact, despite the secondary importance of

[58] For this argument, see Dina Rome Spechler & Martin C Spechler "A Reassessment of the Burden of Eastern Europe on the USSR" in *Europe-Asia Studies* vol. 61 no. 9 (November 2009), pp. 1645-1657

[59] Dennis Deletant & Mihail Ionesci "Romania and the Warsaw Pact 1955-1989" (Cold War International History Project, Working Paper No. 43; April 2004), p. 27

[60] Jordan Baev, *Sistemata za Evropeiska Sigurnost I Balkanite v Godinite na Studenata Voina* (Sofia: Damyan Yakov 2010), p. 99

the south to military thinking. Zhivkov used this to offset domestic military costs by securing military gifts by both Khrushchev in 1963 and Brezhnev in 1965, the first one alone being worth over 74 million roubles.[61] This freed up domestic investment for the civilian economy, and committed the USSR to even more assistance to the small Balkan state. Closer ties to the USSR, combined with the aforementioned need to strengthen Bulgarian positions within COMECON, were a fertile ground on which to create an export-oriented niche.

Fathering Bulgarian Electronics

There were a number of machines a country could specialise in if it wanted to find a golden export, and electronics was not the only one. Bulgaria's turn to the sphere was driven by a highly-placed, highly-connected actor who is the one name that every veteran of the Bulgarian computer industry would name if asked about the history of the industry. Professor Ivan Popov was, in the words of Vasil Nedev, "its [Bulgaria's] biggest scientific industrialist in its whole history…the patriarch of its modern industry."[62] The figure of Ivan Popov is indispensable to the history of Bulgarian socialist modernisation as a whole and electronics in particular. His international education and experience, political conviction and clout, managerial skills and personal contacts came together to create one of those historical actors who show the contingency of history, and where one person's particular position and ideas can shape entire structures into new paths. As Stoyan Markov notes "he knew that Bulgaria was poor in resources…he knew electronics was a profitable area that did not depend on raw resources that Bulgaria lacked".[63] Popov was the man who addressed the aforementioned problems and possibilities, and championed electronics as a way out of the state's

[61] Ibid., p. 117

[62] Milena Dimitrova, *Zlatnite Desetiletiya na Bulgarskata Elektronika* (Sofia: IK Trud 2008), p. 112

[63] Interview with Stoyan Markov, 28th July 2015

predicament, as the best way to take advantage of the Soviet market and COMECON specialisations. It is thus imperative for this story to dwell on his life and rise to power.

Ivan Popov was born in 1907 in the medieval capital of Veliko Turnovo.[64] His teacher parents were socialists, and encouraged his studies, which he continued in the 2nd Men's Gymnasium 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 Nedelya 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 1930-1. His first scientific work dates from this year too, helping him secure a stipend to Toulouse University in France, which he graduated in 1933 with a golden medal, specialising in electrical technology and hydrology. He stayed on in Paris to work on the practical applications of his thesis work on weak currents, which he managed to patent. In 1934 he returned to Bulgaria, opening "Electrotherma", a private firm that produced heating elements and medical instruments, proving successful enough in the local market to expand in 1939-1941.

Political events, however, caught up to 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

[64] Ivan Popov, who died in 2000, did not leave a publicly accessible personal archive, or any memoirs, much to the detriment of the history of socialist Bulgaria. However, the contours of his life are well known due to his biographical sketches as a high-ranking party member, while all interviewees, memoirs or narratives of the industry talk about him at length, leaving us with a plethora of impressions of him by subordinates and colleagues. Unless otherwise stated, the biographical sketch here draws extensively on Appendix 3 of Kiril Boyanov's *Shtrihi ot Razvitieto na Izchislitelnata Tehnika v Bulgariya* (Sofia: Akademichno Izdatelstvo Prof. Marin Drinov 2010), pp. 178-194; the chapter "Ivan Popov" in Dimitrova, *Zlatnite Desiteletiya*, pp. 95-112; and Jouko Nikula & Ivan Tchalakov, *Innovations and Entrepreneurs in Socialist and Post-Socialist Societies* (Newcastle: Cambridge Scholars Publishing 2013), pp. 78-112

up to 1943, and then a constructor in 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 resumed its production lines under Soviet occupation.[65] During this period in Hungary, he travelled widely in Germany, Austria, Czechoslovakia and occupied France, forging business and personal links with people in the electrical industry throughout Europe. In 1949-50 he came back from Hungary to Bulgaria, becoming the director of the power engineering factory “Kliment Voroshilov”, which was to become a key school for Bulgarian engineers. During these post-war 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 help 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.

Meanwhile, however, his economic clout grew 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 resumed his academic career as the heady of 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 exact, workaholic, somewhat humourless but always extremely professional, competent and fair boss. [66] He was always demanding, expecting quick and accurate work by his subordinates, and in return he

[65] It is interesting to note that this key figure for COMECON’s economic history developed in another “alternative” European economic order – that of Axis Europe

[66] Interview with Peter Petrov, 10th June 2016

championed them in ministries and the party. Maybe because of such methods, he was the subject of a 1952 article in *Rabotnichesko Delo,* called “Short Circuits” that accused him of authoritarian and dictatorial work in “Elprom”.[67] Despite a subsequent rebuttal in the same pages, and a disciplinary action against the author Ivan Manolev, in 1952 Popov was moved to a permanent position in the State Polytechnic, dismissed from his managerial positions. In his academic capacity, he developed new programs in engineering education as well as designing electrical engines and regulators which found application in the industry. His clout meant that between 1954 and 1958 he was deputy rector of VMEI (still MEI at that time), a time of over twenty scientific projects and monographs, some published in (both) Germanies, the USSR, France. His academic star was shining bright and after 1958 he spent four years in 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 4 months lecturing back 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 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 larger 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 organisation and position, the importance of

[67] “Kusi Sudeninya”, *Rabotnichesko Delo,* issue 46, 15th Feb 1952

which will be seen in chapter 2, gave Popov the commanding heights over the strategic direction of research in Bulgaria, 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 – unquestionably the most dominant. It was during this quick rise that he also became one of Zhivkov's favourites, seeing in him a capable and innovative professional.

In the early 1960s, Popov was one of the few high-ranking Bulgarian party members with internationally tested and recognised expertise in any economic field. He was fluent in Hungarian and Russian but also German and French (a skill bolstered by marriages to both a French and a German woman), giving him unprecedented for the mostly monolingual BCP functionaries access to foreign ideas, bolstered by a network of industrial and scientific contacts cultivated throughout the fascist-dominated European 30s and 40s. His ideas for Bulgarian development stemmed from his research and experience in power and electrical engineering, keeping him interested in all the latest developments in world electrical technology. It was logical that he noted the work in the parallel field of electronics that emerged in the Second World War. Experiencing the industrial and political climate of late 1950s GDR, he was convinced in one thing – if Bulgaria was to compete in metallurgy or the heaviest sectors of industry with the East Germans, Czechs or Poles, it would lose. During these early months and years back in Bulgaria after his stint in Berlin, he had many meetings with Zhivkov who was seeking an economic direction. In touch with the first Bulgarian doctoral students who studied in the nascent field of electronics in the USSR and GDR, he advised Zhivkov that "cybernetics, computer technology, fine mechanics. Here is our strength."[68]

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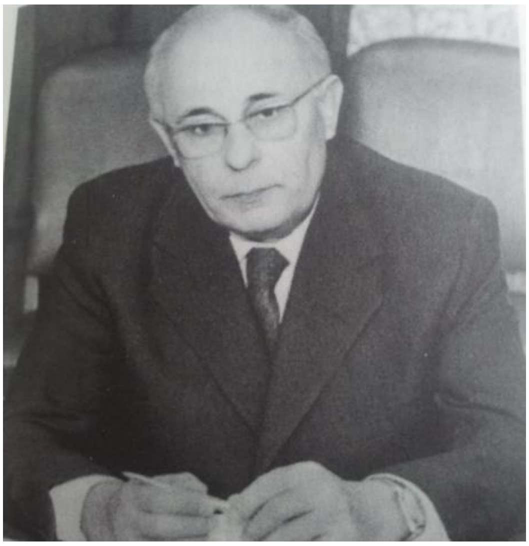
[68] Dimitrova, *Zlatnite Desiteletiya*, p. 101



Pic. 1: Ivan Popov, during his years as head of the CSTP. (Source: Dimitrova, Zlatnite Desitiletiya)

Popov's role as the father of Bulgarian electronics was not down to inventions or scientific work in the field. Indeed, his academic career was in a related but different area. However, it gave him the intellectual tools to recognise the importance of the new sector, and its possibilities, as well as to understand the directions of specific research and productions within it that would be most avant-garde and thus profitable. His scientific network was wide, both beyond the Iron Curtain and within it, especially bolstered by his time as head of a laboratory in Berlin. But his key characteristic was the managerial style which contemporaries describe as "American-style". The 1970s electronics minister Yordan Mladenov describes him as "more like an organiser in the American sense of the word 'manager'": finding and mobilising financial resources for projects, organising the right design teams and attracting the best cadres, and a general awareness of the industry and market.[69] His iron working discipline, often between 6am and midnight, helped his productivity during these years. Once he moved away from the scientific work of the 1950s, he became a supreme organiser of science, utilising his languages, experience as head of a laboratory and university, and political connections – which stretched to Moscow, where he

[69] Ibid., p. 25

was colleagues with similar party-engineering cadres in the radio industry. Unlike many other sectors of the socialist economy, his personal clout and desire for accurate reports (which he was famous for reading in full) helped instil a more internally accountable, if stressful, working atmosphere. He demanded not just professional work, but a professional appearance from all his subordinates. [70] Ivan Popov's "fatherhood" of Bulgarian computers was in championing it as a field and in organising a productive, well-financed environment that would allow an emerging group of scientific and engineering cadres to make it a possibility. After 1962 he was at the place that he needed to be to push through his project of a high-technology, low-resource but high-yield sector and make it a success. But one man, responding to the problems of Bulgarian industrialisation and the possibilities of the COMECON market, could not be enough to create something anew. He could develop, however, some existing capacities and emerging scientific potential.

The Preconditions for Success

Despite the focus on heavier industries, and a general lack of tradition in such high technology, there were a few cores of expertise available in Bulgaria, from which to build up. The biggest school of many of the new specialists was the high voltage factory "Voroshilov" in Sofia, specialising in communications equipment, and uniting since 1949 all smaller companies and enterprises of the sector in the capital. It was built with Soviet help, and quickly developed as a large production site for radios and telephone systems,[71] but also a hotbed for budding engineers. It was also Ivan Popov's first, if short-term, industrial appointment once in Bulgaria. In 1951-2, Soviet engineers helped organise the shop-floor according to a similar factory in Rostov-on-Don, passing over manuals and specifications. By the mid-1950s, the factory was serially producing telephones and whole exchanges, UHF

[70] Boyanov, *Shtrihi*, pp. 190-1

[71] *Entsiklopediya Bulgariya*, vol. 3, (Sofia: Izdatelstvo na BAN 1982)

stations for civilian and military use, and was developing the first Bulgarian television set (the “Opera-1”). Groups of up to 40 engineers at a time were sent to the GDR and Czechoslovakia to learn the skills – both technological and organisational – to run the factory successfully, quickly building up a core of experienced engineers.[72] To overcome the fact that only some could be sent abroad, the factory hit on a “teaching” solution - Bulgarian technicians and students who had studied abroad or knew English, French or German would be assigned one or two foreign journals to follow. At the end of each month, each technicians would have to submit a commentary on an article or two, and the collection of this would be published at the end of each month, synthesising the new advances for all factory staff. In such a way, a factory library was created and Bulgarian technicians remained informed of Western developments.[73]

As the factory built up steam, its engineers started noticing the problems with the license copy of their Soviet military field radio they were producing. A team led by a military engineer, Stoyan Djamiykov, set out to produce a better radio for the needs of the Bulgarian but also Warsaw Pact armies. This was, together with the “Opera” television, the factory’s first foray into own research and development. It was also a testing ground for many young engineers. The radio would materialise in 1964, going on to win tenders with the Bulgarian, Hungarian and Polish armies, and securing the factory’s reputation.[74] Television production would also lead it to become the first factory in Bulgaria with a degree of automation, getting its first two mechanised conveyor-belts in 1962.[75] The country’s cutting edge technicians in electrics and communications were clustered there, and throughout the early 1960s, its staff

[72] Peter Totev interview in Dimitrova, *Zlatnite Desitiletiya,* pp. 37-8

[73] Ibid., p. 40

[74] Stoyan Djamiykov, *Zapiski na Konstruktora,* (Sofia: Avangard Prima 2015), pp. 96-7

[75] Dimitrova, *Zlatnite Desitiletiya,* p. 43

were used as the core of new factories that took on the responsibilities of different productions, which the factory united. The factory itself retained radio relay and long-distance communication production, but its mark on Bulgarian industry was already made.

Future actors in electronics got their first taste of modern technology there. Lyubomir Antonov, part of the trio that created the first Bulgarian calculator (discussed in chapter 2), got his first start in the television laboratory at the factory.[76] When given the chance to go over to the BAS Institute of Communications, he chose to stay as the factory remained, throughout the 1950s and into the early 1960s, the best equipped place in the field in the country.[77] Often, however, the work still had to be improvised and depended on the young engineers' own creativity when technologies and even blueprints were lacking. Antonov recalls how he created the first Bulgarian digital measurement instrument after a Romanian delegation visited in 1958 and informed him this was the future of electronics, scrapping together needed sensors from friends in BAS and other laboratories. Other times, all he had to go on was the idea that a machine existed, such as an analogue computer after reading an English book in Russian translation. To create it, he had to go back to the mathematical basics by talking to his old university lecturers; as well as emulating transistor technology he read about in a "Phillips" catalogue.[78] Working out the schematics, his machine was delayed by the lack of deliveries of silicon transistors, leading to colleagues changing them for radio lamps, meaning the machine was obsolete the second it was created (problems with the production of such basic elements of Bulgarian electronics would plague the industry throughout its history). However, it was a useful school for young engineers, pushing them to find their own solutions in an environment of relative information poverty.

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[76] Lyubomir Antonov, *Kakvi Sum Gi Vurshil* (unpublished memoir, available at http://bbaeii.webnode.com/bylg-electronica-i-inormatika/; last accessed 23rd Oct 2016), pp. 66-7

[77] Ibid., p. 68

[78] Ibid., pp. 74-5

Pic. 2: Radio production in the "K. Voroshilov" factory, 1962. (Source: Sandatsite Project)

The cutting-edge of electronics research in the Bloc, however, was outside – in the USSR and the GDR. In 1956, under the influence of the "thawing" of Soviet science as well as politics, and the gradual growth of cybernetics as a field in the USSR, the first theoretical works on computational machines in the country were done in Sofia by Prof. Bozhorov and Prof. Nedyalkov. At the same time, Prof. Lyubomir Iliev at Sofia University attended a Moscow conference on the "Development of Soviet Mathematical Machine-Building".[79] Upon his return, he would become the intellectual champion of the field in the university, pushing for some students to be sent to Moscow for their undergraduate studies in the field. By 1957-8 there was already at least one student studying electronic engineering in Moscow (Stoycho Chamarov),[80] while the first sizeable group of Bulgarian students and teaching

[79] Kiril Boyanov, "Purviyat Izchislitelen Tsentur v Bulgariya – Nachalo na Informatsionoto Obshetsvto u Nas" in *Bulgarska Nauka,* vol.6 no. 4 (2011)

[80] E-mail exchange with his daughter Yana Hashamova, 28th Feb 2015

assistants from Sofia University in the field of "Digital Methods" went to the Soviet capital in 1959 – among them were future luminaries of the science in Bulgaria such as Blagovest Sendov. The first Bulgarian doctoral student in the field, Racho Denchev, was also accepted to Moscow State University that year.[81] Others went to the GDR, which was another source of education in the sphere – Lyubomir Antonov specialised in Berlin in 1960,[82] while Peter Petrov (who would go on to work in the BAS Institute of Technical Cybernetics & Robotics - ITCR) took an electronic automation specialisation there in 1962.[83] Others, such as the future head of the ITCR – Academician Angel Angelov – started off with semi-conductor specialisations in Moscow in 1956 and continued to work in a joint East German-Bulgarian project on the Bloc's first digital telephone exchanges in 1960.[84]

A critical mass of intellectual interest and cadres was being created even before Popov came back to head Bulgarian science in 1962. A Council of Minister order from the 25th April 1961 created the country's first electronic Calculation Centre at the Institute of Mathematics at BAS, and created the Faculty of Higher Analysis in Sofia University.[85] Iliev was made the deputy-director of the Mathematical Institute (renamed Mathematical Institute with Calculation Centre), under the director Academician Nikola Obreshkov; the main engineer was Ilko Yulzari. This would become the core of the first steps in domestic computing, which will be explored in the next chapter. In preparation for more serious work, Iliev organised a summer school for his most promising mathematicians at Dubna in the

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[81] Boyanov, "Purviyat Izcheislitelen Tsentur"

[82] Antonov, *Kakvi Sum Gi Vurshil*, p. 77

[83] Interview with Peter Petrov, 19th March 2015

[84] Peter Petrov "Angel Simeonov Angelov na 85 Godini" (copy of article celebrating Angelov's 85th birthday, kindly presented to me by Petrov)

[85] Evgeniy Kandilarov, "Elektronikata v Ikonomicheskata Politika na Bulgariya prez 60te-80te Godini na XX Vek" in *GSU-IF*, vol. 96/7 (2003/4), p. 440

USSR, where the COMECON's Joint Institute for Nuclear Research was based, with its own powerful computer centre.[86]

Other nuclei of engineering potential, however, also emerged. Aware that the developing industrial potential of the country required more than a few engineering specialists who could not just construct, but do actual research and development, the state created – also in 1961 – the network of Bases for Technical Development (BTD) in various major textile and machine-building enterprises. Their task was to research and implement the newest technologies in the various sectors. Some would go on to become independent institutes due to their importance and success, paramount among them being the "Instrumental Industry" BTD.[87] ITCR's predecessor, building up on a small foundation in 1959, also grew into a united section at BAS that dealt with automation.[88] Others developed new directions of research in existing institutes, such as Angel Angelov, who upon his return from Berlin in 1963 set up a section of "Industrial Electronics" in the existing Research Institute for Electrical Industry, working on automation and semi-conductors.[89]

By the early 1960s, then, Bulgarian industry had a growing experience in radio, communications and television production at "Voroshilov", as well as a promising nucleus of students, scientific workers and engineers who had learnt and specialised in electronics at the best Soviet and East German centres. Their potential was quickly recognised by the state, which created the research basis at both BAS and industry to harness their extremely valuable skills, paving the way for the first domestic developments in computing. With Popov's rise,

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[86] Ibid., p. 441

[87] Marcheva, "Problemi na Modernizatsiyata", p. 204

[88] Peter Petrov, "55 Godini Avtomatika, Kibernetika I Robotika v BAN" (Chronological piece available at the website of one of ITKR's successors at http://css.iict.bas.bg/history.html; Last accessed 23rd Oct 2016)

[89] Petrov, "Angel Simeonov Angelov"

they had also found their champion and grand organiser. However, they were entering a field where the rest of the COMECON was also making its first steps.

The State of Socialist Computing at the Dawn of the 1960s

Computing in the Eastern Bloc was in a perpetual game of catch-up. In 1950 Mikhail Lavrentev, the head of the Institute of Precise Mechanics and Computer Technology in Moscow, stated that the country was up to 15 years behind the US in the field, and would have to catch up to it in less than five if it was to not lose the arms race.[90] However, at the same time, Soviet scientists in the early 50s were *not* to copy the philosophical ideas – seen as reaffirming idealism and metaphysics – that accompanied the rise of computers. Cybernetics was denounced as a bourgeois and reactionary pseudo-science in articles in the 1952-3 period, where someone writing under the pseudonym "Materialist" criticised Weiner and Shannon for going down a route that has already been trodden as far back as the 18th century, when it might have been progressive but it was manifestly unsuitable for the modern age.[91] In 1954, the *Short Philosophical Dictionary* solidified its official reputation as a "pseudo-science",[92] hampering discussions and pushing Soviet science even further behind contemporaneous trends. However, this was inertia from the Stalinist period, and Stalin's death – albeit belatedly – eased the restrictions placed on Soviet science too. By 1955 the existence of Soviet computers was de-classified, and in 1958 the first book aimed at the general public, military officer Igor Poletaev's *Signal*, was published. In it he encapsulated what the discipline's promise was:

[90] Slava Gerovitch, "Mathematical Machines of the Cold War: Soviet Computing, American Cybernetics and Ideological Disputes in the early 1950s" in *Social Studies of Science* 31/2 (April 2001), pp. 256-7

[91] Loren R Graham, *Science, Philosophy and Human Behaviour in the Soviet Union* (New York: Columbia University Press 1987), p. 273

[92] David Mitchell, Jerome Segal & Slava Gerovitch, "From Communications Engineering to Communications Science: Cybernetics and Information Theory in the United States, France, and the Soviet Union" in Mark Walker (ed) *Science and Ideology: A Comparative History* (London: Routledge 2003), p. 81

> 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.[93]

Once unleashed, cybernetics became a dominant language for many Soviet scientists, who sought in it everything from a confirmation of Marxism to the "cyberspeak" of 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, in combination with cybernetics, arrived at the opportune moment to become a superstar of Soviet science, which was searching for a "panacea for Soviet economic woes."[95] By December 1957 the Soviet Academy was suggesting to the Politburo that the use of computers in planning is of exceptional importance to its efficacy, introducing a much-lasting effects of cybernetics into economic thinking in the Bloc than in the West. Planning, in cybernetic terms, was a feedback system of control of enormous proportions, with the Soviet economy a potentially fully controllable system with a myriad information flows.[96] By 1960, mathematical modelling of the economy using computers was already discussed at a first Soviet conference on the topic, foreshadowing the incorporation of cybernetics as political mantra and utopia in the party's congress in 1962. After in December 1959 quietly promoting automation in the economy, without full-blown structural reform, the Central Committee had now embraced the new ideas, calling for the importation of rational Western techniques of

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[93] Igor Poletaev, *Signal: O Nekatoriyh Ponyatiyh Kibernetiki* (Moscow: Izdatelstvo Sovetskoe Radio 1958), p. 23

[94] As the history of Soviet cybernetics is beyond the scope of this work, for this argument and for an overview of the topic, Slava Gerovitch's enthralling *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (Cambridge, Mass: MIT Press 2002) remains the go-to book.

[95] Slava Gerovitch, "InterNyet: Why the Soviet Union Did Not Build a Nationwide Computer Network" in *History and Technology,* vol. 24 no. 4 (Dec 2008), p. 337

[96] Ibid.; for an excellent overview of the attempts to network Soviet society to achieve this, see Benjamin Peters *How Not to Network A Nation: The Uneasy History of the Soviet Internet* (Cambridge, Mass: MIT Press 2016), a work that will return in later chapters.

management if they were of proven quality. As the Sofia "Voroshilov" factory was just starting to use its first mechanised conveyors, Khrushchev's words in November 1962, envisioned society as functioning like an automated assembly 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]

These ideas of automation and cybernetic economics had a profound effect on Bulgarian science too, which will be picked up in later chapters (where the continued development of Soviet cybernetic thinking will be interwoven), but in a concrete way it created the conditions for an explosion in the sector. If by 1962 the imperial centre at Moscow was proclaiming the need to automate and computerise as a way to organise socialist society, it would soon need the right material, as would all of its allies that sought to build communism.

Computers did, of course, exist in the Bloc by the late 1950s, spurred on by the military arms race as well as the economic needs of the countries. Despite Stalinist science's rejection of many Western ideas, it knew that calculating machines were indispensable to its task of creating and perfecting a nuclear and military arsenal. 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 small Moscow team. Both were quickly harnessed to the needs of nuclear physics, jet propulsion, radio location and aviation.[98] In 1955 the BESM (from *L*arge Electronic Calculating Machine, closer to the truth than the previous one) started operating at the first purposefully created computer centre in the Soviet Academy of Science, where

[97] Gerovitch, "InterNyet", p. 340

[98] Gerovitch, "Mathematical Machines of the Cold War", pp. 265-6

despite being used by the scientists, it was again almost exclusively used for military matters. It remained the fastest computer in Europe for at least two years,[99] and would spawn a successful range of machines, culminating with the BESM-6 in the mid-60s, which was a mainstay of Soviet computer centres. Missile defence and design took the majority of the machine-time of the first serially produced Soviet computer, the Strela (Arrow) series, manufactured sine 1953; the same team was tasked with creating the nerve centre for the first Soviet anti-missile defence shield around Moscow, creating the specialised M-40 and M-50 in 1958-9.[100]

Pic. 3: The MESM computer, circa 1951. (Source: Computer History Museum)

Other socialist countries also had experience in creating machines. East German industrial prowess produced the first non-Soviet socialist computer. In 1955, the renowned Carl Zeiss firm in the GDR built the country's first machine, the Oprema – primitive as it was, it was a testing ground for ideas that led to the ZRA-1 in 1958. Meanwhile, a parallel development at the Dresden Technical University produced the D-1 in 1956.[101] In

[99]Boris Malinovsky, *Pioneers of Soviet Computing* (Published electronically, 2010; http://www.sigcis.org/files/SIGCISMC2010_001.pdf; Last accessed 24th October 2016), p. 23

[100] Gerovitch, "Mathematical Machines of the Cold War", p. 268

[101] James W Cortada, "Information Technologies in the German Democratic Republic (GDR), 1949-1989" in *IEEE Annals of the History of Computing*, vol. 34 no. 2 (Feb 2012), p. 37

Czechoslovakia, the pioneer Antonin Svoboda had designed the country's first computer as far back as 1951, but could not complete the project until September 1957, when the SAPO came online to solve needs in central planning calculation and scientific work in the Academy of Sciences. It was followed by the EPOS 1 and EPOS 2, created by Svoboda's team after SAPO burned down in 1959.[102] In Romania, Victor Toma fathered the first digital computer there, the CIFA-1, at the Institute of Atomic Physics in the Romanian Academy in 1957.[103] It was his visit to "Voroshilov" that would Antonov credits with his turn to digital machines. The Hungarians built an experimental electronic calculator-computer in 1958, the MESZ-1, at Budapest Technical University.[104] In Poland, the ODRA series, innovative and indigenous too, started being built in 1959, with the later software-compatible with the then-famous British ICL series.[105] Many of these Eastern machines were inspired by developments in the West (especially the Odra), yet due to the constraints of different electronic elements, as well as the paucity of information on the actual designs, most showed novel and homespun solutions, difficult to put into production. Yet Bulgaria was severely lagging behind the regional technology sector by the early 1960s. It had not yet developed a single machine of its own.

However, none of these machines were yet in true serial production. Only seven Strela machines were built by the Ministry of Instrument Making, and a later incarnation of the BESM would start serial production ten years after the original's introduction. The early

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[102] Petri Paju & Helena Durnova, "Computing Close to the Iron Curtain: Inter/national Computing Practices in Czechoslovakia and Finland 1945-1970" in *Comparative Technology Transfer and Society,* vol. 7 no. 3 (Dec 2009), p. 311

[103] Anonymous, "History of Computing Developments in Romania" in *IEEE Annals of the History of Computing,* vol. 21 no. 3 (1999), p. 58

[104] Zsuzsa Szentgyorgi, "A Short History of Computing in Hungary" in *IEEE Annals of the History of Computing,* vol. 21 no. 3 (1999), p. 51

[105] Andrew Targowski, *The History, Present State, and Future of Information Technology* (Santa Rosa: Informing Science Press 2016), pp. 123-6

ODRA machines were single models, used for training purposes; the Czech SAPO and Romanian CIFA remained literally unique. Even the GDR's more advanced industry managed to produce just 32 copies of the ZRA-1, and this too took a number of years.[106] In Soviet hands they were used primarily for military and space needs, while the Eastern Bloc ones were products of scientific visionaries who waited years for full institutional backing. Almost all had their start or spent their life in various national academies of science or universities. Not a single state – not even the USSR – had the necessary infrastructure and organisation to mass produce computers yet, and often each machine differed from the previous in a slight way, as scientists tinkered to improve each model. These were artisanal rather than industrial computers, and none were ready to solve the tasks that Khrushchev set before the sector by 1962. Cold War concerns meant most of them were behind blast-proof doors, using military-specific software, which was not applicable to the civilian economic tasks they were to be harnessed to. Throughout COMECON, a market gap existed. Specialisation was looming, and electronics was shaping up to be one of them given the utopian programs of the CPSU.

In Bulgaria, a small but growing cadre of bright engineers had found a patron in the figure of Ivan Popov, while the party was scrambling for a golden export to balance its trade. Despite starting from 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 presented a low-resource, high-yield field where not a single socialist state could yet claim primacy. The rising political star of Popov drove this point home to Zhivkov and the Bulgarian political elite, paving the way for the creation of a truly industrial

[106] Cortada, "Information Technologies in the GDR", p. 37

[107] Here, of course, I call on the work of Alexander Gerschrenkron and his *Economic Backwardness in Historical Perspective: A Book of Essays* (Cambridge, Mass: Belknap Press 1962)

computer sector. Once started, Bulgaria would surprise its advanced fraternal countries, and reap enormous benefits.

Chapter 2. The Golden Factories & the Captive Market: The Development and Apogee of the Computer Industry

"Bulgaria builds socialism!" and "Only Levski!"[1] – these were the two phrases that the first Bulgarian computer, the "Vitosha", spelled out at the Moscow exhibit of Bulgarian technological prowess in late July 1963.[2] Just over twenty years later, by 1985, Bulgaria was responsible for 45% of all Eastern Bloc electronic trade,[3] with the industry producing large mainframes, personal computers, memory devices on magnetic discs and tapes, tele-processing systems, industrial robots, automated systems of control for machines and administration – a full spectrum of modern technology for all aspects of a modern society and economy. From inauspicious beginnings, the country leapfrogged all its socialist competitors to capture a disproportionate amount of the COMECON market, reaping billions of levs in profit. Doing this, it transformed many aspects of socialist trade, society and thinking. However, to explore these effects, the industry's fast growth and performance in the international socialist market must be explored. This chapter will look at the way that Popov managed to secure political backing for this project, the way it grew in the 1970s and 1980s and its interactions with the COMECON and above all the USSR.

The story of the growth of the industry from the cumbersome "Vitosha" to the miniature electronics found in the "Pravetz" PC is one of state-led investment and manoeuvring in an international market that operated in very different ways to other economic integration projects going on at the same time, such as the European Economic Community. While the Bulgarian computer industry was created with the most prosaic of all ideas – monetary profit – its growth was paralleled by changed thinking at the highest

[1] A popular football slogan by supporters of PFC Levski-Sofia, one of the country's most popular clubs.

[2] Kiril Boyanov, *Shtrihi ot Razvitieto na Izchislitelnata Tehnika v Bulgariya* (Sofia: Akademichno Izdatelstvo Prof Marin Drinov 2010) p. 22

[3] TsDA f. 1B op. 68 a.e. 1836 l. 201

echelons, where ideas of creating a new man and a new type of socialist economy were changed by the possibility opened up by cybernetics and computers. At the same time, COMECON's economy was also serving political interests, as the idea of socialist division of labour was superseded by the late 1960s by that of socialist integration, a step towards creating a real economic bloc which served many purposes – a response to the need to catch up with the West, to re-assert Soviet clout, and even as a step towards communism. Throughout, the story of the economic miracle of this technological sector is permeated with politics, both domestic and international. The golden factories of Bulgaria, as they are sometimes called informally, are a glaring example of the embeddedness of the economy in politics. They also reveal a story of a small state leveraging its political loyalty and the framework of socialist integration and five-year trade deals to often hold its superpower backer in a check-mate situation in trade terms. The Bulgarian computer industry worked in the national interest, and rarely in that of the international socialist community.

The First Bulgarian Computer

From its foundation in July 1961, the Calculation Centre at the Maths Institute of BAS started work on creating the first programmable, digital computer in Bulgaria. Every state in the socialist bloc (sans Albania) had developed a machine by now, and despite this there was still opposition from older professors who saw analogue machines as enough. Professor Tagamlitski, one of the members of the institute's scientific council, asked Sendov, one of the young, newly trained specialists, to calculate 2+2 on the analogue machine MH-7 that the institute possessed. The machine came back with 3.95, as addition and subtraction were not operations usually done by the machine. Tagamlitski joked that a new digitial machine, costing many times more, will probably get it to 3.98, Boyanov (a member of the Calculation Centre from its inception) recalls.[4] However, Iliev was adamant of the need for

[4] Boyanov, *Shtrihi,* p. 16

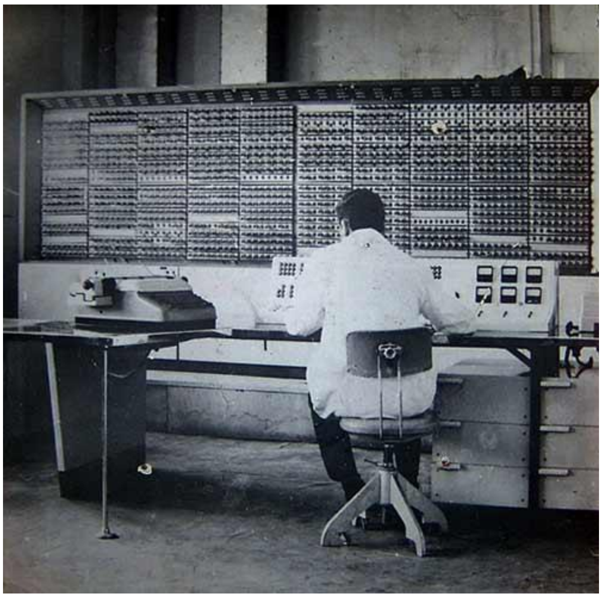
such a machine, and work progressed quickly. Seminars on Boolean algebra and programming were organised in 1962, and different people in the centre were given tasks such as the creation of the power block (Boyanov), magnetic drums for the operative memory, system commands - in short everything that a modern computer would need. Teams visited Romania and GDR to acquaint themselves with Toma's CIFA-1 and the Dresden D-1.[5] The scientific plan of the institute for 1962-3 put the creation of a digital calculating machine (as the parlance was at the time) at the top of the list, an important part of the state plan for scientific and technical progress that CSTP co-ordinated. Work progressed quickly throughout 1962, as the team worked fast in order to ready it for the 8th BCP Congress, and by early 1963 the team was ready to start working on its settings as the hardware was complete. Based on radio lamps with a life of around 10,000 hours, the machine had formidable dimensions – four by two metres. A special ventilating system was constructed to cool the goliath. A command panel united all inputs, and an electric typewriter was attached as the output device. Together, the machine required around seventy square metres of space, with the right temperature needs too.[6] It was named Vitosha, after the mountain on the outskirts of Sofia.

Creating even such a relatively primitive machine was a difficult process for a team that had no experience in the field apart from the observations of foreign computers and theoretical knowledge. The precision needed for the magnetic memory required lathes only present in the military factories in Sopot, while its outer layer required manufacture at Dubna in the USSR. Boyanov recalls his mistake in ordering a *kollergang*, an industrial edge mill for the creation of the ferrites needed for the memory, from the USSR. It turned out in his inexperience he had ordered one meant for a factory rather than laboratory, leading to last-

[5] For a quick overview of these and other socialist bloc machines, see chapter 1.

[6] Boyanov, *Shtrihi,* pp. 17-8

minute scrambling to find a home for it – thankfully, a Stara Zagora factory was looking for one, so it was transferred there, and a more suitable one was purchased from Hungary.[7] Slowly, but surely, the team was learning valuable lessons in creating a complex machine.



Pic. 1: The Vitosha (Source: Kiril Boyanov personal archive)

Ivan Popov's visit in early 1963 made the work even more urgent, as he wanted the machine to participate in the Moscow exhibit between August and September "Bulgaria Builds Socialism", aimed at showcasing the state's achievement after nearly two decades of communist rule. As the machine was not ready yet, it was decided that the whole team would go to the Soviet capital and finish the montage on the ground. Problems at customs and long work-days did not stop the work from pushing ahead, helped by Yulzari's use of bottles of Bulgarian cognac to free up more exhibition space from the local administrators. Another problem appeared – the need for a cable capable of supplying much more power than currently available. A local engineer, bribed with yet more cognac, "solved" the problem by leaving the Indian exhibition space next door without power in the interests of fraternal friendship.[8] By late July, however, it was all worth it, as the machine went operational.

[7] Ibid., p. 19

[8] Ibid., p. 22

The exhibit at Sokolniki park was visited by Breznhev and Zhivkov, and later by Khrushchev themselves, all leaving impressed with the computer's capabilities. Local administrators, impressed by the Bulgarians' inflated boasts of Vitosha's capabilities, ordered five – impossible, given that Bulgaria lacked the capabilities for mass producing such a machine. After the exhibit, it was returned to Bulgaria, where it had to be installed and calibrated again, and the team continued to develop it further. However, as sometimes happened with such early computers, in late 1964 it was knocked out of operation by a small flood in its operation room.[9]

By this point, however, it had achieved its aim. It had given the team of scientists experience in creating a computer, a project they saw through from the idea to realisation stage in a remarkably short time. Mistakes were made and unanticipated problems met, but in solving or circumventing them, valuable skills had been learnt. More so, the machine's official presentation at Moscow had helped put Bulgaria on the computer map and showed that the country was now also capable of producing domestic designs. The Soviets were sufficiently impressed to recognise that Bulgarian computing now existed as a sphere, helping deputy-prime minister Stank Todorov to negotiate the purchase of the first complete computer for Bulgarian needs – a Minsk-2 machine that became the Maths Institute's first dedicated computer, as the Vitosha was both a showcase and, as we saw, dead by 1964.[10] Vitosha was a testing ground and a school, as well as a statement which would help prove to both the COMECON and the Bulgarian political elite that the country had the scientific capacity to create a high-technology product. Popov's insistence on demonstrating the computer in Moscow was a declaration also to Zhivkov, who saw the machine for the first time in Sokolniki. In practical terms it helped Bulgaria secure a Minsk computer, a machine

[9] Ibid., p. 24

[10] Dimitar Shishkov, *Zvezdhnite Migove na Bulgarskata Kompyuturna Tehnika I Kompyuturna Informatika (1956-1966)* (Sofia: Ciela 2002), pp. 215-6

with serious power at the time, in order to continue the development of skills among the Vitosha team. In political, however, it was a first step towards securing Politburo support for organising a new sector of the economy.

Calculating the Price

As the Minsk-2 was being installed in the Maths Institute, Ivan Popov in his capacity as CSTP head, together with the president of BAS Academician Lyubomor Krustanov and the head of the Committee on Machine-building Mariy Ivanov completed a report to the Politburo titled "On the Development of Computer Technology." On the 24th June 1964, the Bulgarian political elite was acquainted with the world trends in computing, its benefits for society and all its possible applications in a national economy. It pointed out that which Popov had already noted – this was a sector that required few materials, not much in the way of rare metals, and the possibility of using female labour. Even more importantly, it was a sector which would return its investments many times over, and quickly.[11] It taught the Politburo about the difference between digital, analogue and hybrid machines, accenting on the former as the future. Importantly for the development of the sector and the future obsessions of the party, it stated that digital computers were the "heart of automation" in both production and administration, something that was to grow at the expense of the statistical calculation which was predominant at the time.[12] It also noted the developments in the rest of the COMECON, with the USSR and Poland being at the top and GDR close behind, but all more focused on scientific research than automation.

Two weeks later, on the 7th July, the Politburo took its first decision on the development of Bulgarian electronics and computing. Recognising Popov's paramount role, all power for the development was vested in his CSTP, which was to form a Coordinating

[11] TsDA f. 1B op. 6 a.e. 5513 l. 150-3

[12] Ibid., l. 152

Council on the question. It would coordinate fundamental research across universities and BAS, would determine cadre distribution and funds among the institutes and enterprise departments concerned, and thus ensure the best possible resource in the shortest time.[13] The ultimate task was the development of a program of computer development up to 1970 which was to be approved by the Council of Ministers before the end of the year. In terms of production, too, a new body would appear to deal with the industrial manufacture of computers and means of automation, on the basis of a United Industrial Enterprise for Automatics. Funds were also to be made available to the existing Calculation Centre to upgrade and expand its equipment (around 200 thousand levs for 1964-5, of which half in capitalist currency). The CSTP was to coordinate with the Ministry of Foreign Trade (MFT) the purchase of at least four digital computers from abroad, either with a credit or in return for industrial exports. The MFT was also to study any possibility of using existing UN programs that could help Bulgaria – both its Technical Aid Program and UNESCO initiatives in IT. CSTP was also to take the lead, this time with the Ministry of Finance, on making Bulgaria a member of the International Federation of Information Processing from 1965. Foreign specialists, too, were to be invited to Bulgaria during the year in order to help update the research work of the interested institutes, as well as change their organisation and structure to meet the new demands.[14]

The cadre question was to be solved through the creation of new university courses from the new academic year starting only two months later. A "computer machines" specialisation was to be created at VMEI-Sofia, as part of its "Semi-Conductor and Industrial Electronics" course. The technical high school with electric profile "A Popov", also in the capital, was to create a class on the production and use of calculating technology, to ensure a

[13] Ibid., l. 136

[14] Ibid., l. 138-144

school-to-university pipeline in the future. The technical high school of fine mechanics in Sofia was to create classes in mechanical devices for computer machines.[15] This was the final step in the full-spectrum offensive that the Politburo envisioned – in international co-operation, in organising industrial production, upgrading technology, and educating future specialists. In all of these, CSTP and Popov were to take the lead. By April 1965, it had shored up the industrial sector through a reorganisation of the machine-building sector, entailing the creation of state economic unions (DSOs in Bulgarian parlance, from *Durzhavno Stopansko Obedinenie*). Amongst them was one in "Instrument-Building" (with Automation tacked on in later years), to deal with research, design and production in the spheres of instruments for industrial control, automation, and electrical devices and medical apparatuses of all kinds[16] – the first high-technology organisation of such nature in the country, aimed explicitly at the sectors identified by the CSTP as the ones with most perspective for the future.

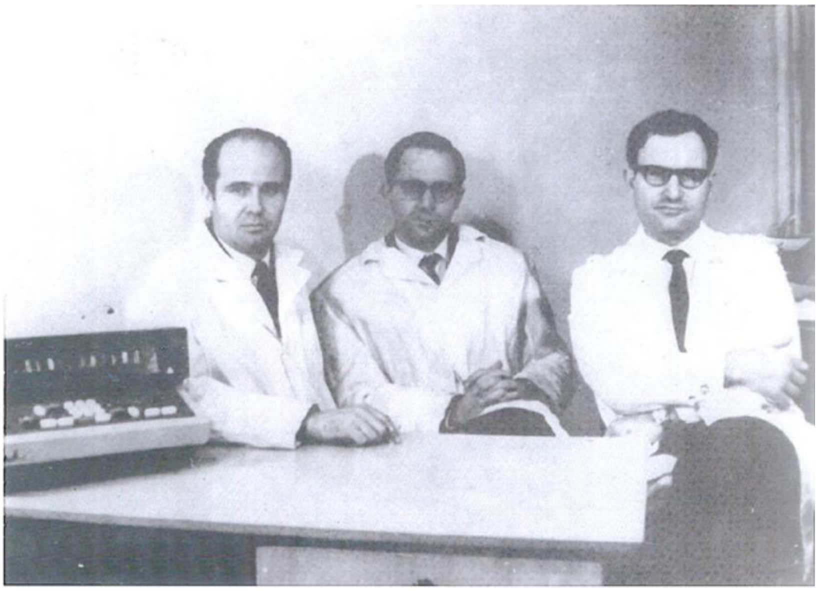
Popov's first step, however, was to organise the creation and production of a cheaper, smaller, and less demanding machine than a computer – an electronic calculator. It was the perfect machine to help in the automation of administrative and office work; it was an item in high demand not just in COMECON but the world; and it would not require as much of a technological leap as creating serial production of something as big as the Vitosha. This task was again placed before Iliev's Maths Institute, with the deadline being yet another Moscow exhibit, this time with international participation – the Inforga-65, in May 1965. This was a new field, with the first electronic calculator appearing in the UK in 1961. By the time the task was given to Iliev, there had only been two more – an Italian and an American one. Lyubomir Antonov was part of the team assigned to this pressing task. He remembers being

[15] Ibid., l. 142

[16] Postanovlenie 26 in *Durzhaven Vestnik,* issue 36, 1965

unimpressed with the British “Anita” calculator they acquired, as it had over 100 keys, making it very difficult to use. Together with Stefan Angelov and Zhivko Paskalev (later replaced by Peter Popov), who had trained in Dubna and felt they could address parts of the task, they set out to work. Quickly they decided to make the new calculator able to do operations such as squaring and finding the square root – unknown in the existing models. Based on germanium transistors that were being built in Bulgaria on a French license, while Angelov worked out algorithms that allowed for much quicker multiplication (the British calculator achieved multiplication by multiple additions).[17]

When Popov visited to check up on the work, he was happy with the work but worried it would not fit into a small enough frame. This, too, was achieved however, completed by the end of 1964 in record time. Naming it was more difficult, until a member of the institute hit on ELKA – both a diminutive form of a woman’s name, and the first two syllables of the Bulgarian for electronic calculator.[18]



Pic. 2: The Angelov-Popov-Antonov team with their ELKA-6521 (Source: Antonov memoir)

[17] Lybomir Antonov, *Kakvi Sum Gi Vurshil* (unpublished memoir, available at http://bbaeii.webnode.com/bylg-electronica-i-i normatika/; last accessed 23rd Oct 2016), pp. 86-7

[18] Ibid., p. 88

The ELKA-6521 was unveiled before Zhivkov and the Politburo on the 17th April 1965, presented at Inforga only two weeks later.[19] Popov presented it to the Soviets, telling Gosplan that this was the Bulgarian breakthrough in electronic calculators and this is only the first model.[20] He promised that Bulgaria was ready for serial production, and that the Soviets should sign import agreements for the whole five-year plan up to 1970 – a bluff that was typical of Popov, according to subordinates. The USSR was, understandably, sceptical – how could little Bulgaria achieve this? Surely, this was a demonstration model, much like the Vitosha. Production of the first ELKA, however, was implemented in Sofia in 1966 and then in the newly created Silistra factory "Orgtehnika", which would remain the home of Bulgarian electronic calculators and organisational technology. Despite Soviet reticence, it found good markets in the GDR and Czechoslovakia.[21]

Meanwhile, the team was quickly developing two new models, the ELKA-22 and ELKA-25, utilising what they have learnt to make more unified and simpler to produce models. Increase miniaturisation and the reduction of internal cables helped make them smaller, while the ELKA-25 added a printing device – becoming the first calculator in the world to do so. Antonov recounts criss-crossing Europe looking to buy a license for a printing device, even getting caught up in an anti-Vietnam War protest in Stockholm, yet in the end he had to create one himself with the help of Ivan Stanchev, a machine engineer.[22] Completed in 1966, they would go into production in 1967 and go on to achieve great success, resulting in tens of millions of levs of exports (impressive for this previously non-existent industry), including in Western countries such as France or Spain.

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[19] Evgeniy Kandilarov, "Elektronikata v Ikonomicheskata Politika na Bulgariya prez 60te-80te Godini na XX Vek" in *GSU-IF*, vol. 96/7 (2003/4), p. 445

[20] Shishkov, *Zvezdnite Migove,* p. 352

[21] Kandilarov, "Elektronikata v Ikonomicheskata Politika", pp. 445-6

[22] Antonov, *Kakvi sum gi vurshil,* pp. 95-7

Meanwhile, however, the Antonov team was awarded the Dimitrov Prize for scientific or cultural achievement – the first such prize to be given in the sphere of electronics.[23] Popov's success in organising the creation and mass production of Bulgarian calculators, the first electronic item actually produced by the state's industry, catapulted him to the Politburo in the same year as the Dimitrov Prize for Antonov and the first mass-produced ELKA – 1966. The success of the different ELKA variants in the following years solidified the position. The Orgtehnika factory in Silistra was still not fully functional, but Popov knew it was time to assault the Soviet market again. The prices that Bulgaria wanted were high – over 1200 roubles per calculator (a pricing policy across all electronics, which we will return to later); the Soviets countered that the GDR had offered one at 730 roubles. Popov, of course, undermined them, knowing that access to thousands of Soviet office desks and enterprises directors would ensure the production's profitability. The price fell to 700 roubles and won the contract, while at the Hannover fair in 1966 the Bulgarians impressed all visitors with the only printer-calculator in the world, and the first one that could do roots operations.[24]

In September 1966, the Bulgarian machines faced another serious test at Inforgtehnika-66 in Moscow, where over one thousand companies from across the world took part. The Bulgarians, in line with their growing clout in the sphere, acquired a five hundred square metre pavilion in the same building as the USA, France and Sweden – jumping into the deep end of technology comparison, as it were. All three types of electronic calculators were showcased, as well as dictaphones, laminators and other office machines. The ELKA-25 was, once again, the star, attracting interest from West German firms who wanted to co-operate in production, as well as Italian giant "Olivetti", seeking co-operation and even private talks with the constructor. The Soviet Minister of Automatisation, Rudnev, was also

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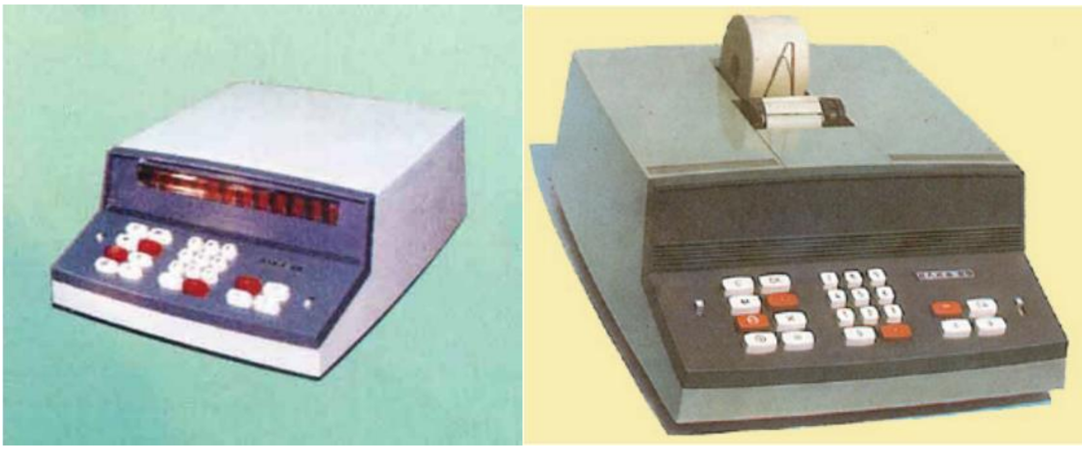
[23] Shishkov, *Zvezdnite Migove*, p. 359

[24] Ibid.

taken with the machine, agreeing to organise export from 1967. The Soviet Ministry of Electronic Production also pledged enough indicator lamps to ensure mass production without Western import, saving currency.[25] The CSTP report of the event noted with satisfaction that

> It must be said that our country passed the difficult test of comparison with some of the most advanced countries in the sphere of organisational technology and computer technics. The overall opinion of our Soviet comrades and of the representatives of numerous capitalist firms is that we have presented ourselves well.[26]

The report continues to note that Soviet indicator lamp production was in fact being developed at Bulgarian request, precisely for the ELKA. The Silistra factory was also, at all costs, to start production in the first three months of 1967 as Bulgaria had to maintain the edge it had achieved in calculators over the last two years. The next test would be in Paris and Vienna exhibits later that year.[27]



Pic. 3: The game changers ELKA-22 and ELKA-25 (Source: Antonov memoir)

[25] TsDA f. 517 op. 2 a.e. 169 l. 45-7

[26] Ibid., l. 45

[27] Ibid., l. 47

By 1968 the required level of organisation and success was achieved, with nearly 2.7 million levs sold (around 3.2 million dollars)[28], the majority to the USSR – and rolled in together with emerging electric typewriter production, it topped nine million.[29] In 1969, 9572 ELKA-22s were sold abroad, including 108 to France (at a price of 592 levs against the 969 levs asked of the USSR).[30] As the rest of the computer industry was being set up, the ELKA family continued to be the mainstay of Bulgarian electronic export in the early 1970s – the ELKA-22 alone accounting for 13 million out of the 22.7 million levs of electronic export in 1970.[31] By that year, ELKA-22s were being sold to Spain, Turkey and Norway too, one of the few Bulgarian machines that placed well in the West.[32] In 1971 it was selling 20.5 million out of the nearly 56 million electronic export, overtaken for the first time by another item - printed boards for Soviet Minsk-32 computers;[33] in 1972 it was back to the biggest exporter, with over 32 thousand units sold for nearly 27 million levs (but now out of a much bigger overall export).[34] As other electronic devices entered mass production and export by 1972, the ELKA sales stabilised around 20 million levs per year,[35] but new models continued being developed for production in the now fully functional "Orgtehnika" Silistra factory - from

[28] The official conversion rate to the dollar around the late 60s and early 70s was 1 lev to 1.2 USD; of course, it is hard to make such comparisons when trade within COMECON was done in the convertible rouble. The black market exchange rate was, of course, much less flattering to the Bulgarian currency, but here we are dealing with official figures, so it is not of concern.

[29] TsDA f. 830 op. 1 a.e. 88 l. 1-2

[30] TsDA f. 830 op. 1 a.e. 89 l. 2-3

[31] TsDA f. 830 op. 1 a.e. 90 l. 1-2; data on general calculator sales worldwide is lacking, yet a close competitor – the Olivetti Programma 101, which had conquered the huge US market – sold around $130 million worth throughout the 1964-9 period, giving an average of around $26 million per year; meaning the ELKA did more than admirably in its own sphere.

[32] Ibid., l. 5

[33] TsDA f. 830 op. 1 a.e. 91 l. 3

[34] TsDA f. 830 op. 1 a.e. 92 l. 2

[35] TsDA f. 830 op. 1 a.e. 93 l. 3

1969 Lyubomir Antonov had been put in charge of a newly founded Institute for Electronic Calculators.[36]

There were many problems with the production of the machine, indicative of the growing pains of a new industry in a state with little experience in high technology. Firstly, Antonov remembers positive responses in Italian and West German firms, including orders of ten thousand ELKAs to be delivered within three months – this in 1966, when the production was still not fully organised, and Popov was bluffing in the USSR in order to secure lucrative contracts.[37] The bigger problems, however, was the quality of production itself, especially when exported to the West. Snezhana Hristova recalls having to go to France very soon after the initial export there in 1967 in order to fix as many as she could, spending two months working on defective machines. Even then, half of them had to be returned to Bulgaria, irreparable – she blamed the poor initial conditions in the Silistra factory, especially climatic control, so important to the sensitive electronic industry.[38] This vexed Popov, who used a visit to France to organise the visit to the Silistra factory of an engineer who was also a member of the French Communist Party, in order to convince the party to allow a Westerner in such a sensitive site. The French visit pinpointed a problem that would be part of the Bulgarian electronic industry throughout its history – poor worker habits, in this case not wearing gloves. Sweaty palms would result in some perspiration getting stuck in the solder joints, where it would over time act as a corrosive, no matter how airtight the machines were on the outside. When Popov implemented changes, machines were still coming back defective – a surprise visit revealed a couple of workers who continued to shirk the regulations. The ensuing disciplinary measures against two women in the factory brought

[36] Antonov, *Kakvi Sum Gi Vurshil*, p. 104

[37] Ibid., p. 100

[38] Milena Dimitrova, *Zlatnite Desetiletiya na Bulgarskata Elektronika* (Sofia: IK Trud 2008), p. 216

many problems to Popov, who was accused of draconian measures. The Politburo member, however, was adamant – there was no point in importing the latest Japanese and Western European technology and licenses if Bulgarian working habits would destroy the good work in the last moment.[39]

Despite such problems, the ELKAs were a huge success. They were the first mass-produced item of the Bulgarian electronic industry, the first one that won markets in COMECON and sold successfully in the West, and a sign of growing technological skill in the country. The creation of new factories and institutes connected to it, as well as the trumpeting of its success in 1965 and 1966, helped make electronics a sought-after specialisation in universities and schools. It was also proof of Popov's skills as a strategist of technological production and economic breakthroughs, earning him a Politburo place and thus immeasurable power over the future direction of the economy. This was helped by another one of Popov's "greatest hits", coinciding with the growth of ELKA, which paved the way for the creation of an industry that could produce not just calculators, but also computers and magnetic discs.

The Japanese Connection

By 1964-5 Bulgarian scientists had proven their intellectual capability of creating electronic devices in the same category as their counterparts, sometimes, as with the ELKAs, even ahead of their competitors. However, they still lacked the experience of implementing the intellectual product into serial industrial production, especially in the more complex sectors as "Vitosha"-style machines. The easiest way to get over this obstacle would be co-operation with a leading firm or organisation in the sector. While Soviet technical aid was key to training personnel in electronic fields, the Ministries of Electronic and Radio

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[39] Jouko Nikula & Ivan Tchalakov, *Innovations and Entrepreneurs in Socialist and Post-Socialist Societies* (Newcastle: Cambridge Scholars Publishing 2013), pp. 95-6

production were also far behind their Western counterparts in this field. The real expertise in industrial electronics lay beyond the Iron Curtain, behind the embargo restrictions on high technology imposed by COCOM. The efforts to break this through espionage and joint enterprises will be explored in the following chapter, but there was an alternative to Western European or American experience that was also emerging in the early 1960s.

Japan's post-war economy was one of the so-called miracles in terms of growth, yet it was its stance towards the socialist bloc that made it a viable alternative to other capitalist countries. The political alliance with the USA masked a deep anti-US sentiment, as well as a wish to escape the economic straitjacket they were held in. Its political stances such as lack of recognition of Communist China or continued disputes over the Kurile Islands with the USSR were not to be an impediment to a more nuanced and open economic policy. Between 1952 and 1958, for example, four private-sector trade agreements were signed between the Japanese business community and the People's Republic of China foreign trade ministry. [40] American worries that this was the precursor to political disloyalty would not stop the Japanese from expanding such measures, driven by the desire for export markets. Attempts to sell in South-East Asia, a continuation of colonial-era spheres of influence, met the same fate as a proposed "Marshall Aid for Asia" – American recalcitrance. Eventually, this would lead to a deluge of Japanese exports to the Western markets,[41] but the COMECON and China also presented huge and lucrative untapped territories. In 1956 the Soviets and Japanese officially ended the war (with negotiations stalled due to the fate of the northern islands), paving the way for Japanese membership to the UN and a different approach to Eastern Europe.

[40] Sayuri Guthrie-Shimizu, "Japan, the United States, and the Cold War 1945-1960" in Odd Arne Westad & M Leffler (eds) *Cambridge History of the Cold War, Vol. 1 – Origins* (Cambridge: Cambridge University press 20xx), p. 257

[41] Ibid., p. 258

The new Japanese Prime Minister from 1960, Hayato Ikeda, turned away from foreign-policy issues towards "bread-and-butter" economic concerns, accommodating the socialist opposition by bringing moderate left-wingers into the Diet and staking public support on an economic policy with the aim of doubling income within a decade.[42] This was part of his concept of dividing politics from economics, aimed at serving Japanese economic interests wherever they could be maximised.[43] Trade with the USSR grew fast, reaching $281 million by 1962, and Japan would eventually become the biggest Soviet trade partner among the capitalist states.[44]

This Japanese policy and rapprochement with the socialist community opened up possibilities for Bulgaria too. A number of meetings at the Plovdiv Fair, in China and India, sounded out the possibility of re-opening economic and diplomatic relations. Tentative economic trade opened up again in 1957, while in September 1959 the two countries signed a joint communique in Warsaw, which renewed diplomatic contacts officially.[45] The first trade agreement was signed in 1961, facing the Bulgarians with the problems of improving goods' quality in order to help export. Despite this, the Tokyo diplomatic mission was given the task of concentrating on technical aid that could be achieved through Japanese co-operation and joint enterprises, with Bulgaria participating at the Tokyo International Trade Fair for the first time in 1963, showing off tobacco, tinned goods, chemicals, pharmaceuticals, oils and some lathes.[46] Over the decade, trade would peak at around $45 million dollars, helped by

[42] Michael Schaller, "Japan and the Cold War 1960-1991" in Westad & Leffler, *Cambridge History, Vol. 3 – Endings,* pp. 161-2

[43] Evgeniy Kandilarov, *Bulgariya I Yaponiya: Ot Studenata Voina kum XXI Vek* (Sofia: Izdatelstvo Damyan Yankov 2009), p. 42; the only monograph on Bulgarian-Japanese Cold War relations is also a great overview of the country's importance for Bulgarian technological policy

[44] Ibid., p. 63

[45] Ibid., p. 47

[46] Ibid., p. 71

Bulgarian shipping imports, solidifying Japan as a potential capitalist partner in machine-building and a veritable window to the West.

Thus, when the CSTP started contemplating a partner for implementing computer production on an industrial scale, it was the Bulgarian embassy in Tokyo it turned to, in September 1964.[47] Hristo Zdrachev, the Bulgarian ambassador to Tokyo, replied that industrial giant Fujitsu was the best firm to approach, both in terms of technological level and willingness to co-operate with socialist states.[48] Its president, Tsunesuke Vada, had visited Bulgaria in 1963 and met Popov in his capacity as head of the CSTP. He agreed to send a representative of the firm to Bulgaria in early 1965, who arrived with many technical documents, which allowed the Bulgarian team to choose the machine best suited to them – a FACOM 230-30 digital computer, with the full gamut of peripherals and memory devices. In September of the same year, Popov visited Japan, bringing along Dimo Dimov (a scientific advisor to the Council of Ministers and future director of Izotimpex, the exporting arm of the industry), completing the negotiations with Fujitsu by the end of the year. Bulgaria agreed to buy one or two complete machines, together with the programs; to purchase the peripherals for twenty more machines, at the cost of $4 million, with Fujitsu agreeing to deliver the other parts needed for the machine, to be put together in Bulgaria; and the company would train a number of specialists so they can carry out the work back in Sofia. The agreement was over the length of five years, with the needed credit and non-sharing of the license with other parties also agreed.[49]

The first group of specialists, such as Stefan Angelov (involved in the ELKA development) and Blagovest Sendov, left for Japan at the end of the year, studying all

[47] Ibid., p. 85

[48] Interview with Dimo Dimov, in Dimitrova, *Zlatnite Desitiletiya*, p. 79

[49] Ibid., p. 82

hardware and software sides of the complex machine. In early 1966 the agreement was ratified by the governments, and the CSTP started organising the sites for the production of the FACOM. The Committee of Machine Building was originally given the task, but its slowness and disorganisation due to its total unfamiliarity with this sector, spurred Popov to secure the transferral of the project to his organisation, creating the Central Institute for Computer Technology (CICT's story will be discussed further on in the chapter) and inaugurating the ZIT factory (Factory for Computer Technology, in Sofia) under the auspices of an engineer called Ivan Marangozov.[50] While this was being set up, another group of specialists left for the Fujitsu factories in Kawasaki in autumn 1966, staying for up to a year – they were the first group of CICT engineers trained in such advanced factories, and the group that managed to fully implement the FACOM into Bulgarian production once back to ZIT.[51] Their breakthrough was working out how to create the FACOM 230-30 using diodes and transistors available in the Eastern Bloc, made in the USSR, GDR and in the new Botevgrad factory in the country. This machine would be dubbed the ZIT-151, a functional copy of the Japanese machine, and the first mass-produced Bulgarian digital computer.

Together with this, CICT specialists were trained to use the Fortran and Cobol programming languages, as well as key aspects of computer architecture.[52] Dimov, who spent much time in Japan and Fujitsu between 1966 and 1970 co-ordinating the co-operation, recalls his impressions with the work ethic and organisation. He noted a meritocracy based on education and achievement, rather than political contacts, as well as the slow process of decision making which, however, resulted in perfect work once an agreement was reached – all of which contrasted to the Bulgarian conditions of decisions based on over-taking and

[50] Ibid., p. 84

[51] Kandilarov, *Bulgariya I Yaponiya,* p. 86

[52] Dimitrova, *Zlatnite Desitiletiya,* p. 86

over-fulfilling, backed up by sloppy work organisation and habits.[53] Despite such differences, work progressed quickly, and by 1967 Dimov was in charge of organising the transfer of know-how in magnetic discs. Four Bulgarians from CICT, under the leadership of engineer Ivan Arshinkov, spent months in the Nagano factory,[54] mastering the arts of fine mechanics so needed for the creation of the delicate magnetic memories which would catapult Bulgarian electronics to their pre-eminent position in the socialist market.

As the first home-produced ZIT-151 rolled out of the Sofia factory in 1969, the Japanese co-operation agreement and help had transformed the capabilities of Bulgarian electronics. Six years earlier scientists in a mathematical institute had to create a working machine to demonstrate prowess, while now they had the backing of purpose-built factories and a computer-dedicated institute, as well as a Japanese giant in the field. The details of the most modern computer architecture, the fine mechanics of magnetic discs and the algorithmic secrets of contemporary software were now opened to Bulgaria through this gap in the COCOM armour. Bulgaria was in prime position to fight its corner in the emerging COMECON order which will be explored next.

Japan had another key role to play, however, and not just in the concrete specifics of the technology. It was a country that captured the imagination of the Bulgarian technocratic and political elite. Apart from Popov and Dimov, who saw the potential in the country as a partner, other key figures for Bulgarian scientific policy and the computer sector got their start in Japan. Nacho Papazov, who headed the CSTP after Popov (between 1971 and 1984), was ambassador to Japan between 1967 and 1971, going on to write a book about the Japanese economic miracle. During this time Ognyan Doynov, the figure that displaced Popov from the heights of Bulgarian economic and scientific management in the mid-1970s,

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[53] Ibid., p. 87

[54] Ibid., p. 88

got his start as deputy trade attaché to the country under Papazov's ambassadorship. In his memoirs, he credited the country with giving him a modern knowledge of Western management techniques.[55] Most importantly, however, it was Zhivkov himself who got the Japan bug. A desire to be a "mini-Japan" is commonly attributed to him by the popular imagination, and conventional wisdom sees his visit to the country for EXPO'70 as the start of a Bulgarian obsession with electronics – erroneously, as we have seen. However, the visit in 1970 did leave a deep impression in him.

Pic. 4: The Bulgarian pavilion at EXPO'70 (Source: soc.bg)[56]

In practical terms, it was the start of Doynov's meteoric rise in politics, as Zhivkov was very impressed with him and invited him back to Bulgaria as an advisor to the State

[55] Both Papazov and Doynov's experiences will be discussed more fully in later chapters.

[56] The Bulgarians took EXPO'70 very seriously, as a chance to boost relations with this important country. Preparation started in 1967, and the innovative pavilion design was approved in 1968, granting the project to the team of architects led by Todor Kozhuharov and Evlogi Tzvetkov who aimed to symbolize the Balkan mountains through the four glass peaks. In six months it was visited by over 9 million people and the subject of 1200 publications in the press, a real surprise hit at the exposition. It was decided to bring the pavilion back to Bulgaria and make it permanent, either in Sofia or on the premises of the Plovdiv Trade Fair. The project, however, never saw the light of day due to ever-rising costs.

Council – the man that would displace Popov got his golden moment in almost the same way Popov did just ten years before in the GDR. It also, however, left a deep impression on the communist leader. His visit in May 1970 was the first by a socialist leader and was, despite being unofficial, heavily covered by the media, as well as focused on showing off the Japanese miracle to a high-ranking Soviet Bloc boss. His preconceived notions about the capitalist order of things that he expected were quickly turned over, especially by what he saw at EXPO'70 in Osaka – something that made a much bigger impression than meeting the Emperor. He recalls realising "our deadly lag behind the advanced capitalist countries. And not only that. For the first time I felt oppressed by the shortcomings of the socialist system."[57] He was "crushed" by his visits to enterprises and in his meetings with leading captains of the industry. This was a true miracle, he realised, with tempos much higher than what he had seen elsewhere in the capitalist world – he recalls "a forest of chimneys", a symbol of progress despite the pollution he noted.[58]

On his way back to Bulgaria he had a stopover at Khabarovsk, where he penned a note to Brezhnev, waxing lyrical on Japanese achievements and arranging for a further stop in Moscow. At the Kremlin, Brezhnev harangued him as having been blinded by trickery and a one-sided view that discounted the exploitation of the workers there; but Zhivkov was adamant that the industrial strength he had seen was worth noting. "Up until Japan my impression that we were lagging was based on my political experience and of my knowledge of the socialist states" he recalls – and after further visits to West Germany and Italy, he was convinced that his Japanese epiphany pointed the way forward: high technology, quality exports, and contact with the West.[59]

[57] Todor Zhivkov, *Memoari* (Sofia: IK Trud I Pravo 1996), pp. 512-3

[58] Ibid., p. 513

[59] Ibid., p. 514

Even though they were 26 years removed from the fact, the memoirs are supported by the report that he presented to the Politburo upon his return in 1970. The Bulgarian economy was criticized through the prism of Japan – it was in dire needs of intensification and modernisation, something that had been entering discourse since the 1960s. Bulgaria could not rely on its own inventions to make up the lag, and had to choose the best from the West – but the enterprises and ministries must also be better at implementing them, so industry does not end up with "rags".[60] Goods' quality had to improve if they were to be sold on the world market, and the problem was not in financing but in implementation and lack of knowledge of the most modern developments. Old documentations, bad design and sloppy work were all reasons for the low productivity of Bulgarian factories, and all were down to the lack of information and contacts with the world's achievements.[61] Foreign inventions were more importand and more productive than domestic ones, and a further 50 million levs would be made available for new licenses. A better policy was to be followed, with the purchase of everything needed to implement the item immediately; and no "Bulgarisation" – any changes that might pass it off as a domestic achievement - of the innovation until after it was in production![62] The conclusion was clear – Bulgaria is a small state, and it can't be different to all other countries in the world which use foreign achievements to get ahead, needing it even more.[63]

The need to intensify the economy, implement the latest technology and through that open up to the world did not start in 1970, but did receive an urgency after the Japanese example made such a deep impression on Zhivkov and when so many high-ranking members

[60] TsDA f. 1B op. 35 a.e. 1457 l. 11-13

[61] Ibid., l. 17

[62] Ibid., l. 19-21

[63] Ibid.

of the party had worked in or with Japan. However, by the time Bulgarians were learning from the Japanese, and before Zhivkov left his heart in Osaka, the country's sector was already being organised in order to create a comprehensive plan with which to capture the socialist market.

From Piece-Meal to Policy

The creation of the ELKA and the know-how gained from Fujitsu were fruits of Popov's strategy that was carried out with whatever cadres and institutes were available at the time – Voroshilov factory engineers, scientists at the Maths Institute and other parts of BAS and the universities. In 1965, when both of these projects were taking-off or being presented to the world, there was no umbrella organisation or institute to specifically work towards Popov's project of creating a high-technology, low-resource industry. Thus, organisational problems were pressing just as much as intellectual and technological ones.

The first step was to create a site that could research and design the full spectrum of hardware and software that a modern computer industry needed. Places such as the Maths institute were simply not able to do that. Other BAS institutes that were created to further the Politburo ideas of cybernetic governance, automation and intensification of the economy, such as the Institute of Technical Cybernetics (formed in 1964 on the basis of earlier sections of BAS in telemechanics) were aimed at industrial mechanisation and eventually robotics – and while they would become the intellectual centres for some key developments of the later industry, such as the personal computer, they were not aimed solely at computer machines.[64] The patient lobbying for the sector by Popov, and its successes by 1965, drove a Council of Ministers decision from January of that year to create a Central Institute for Computing Technology (CICT; *Tzentralen Institut po Izchislitelna Tehnika*) under the auspices of CSTP. The Maths Institute group that worked on the construction and hardware of computers was to

[64] The ITCR's story is key to chapters 5 and 6, and will be picked up in more detail there.

be the core of this new institute,[65] and by the 1st March 1966 it was officially inaugurated. It started with 233 scientific workers, under the director Boris Borovski, with Yulzari and Dimitur Atanasov as deputies.[66]

From its inception, the institute focused on both software and hardware. Its initial plan, for 1966, was to focus on algorithmic languages, economic information database systems for digital machines, and automation of programming. Quickly, research on implementing ELKAs into production were added, as were other more theoretical and organisational projects such as a prognosis of computer development within the country up to 1980, to serve as guidelines for what was to be implemented.[67] Growth in personnel was to be very quick too, with 250 extra staff slated for 1969 and a further 280 for 1970 to ensure that COMECON obligations (the subject of the next section) would be met.[68] CICT would quickly grow to be the backbone of the industry, and its importance meant that it was already the biggest scientific institute in the country by 1972, while by the 1980s it would number over 3000 workers – highly qualified specialists and an unprecedented concentration of engineering and technical talent for a country of Bulgaria’s size.[69] Its growth was especially marked under Angel Angelov, who headed the institute from 1968 to 1975 (and who would head another key institute – the ITCR – later). His tenure coincided with the creation of the ES series of computers within COMECON (explored in the next section), which drove him to organise a huge number of new scientific sections within the institute, to deal with topics such as magnetic tapes, magnetic discs, controllers, interfaces, programming, terminals,

[65] Lybomir Iliev, *Matematikata v Narodna Republika Bulgariya* (Sofia: Sayuz na Matematitsite v Bulgariya 1984)

[66] Snezhana Hristova, *40 Godini Tzentralen Institut po Izhislitelna Tehnika* (unpublished memoir available at http://bbaeii.webnode.com/bylg-electronica-i-inormatika/; last accessed 4th November 2016)

[67] TsDA f. 37A op. 1 a.e. 1 l. 7-32

[68] TsDA f. 37A op. 1 a.e. 2 l. 46

[69] Shishkov, *Zvezdnite Migove*, p. 225

automation of design and others. Boyanov recalls Angelov's key role in determining what Bulgaria was to focus in within the ES system, in order to maximize profits

> …for long nights, engineer Angelov used to gather us and five or six of us would discuss it over a vodka (it was cheap back then – 1.73 levs) or over coffee, what was most productive to specialise in. After those discussions we took a decision that turned out to be strategic. In a computer system at that time, the biggest number of devices were discs and tapes, and as all central processors, from the slowest to the fastest, use the same peripherals, it was decided that if Bulgaria specialises in discs and tapes we would export a lot and to all countries.[70]

Angelov himself recalls the story in more detail, and gives due to both Ivan Popov and another expert who helped him calculate the ultimate focus:

> There was actually fierce competition who could make what in that sphere. Bulgaria was successful because we had made a calculation of what costs how much. We, from Bulgaria, specifically calculated the cost of the components of the entire enterprise of a "calculation center": the central processor and the peripheral devices. According to our calculations, the central processor, in its smallest version, would cost about $200,000 (it could do what a single PC today could do for less than a $1,000). We said that up to 2 million dollars were the costs of the peripheral devices, which was exactly the case. From these peripheral devices, there were two kinds: 1) memory devices on tape or 2) memory devices on magnetic discs. We showed these two kinds comprised over 80% of the cost of a "calculation centre." Three people were responsible, a triumvirate: 1) Prof. Ivan Popov 2) Michail Krinkov (who was an independent, not a party member, very intelligent and competent specialist on matters of automation), and 3) myself.[71]

As CICT was founded in 1966, Popov also oversaw the creation of the Central Institute for Scientific-Technical Information (CISTI) and the Central Scientific-Technical Library (CSTL), giving engineers access to the latest periodicals and publications in the technical fields. However, while the intellectual and informational capabilities of the industry were catered for, the production wing of the industry was still piecemeal and haphazard – old barracks were making way for the calculator factory in Silistra, while ZIT was still not fully functional while learning from the Japanese. What was needed was a purpose-created organisation to unite the different facets of this industry.

[70] Kiril Boyanov, Speech Commemorating Angel Angelov's 80th Birthday, 12th February 2009, Sofia (text accessible at http://bbaeii.webnode.com/bylg-electronica-i-inormatika, last accessed 6th November 2016)

[71] Interview with Angel Angelov conducted by e-mail through his daughter Sonia Angelova Hirt, 29th June 2016

From the start of 1967, Popov lobbied Zhivkov and the rest of the party leadership towards this end. Noting that this was a strategic sector of national development, and that it was a wholly new world for Bulgarian industry, he made it clear that an organisation was needed to carry out the two main tasks – creating and designing the technical means of electronisation, and implementing them into production. If both tasks were under the purview of a single organisation which could oversee the computers from cradle to grave, so to say, the tempos of growth would be much faster than if things were left to factories and institutes under CSTP, the machine-building industry, BAS and others.[72] Based on this report, the Council of Ministers voted for the creation of a DSO (State Economic Union) in "Computational and Organizational Technology" (IZOT in the Bulgarian abbreviation, from *Izchislitelna I Orgazitsionna Tehnika*), which was to be responsible for the research, design, production, implementation, servicing and sale of this technology – both in Bulgaria and abroad.[73] On the 17th February 1967 Bulgaria had created its own industrial conglomeration in the high-technology field, which would be the heart of the industry until the regime's end.

The new organisation united both scientific and productive cells that currently operated in the country – CICT, the Sofia Central Institute of Elements, the Central Design Institute "Orgproekt", the Central Experimental Base at Gabrovo, the Base for Technical Development of Organisational Technology in Silistra together with the town's "Orgtehnika" factory, the Training Centre for Qualifications in Computing and Organisational Technology, the Sofia ZIT factory, the typewriter factory in Plovdiv and the state industrial enterprise "Office Equipment" in the capital. This would not be enough, Popov made it clear – Bulgaria couldn't expect Soviet help for the development of all new factories that would be needed if the country was to become a leader in COMECON, and at least three new factories in

[72] TsDA f. 136 op. 44 a.e. 10 l. 27-33

[73] Ibid., l.1

memory devices alone would need to be completed by 1975, in order to ensure exports of 469 million levs that year.[74] IZOT would have to mobilise its own funds, leading to the creation of a Fund for Computer Technology Development, to be financed by the enterprises' profits and interests. These would finance new productions that aimed to replace expensive foreign imports, and the modernisation of the existing factories, made more necessary by the fast-changing nature of world electronics. Some of the money would also be used to train the cadres, keeping them abreast of new developments, including financing long trips to the West.[75] To spur such developments, in 1969 the capital investments up to 1975 were set at 192 million levs, in order to create the new sites needed.[76]

To get such heavy investment in IZOT, and base its development on self-financing from the beginning (ensuring that the anticipated profits would benefit the sector first, rather than prop up much less productive industries of the command economy), Popov had to overcome the inherent conservativism of many of his Politburo colleagues. Most were in their position thanks to their partisan and party credentials, lacking the education of Popov or Zhivkov's willingness to listen to experts rather than old precepts. That is why Popov organised a compulsory two day seminar on questions of technology for his colleagues in February 1968, a year after IZOT was formed but before it had yet got the full financial backing of the state. Attendance was mandatory for all full and candidate members of the Politburo, leaders of Central Committee departments or the Secretariat, members of the permanent government group of the Bulgarian Agrarian National Union,[77] ministers, first secretaries of all district party committees and people's councils – the highest echelons of

[74] TsDA f. 1B op. 35 a.e. 381 l. 41-2

[75] TsDA f. 1003 op. 1 a.e. 1 l. 2

[76] Ibid., l. 1

[77] BANU was a coalition partner to the BCP throughout the regime's history, a curiosity which had practical benefits such as using it to negotiate with regimes and organisations which would not do so with the communist party.

state and party, in the capital and provinces, had to go back into the role of a student. The lecture plan included three hours on world methods of organising and developing scientific research, presented by the Professor himself, and two hours on world computer developments specifically, by hand-picked specialists in the field. The second day familiarised the leadership with the implementation of computer technology and its implications for society and economics, through two hours on creating a national system for processing economic data and concluded with a two hour lecture by Popov on comparing the levels of the technologies of the future at home and abroad.[78] The seminar's structure and content was clear – to drive home the point that this industry was profitable and the future of all world technology, and that Bulgaria would be left behind if it didn't act.

The Popov offensive continued in 1969, as COMECON specialisation kicked in, with a report that drew attention to the importance of the elements base. Modern computing, he held, needs modern integrated microelectronics,[79] which lead to miniaturisation, lower costs, and allow for automation in all walks of life.[80] Together with the head of the State Planning Commission (SPC), Tano Tsolov, he underlined that microchips would be the base for all computing, automation and radio equipment in the 1970s and beyond. The party acted quickly, and in October of the year, another DSO in electronics was created – that in "Electronic Elements". Based in Botevgrad, where the main semi-conductor factory was operating since 1963 but much expanded after 1967 to produce silicon and not germanium

[78] TsDA f. 1B op. 35 a.e. 54 l. 24-5

[79] The integrated circuit, or the microchip, was the revolution in electronics which allowed for the fast development of computers after the 1960s and their entry into everyday life. The first such circuit was created in 1958, with mass production starting in the 1960s, and increased miniaturisation throughout the following decades.

[80] TsDA f. 136 op. 48 a.e. 434

transistors, it duplicated IZOT's aims and structure, but in the field of micro-electronics.[81] A report by Mariy Ivanov, the minister of machine-building, justified this creation in the language already used for IZOT two years earlier – a unified techno-economic state plan was needed if Bulgaria was to create a lasting sector. Already electronic production had grown 48 times since 1965, when the first ELKAs and semi-conductors were built, and by 1975 the aim of these DSOs was to produce over a fifth of all Bulgarian machine goods.[82]

A week later, the Politburo voted on the massive expansion of IZOT in order to fulfil COMECON and state needs, which were tied to the BCP theses of September 1969 on the automation of the industry and the implementation of scientific-technical progress. This story is key to the later chapters and will be picked up there, but its industrial-economic effect was the take-off of IZOT factory construction. By 1970, seven new factories would be created under the IZOT umbrella. These were the Pazardjik Factory for Magnetic Packets (ZMD-Pazardjik); Factory for Memory Devices at Veliko Turnovo (ZZU); the Shumen Factory for Instrumental and Non-Standard Equipment (ZIENO); the Ruse Factory for Printed Boards (ZPP); the Stara Zagora Factory for Peripheral Devices (ZPU); the Plovdiv Factory for Memory Devices (ZMD-Plovdiv); the Blagoevgrad Factory for Mechanical Constructions (ZMK). Very quickly, more factories were added – the Factory for Magnetic Heads at Razlog (ZMG); Factory for Registration Technology at Samokov (ZRT); the Gorna Oryahovitza Factory for Magnetic Dust (ZMP); the Harmanli Factory for Electrical Power Devices (ZTU) and the Mehatronika factory in Gabrovo.[83] As can be seen from the names, IZOT was constructing a two-echelon factory system – for finished goods such as magnetic discs and

[81] The semi-conductor became the basis of one of Bulgarians' favourite Zhivkov gaffes, commonly cited as proof of his low education and unclear understanding of what he was championing: "This year we have built a factory for semi-conductors, next – for full conductors!"

[82] TsDA f. 136 op. 48 a.e. 422

[83] TsDA f. 1B op. 35 a.e. 1063

tapes and computers (the ZIT and Elektronika factories in Sofia, the devices factories in places such as Stara Zagora, Plovdiv, Veliko Turnovo and Pazardjik); and specialised sites for constructing the specific components that went into the devices, such as magnetic heads, the special ferrite dust for discs, the mechanical bodies that housed the delicate equipment and so on.

The territorial distribution also covered a wide range of cities and small towns, including relative backwaters such as Razlog or Harmanli. This was a concerted Politburo decision to integrate the high-technology sites into a wider territorial development plan, aiming to overcome city-village divides and to move jobs out of the capital (easing also the housing problems in Sofia).[84] This was part of the cybernetic governing principles which will be discussed later, but also had the practical effect of necessitating good productive and logistical links between the sites – a hold-up in one factory, especially the ones for basic elements, could have a negative effect on all others. This was at the heart of IZOT's philosophy from the start, allowing 68% of goods produced within it to be for outside consumption (i.e. not for other factories within IZOT), and to reduce the need for outside equipment and elements to less than a third (imported circuits and other elements from the USSR and Eastern Bloc)[85] – a huge difference to the first machines that Bulgarians created in the early-mid 60s, when there was no domestic production of any of these elements.

From May 1970, IZOT was "created" again on the basis of a Politburo decision, to better reflect the existing strengths, size and aims – it would now design and produce automated systems of governance for export and internal needs.[86] It would also have two new

[84] TsDA f. 1B op. 35 a.e. 1172

[85] Evgeniy Kandilarov, "Elektronikata v Ikonomicheskata Politika na Bulgariya prez 60te-80te Godini na XX Vek" in *GSU-IF,* vol. 96/7 (2003/4), p. 464

[86] "ASU", as they were abbreviated in Bulgarian parlance, will be explored more fully in Chapter 5; they were systems that automated production and administration through computers, robots, networked enterprises, automatic overview of labour etc.

directorates – Systemizot and Izotimpex: the former to create these systems and especially the software for them; while the latter was to deal with import, export and internal trade, as well as servicing the technology through its own DSO – Izotserviz.[87] The cybernetic twist of accenting on "systems of governance" reflected the social and economic projects that the Politburo now felt confident of developing once it had created the industry: automation and electronisation of all industry. This story is for later, and the other side of the coin of what the sector was created for, as testified by its new directorate Izotimpex – hard cash. The industrial policy and story of IZOT only makes sense if we zoom out to see what changes were happening in the wider socialist international economy. IZOT was a home-grown beast but with an outward-facing purpose. COMECON, and above all the USSR itself, was its market. Its fast growth, in terms of both cadre qualification and placement of goods, is tied to a captive market which Popov had been anticipating since the early 1960s. IZOT's growth after 1969 can only be understood with reference to the events of 1968-9; but its creation in 1967, before these events, was the reason for the successful Bulgarian negotiation of these new realities – a function of Popov's far-sightedness and Zhivkov's willingness to entertain heavy investment in an area which he knew nothing about.

Learning From & Capturing COMECON

The wider socialist world was an opportunity in a dual sense, both as an area of technological and education exchange where to train cadres for this new industry, and as an economic space which was ripe for the taking. As we have seen, many Bulgarian engineers got their start in this new sector by going abroad – to Dubna, to Moscow, or (as Popov did) to the GDR. A function of the more advanced industries of these countries, these were the natural centres to which to turn when the country needed to build a sizeable cadre of qualified personnel.

[87] TsDA f. 136 op. 51 a.e. 158 l. 23

The group of students from Sofia universities that were trained at Moscow State University and then formed the core of the Maths Institute's computer expertise were just the frontrunners of a larger Bulgarian influx into Soviet institutes and enterprises throughout the 1960s. Once Popov became head of the CSTP, he turned the close co-operation with its Soviet counterpart – the GKNT (*Gosudarstveniy Komitet Soveta Ministrov SSSR po Nauke I Tehnike*) – into a source for technical assistance and aid that was built into the bilateral agreements with the USSR since the dawn of the socialist regime. The GKNT, co-ordinating civilian science and research in the way the CSTP did in Bulgaria, had been in invaluable source of Soviet specialists who helped Bulgaria industrialise in the 1950s. Popov now decided to channel more and more of that help into the electronic sector. The annual agreements between the two countries always involved priority themes that were key for both economies, which both sides were to provide documentation and training on. Reflecting the relative industrial power of each, the vast majority of expertise was provided by the Soviets, in areas from agriculture to fundamental sciences to heavy industry. As a snapshot, in 1966 the annual plan called for co-operation on 83 themes, of which the Soviets were to provide information on 71. They also accepted 219 Bulgarian specialists in a further 95 themes, while the Bulgarians could only reciprocate with hosting six Soviets in two themes.[88] However, from the mid-60s more and more themes were moving away from the traditional areas of metallurgy or chemicals towards those in service of the nascent Bulgarian computers – for example, in the same 1966 plan Automation of Production in the area of industrial batteries and generators was a key theme, while five specialists were to spend twenty days to learn about the use of computer machine in metallurgical technological processes.[89]

[88] Rosiyski Gosudarstveniy Arhiv Ekonomiki (the Russian State Archive for the Economy, henceforth RGAE) f. 9480 op. 9 a.e. 217 l. 3

[89] Ibid., l. 5, l. 21

Even at this early point, however, the Soviets were noting that the Bulgarian economy was showing steady growth, including in these high technology areas. A GKNT report noted that while the Bulgarians are very well acquinted with the state of Soviet science and its enterprises' capabilities, fully utilising the possibilities of technical assistance with pinpoint accurate requests for specific technologies and factories with which to co-operate, Soviet industrial and scientific leaders had little knowledge of Bulgarian achievements and were not making this a two-way street in areas where the Bulgarians had what to teach the Soviets

> …the Bulgarians are excellently informed about the conditions of and state of research, design and construction organisations in the Soviet Union. At the same time, as a rule, Soviet organisations do not know of the technical innovations that Bulgaria carries out.[90]

The Bulgarian economy was in fact favourably reviewed by the GKNT at this time, showing a "tempo of development has not overtaken just countries equal to Bulgaria in economic potential but also highly-developed capitalist countries." It had now built the material base for socialism, and was entering areas which would raise the socialist consciousness of the worker, investing even more in research.[91] Such a favourable assessment by the GKNT, critical of its own enterprises, helped Popov present Bulgarian demands as part of a concerted government plan for building socialism, in line with both countries' interests.

Following the successes of the ELKA, the creation of CICT and IZOT, by 1967 Bulgarians were demanding much more help from the GKNT in aspects of computing – not so much in the technology as in the application of modelling and programming to different areas of the economy: computerised accounting, automation of city waterworks, uses of computers in industrial control, automation of the cement industry, electronic measurement and testing of mechanical constructions were all areas of priority in the birth year of IZOT.[92]

[90] RGAE f. 9480 op. 9 a.e. 218 l. 11

[91] Ibid., l. 1

[92] RGAE f. 9480 op. 9 a.e. 462 l. 12

While the USSR had experience in these areas, however, it had its own problems. Its computers were still tied to scientific institutes and had a limited application to the industry. When Glushkov, Soviet cybernetics' paramount luminary, was lobbying for the creation of a nationwide network that would automate information processing and allow a rationalized, streamlined and incorruptible command economy (in his ideas), his Politburo opponents countered that computers could turn on and off the lights in chicken coops and play Mozart to the poultry to increase yields, and that was enough.[93] The GKNT itself was also critical of the Soviet leadership's conservativism in this area, first led by Konstantin Rudnev (head of the committee until 1965, before becoming the Minister of Instrument Building and Automation, Minpribor) and then by his deputy German Gvishiani (a key figure in GKNT and in the internationalisation of Soviet science). Seizing on the decisions of the 1962 Congress of the CPSU, they lobbied for a real coordination plan for Soviet computers too, within – eventually – the framework of international co-operation. A 1969 report on the issue, addressing questions raised by the Council of Ministers, noted multiple shortcomings of Soviet industry in this sector. Even leading Moscow enterprises such as Serp I Molot metallurgical plant were not using computers effectively most of the year, with peaks and troughs depending on plan deadlines. The industry lacked centralised information on the issues of computers, or programs were not delivered with the computers themselves, making them useless for automating production.[94] An extra sixty thousand people needed to be trained to head automation projects, but the central issue was lack of organisation:

> Because of the lack of a central governing organ, the slower development of Minpribor, the insufficient number of computers and their inability to be used in ASU, the process for creation of government systems has to a large extent been

[93] Benjamin Peters, *How Not To Network a Nation: The Uneasy History of the Soviet Internet* (Cambridge, Mass: MIT Press 2016), p. 163

[94] RGAE f. 9480 op. 9 a.e. 880 l. 12

> ungoverned, with irrational usage of the already deficit cadres. There is also a lack of unity in the ASU created.[95]

The Ministry of Instrument Building and the Ministry of Radio Electronics were criticized as woeful in supplying enough peripherals. Nine of the required fifteen factories in the radio ministry and nine of twelve in Minpribor had not even started construction of the premises, let alone the machines. And all this while the USSR required at least 20,000 Minsk-32 computers by 1975. Capital investment was to be increased, the report suggested, but it is indicative that the priority area was defence electronics, taking 40% of the investment.[96] This gargantuan appetite for high technology, including computers, by the Soviet defence sector would be a boon for the Bulgarians as much as it was a crippling obstacle for the Soviet civilian economy. The report concluded with implorations to the CPSU to speed up construction work and ensure funds not just for the factories but also a further hundred and sixty thousand cadres in computing and automation in all areas by 1975. This would have to go hand-in-hand with solving the problem of developing the production of "materials needed for using automated systems of governance (special papers, perforated cards, magnetic tapes and so on)."[97] Overall, this report was the natural culmination of GKNT complaints throughout the decade. Soviet science had the know-how, but Soviet industry did not have the power and organisation to fulfil the needs of the economy for computers and means of automation, key to building socialism and catching up with the West. A disproportionate amount of computers would also have to continue going to the armed forces, if the USSR was to keep up with the USA in the arms and space races. In computing, the USSR could not go it alone.

95 Ibid., l. 150

96 Ibid., l. 151-4

97 Ibid., l. 221

Small steps to co-operate in electronics across the Bloc had already been taken in 1964, when a commission on the questions of computer technology was created at COMECON, to co-ordinate between the different academies of science in areas of research and design.[98] However, proper intergovernmental co-operation was to come only later in the 1960s, after the questions of a socialist division of labour had been torpedoed and effective co-operation had been stymied by issues of sovereignty. In 1965 a subcommittee on radio and electronics was created at the Permanent COMECON Commission on Machine-Building (created in 1956), starting tentative work on co-ordinating between the different states' plans as well as preparing suggestions for further specialisations.[99] It noted that over thirty different computers were being produced in the socialist world, most of them non-compatible with each other in hardware or software, making it impossible for real co-operation between states, or for the implementation of, for example, a Polish program in a Czech machine. This undermined any possibility of co-operation, and worked against any possible economies of scale. No state in the region had the incentive to create the large production conglomerations in this sphere, as they were mostly working for their national markets.

It was with this in mind that COMECON created the Intergovernmental Commission on Computer Technology (ICCT) in 1968, the beginning of real integration of socialist countries in the area of computing. A key role in this was played by Popov himself, who had pushed for this – and had been preparing Bulgarian industry for this moment. The head of the ICCT was to be the deputy director of the Soviet Gosplan, Mihail Rakovski, and other members were drawn from all socialist countries at the rank of deputy minister or above. A Coordination Centre was headquartered in Moscow, with a rotational system of presidency

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[98] Vasil Nedev, *Hronika na Bulgarskata Kompyuturna Tehnika* (unpublished, available at http://bbaeii.webnode.com/bylg-electronica-i-inormatika/; last accessed 7th November)

[99] Stoyan Shalamanov, *NRB V Sotsialisticheskata Ikonomicheska Integratsiya: Strukturna Politika* (Sofia: Partizdat 1981) p. 140

and a permanent presence for each state.[100] Popov was one of the towering figures in this commission, due to his pedigree and longevity – he represented Bulgaria into the 1970s, the only original minister to do so. More so, he had ensured that with IZOT's creation in 1967, Bulgaria entered the ICCT with a much stronger hand than was expected by any other state in the commission.

The first and most important decision was to create a unity in the computers in COMECON. Soviet planners had kicked around the idea of a unified series of computers since 1966, but only now could they get their allies on board through this new body. Some Soviet specialists preferred basing such a series on Soviet-made computers, such as BESM or Minsk; others on the British ICL series (which the Poles supported too, due to the compatibility with Odra). Others, however, preferred the IBM Series 360, a large mainframe built since 1964 which had become the main workhorse of much of the US economy. Popov also frvoured the IBM, like the Soviets, and helped to make this the standard on which to base the new ES series of computers (for *Edinnaya Sistema* – Unified System). IBM compatibility ensured that the new computers would be based on a proven world standard, would be able to integrate existing know-how from the USA, and importantly would allow the use of programs created for IBM too. Together with the large mainframes of the ES series, which were to equip the large computer centres for economic, social and industrial data, the ICCT decided on another, parallel run of computers – the SM series (*Sistema Maliyh EVM* – System of Mini Computers), for the use inside enterprises, to control production, or equip smaller computer centres and research labs. This, too, was based on Western standards for similar reasons to the ES – the Digital Equipment Corporation's PDP series was chosen as the basis due to its popularity and capabilities (eventually, in the following decades, the SM would move to a compatibility with the PDP successor, the VAX).

[100] Boyanov, *Shtrihi*, p. 185

Work started immediately, with the first meetings to determine elements bases and standardised documentation in October 1968. The Soviets and East Germans proposed different projects for logic elements of their own industries; while in the key area of printed boards the USSR found itself behind in the race, which was led by the GDR, Czechs, Hungarians – and surprisingly for everyone, the Bulgarians too (who were already preparing the creation of the ZPP factory as part of the IZOT expansion).[101] Other meetings discussed document transfer, so everyone was to have IBM specifications – it was key that by 1972 all specifications of the ES series had to be unified across all nations. Thus, the Bulgarians suggested that documentation co-ordination was the first issue to be solved, to create a functional basis for each country's needs, and potentially a centralised library.[102] The following year, this started in earnest, with the Poles passing documents on the IBM 360's input-output and technical interface, while the Germans presented information on various chips, and the Soviets supplied a dictionary of terms and algorithms. By this point, the Poles too had swung behind the IBM project, with the East Germans still suggesting a different approach (mostly as the Soviets' suggestions for usage of their element base had got the most support in discussions).[103]

The ICCT also created permanent Council of the Main Constructors (SGK from the Russian abbreviation), which would be the highest decision making body in scientific questions for the ES and SM series. By 1973 it would be divided into three – one for the ES series, one for the SM, and one on application. Multiple temporary working groups would be created under their auspices, to address questions of hardware and software. The first Bulgarian representative was Boris Borovski, the head of CICT in 1968, but he was quickly

[101]TsDA f. 37A op. 1 a.e. 7 l. 16

[102] TsDA f. 37A op.1 a.e. 17 l. 7-11

[103] TsDA f. 37A op. 1 a.e. 22 l. 2-10

replaced by Angel Angelov who would attend two to three meetings per year at the Moscow centre for the SGK – often replaced by his deputy, Stefan Angelov.[104] It was up to him to fight the Bulgarian corner in the divvying up of the pie in who was to produce what within the ES and SM families.

Angelov held the post until 1980, the longest tenure by any such SGK member, and from his first meeting he was given specific instructions by Popov. Bulgaria was entering the fight with a powerful industrial organisation and a dedicated scientific institute, but IZOT was still building up its factories and capabilities. Angelov himself, as seen above, had worked out that the peripherals and especially memory devices would be the most profitable part of the new series of machines, as they would be compatible with any central processor. The vast needs of the planned economies for data storage and processing, used in all their state planning commissions and computer centres, required many megabytes of storage. At the same time, as the ex-director of ZMG Razlog recalls, the Soviet defence industry would buy huge amounts of discs that they did not immediately need, as a back-up and redundancy. Locked away in underground bunkers, they were the back-up in case of a nuclear war, where electro-magnetic pulses would damage many of the data centres of the Soviet military and strategic rocket forces – it would be then that these tapes and discs would be needed, to support the military effort. Thus, memory would be bought in unseen quantities by the USSR, even more than was needed by its central planning tasks.[105]

Memory would thus be the key aim of the Bulgarian delegation at the first SGK meeting. However, Popov was also keen to get at least one of the processors, as this was a key technology for internal needs as well as the market. The ES series would have a number of processors, from small to large, and different countries could make their cases why they

[104] Kandilarov, "Elektronikata v Ikonomicheskata Politika", p. 437

[105] Interview with Alexander Tzvetkov, 6th April 2015

were well suited to produce any of them. An actual computer was key to Bulgarian industry – it was a high-value good, it was prestigious, and it would mean that Bulgarian computer centres would not have to rely on outside help. It was with this in mind that Popov instructed Angelov to promise the world in Moscow, in a daring case of bravado:

> You will emphasize that we have Japanese know-how; that many people have specialised throughout the world. You will multiple everything by ten, just so we can take this specialisation. If other countries promise three years, you will promise a year and a half. If they say – two years, you will say one year…It doesn't matter that it might not happen, let us start and after two years, even if we haven't finished it, we will be so far ahead that we will have already secured the positions.[106]

It worked. Much like his boasting of the ELKA success while it was still not in mass production a few years earlier, Popov's gambit worked again, helped immensely not only by the calculator but also by the existence of IZOT and CICT, as well as the close links with Fujitsu. Little Bulgaria had come out of nowhere and in a few short years had vaulted into a prime position in the Eastern Bloc, with hundreds of specialists, new factories, and Western licenses. Now, it was saying it could do anything the rest could do better, faster and more reliably – and there was reason to believe them.

The gambit paid off, and Bulgaria received four key specialisations to begin with – one computer and three memory devices. The ES series was to have a number of machines, the smallest one going to Hungary and the largest ones being Soviet, but the Bulgarians won the right to create the ES-1020 machine, one of the middle-sized ones, in co-operation with the National Institute for Electronic Computers in Minsk (GDR and Poland also got some middle machines).[107] Thus, Bulgaria would be mass producing a computer capable of equipping calculation centres for the national economy. More importantly, however, it won

[106] Interview with Angel Angelov in Dimitrova, *Zlatnite Desiteletiya,* p. 130

[107] Computer size classification back then differs from today's; yet the "large" computers would be roughly equiavalent to the groups of today's large mainframes and supercomputers, capable of handling many users and carrying out fast calculations – these would be computers used for the processing needs of defense, space research, the central economic planning; medium-sized computers would be regular mainframe computers, capable of sustaining the needs of a large enterprise or institute (after all, the Bulgarian ES-102X series were equivalent to IBM 360 machines, which carried out similar tasks).

three memory device specialisations, applicable to all ES machines – the ES-5012 magnetic tape device, ES-5052 magnetic discs and ES-5053 changeable magnetic disc packs (early hard drives could have their memory interchanged when needed).[108] At the end of December 1969, these decisions were ratified by all members of the ICCT (USSR, GDR, Poland, CSSR, Hungary, Bulgaria), marking an end to disagreements over what specifications and programs to be used – this was the start of real socialist integration in the area, a new step for COMECON and to its end one of the most successful examples of its new approach.

Integration was the new rule of the day for the Eastern Bloc. Peaceful co-existence had moved the Cold War battleground to the sphere of economics and technology, where capitalism had to be overtaken in both living standards and production per head of the population. Only socialist integration on a huge level would allow the best use of resources and create the environment for flourishing national societies. Only in such a way would Bulgaria and the rest achieve what Lenin termed a "unified world co-operative".[109] The BCP noted that the COMECON countries had huge scientific and technical potential, and industrial capacity, with the most important sectors of the industry developing with an "overtaking" speed, especially in electronics.[110] It had uplifted the poorest countries, catapulting them from a timeless rural sleep into the modern age of automata:

> As a result of the socialist industrialisation Bulgaria, Poland and Romania turned from agrarian into industrial-agrarian countries….Machine-building, which is the material basis of mechanisation and automatisation in the national economy, is now one of the main sectors of the national economies.[111]

By 1967, the Politburo noted while its specialists were negotiating the ES deals, COMECON produced 33% of world industrial output (as opposed to 17% in 1950); Bulgaria

[108] TsDA f. 136 op. 49 a.e. 243 l. 77-8

[109] TsDA f. 1B op. 35 a.e. 493 l. 5-6

[110] Ibid., l. 10

[111] Ibid., l. 11

itself had an annual growth of national income per head that was double the European average (8.7 against 4.3 time increase over the period; higher than even Japan, which was at 8.2).[112] The USSR solved the socialist community's resource needs by providing 90% of oil products, 85% of its iron and 60% of its cotton. Together with its cadres of specialists, it was the perfect core for specialisation that would maximize each country's capabilities and strengths in the battle against capitalism, while offsetting shortages in primary products.[113] The Politburo also noted that importance of the trade overall to the economies, especially Bulgaria – 41% of its machine exports to the socialist community were in the area of "specialised" goods, for which they were solely responsible (the highest in COMECON). 72% of Bulgarian trade was also with other member states (again above the average of 62%), and realised 330 roubles of export per head of population, placing it third in the region (behind GDR and CSSR) and well ahead of countries such as Poland (145 roubles per head). The BCP noted that this spoke "of a relatively large participation of the country in the international socialist division of labour".[114] The links with the USSR were even stronger, making up 58% of all Bulgarian trade, and the country imported twice as many machines from them in comparison with other socialist states, making it a "display window for Soviet equipment".[115] Finally, COMECON's huge potential in science and industry was still being stymied by not enough co-operation between states, especially as the East Germans and Czechoslovaks wanted to keep their technological lead to themselves – all this meant more indebtedness vis-à-vis the West, and duplication of licenses bought.[116] The CSTP also noted that things were changing from the first wave of specialisation in the 1950s which favoured

[112] Ibid., l. 14

[113] Ibid., l. 16-17

[114] Ibid., l. 22

[115] Ibid.

[116] Ibid., l. 39-41

the highly industrialised countries. Back then, in 1956 when the first 613 items were chosen for specialisation among the Bloc, the GDR and CSSR, with their traditions in machine building or optics, were to participate in building 73% and 60% respectively to Romania's 9% and Bulgaria's 7%, a reflection of uneven development.[117] This had now been seen as a mistake by others in COMECON, as there was a need to balance the needs of already industrialised and industrialising countries in the interests of the whole socialist community, and now all states could participate in a much more diversified economic field which had been widened by the creation of wholly new sectors such as electronics.

These Bulgarian assessments of COMECON in 1969 highlighted the importance of the organisation to the country's industry, which was tied to the accessible market. It also demonstrated the Politburo's awareness that the Soviets had a vested interest in raising the level of Bulgarian economic performance, as it was a reflection of their own prowess, especially in the Balkans. The central theme was, however, the need for closer integration in order to fight piecemeal approaches to the West in technological and economic deals. The landmark agreement in electronics was a first step for this, demonstrating the ability of all countries to band together and divvy up tasks in such a key area, with the hope of making up for lost years against Western computing. Post-1968, COMECON was thus increasingly integrated, with specialist commissions popping up in other areas of the economy – chemicals, pharmaceuticals, eventually biotechnology. The culmination was the 1971 Comprehensive Program for Socialist Economic Integration, enshrining this drift into the organisation's guidelines. Pricing would now be fixed for five years ahead, corresponding to the states' own five year plans and administrative pricing mechanisms, a step towards moving away from world pricing and creating a much more closed trade bloc, with its own trajectory. There was a mechanism to keep this in line with world prices through moving averages of

[117] TsDA f. 517 op. 2 a.e. 173 l. 62

prices on the world commodity market over the preceding five years – creating a lag. In coordination of plans, autonomy was retained (after the Romanian fiasco of the early 1960s), but if multilateral or bilateral agreements were signed, these would have to be taken into account in internal planning. There was, however, no superior joint body that could enforce these. Joint projects and investments were also encouraged and provided for, easing financial burdens on the poorer states. Concerted joint plans were also agreed, such as the Orenburg gas project, to be partaken in by all members. The clearest and strongest emphasis was placed on science and technology, with specialization to be facilitated by much easier and larger transfer of technology within COMECON.[118]

Despite some more nebulous passages, the Program was a clear attempt to lead to the convergence of member states in economic development and deepen integration through bilateral and multilateral co-operation from science to investment. It introduced forecasting and long-term co-ordination, as well as joint participation in projects. Difficulties remained in creating contacts at enterprise level, where productive units had more authority in Hungary than the USSR.[119] Yet there were the conditions for real progress in circulation – of capital, of technology, and even labour (Bulgarian timber workers in Komi in the USSR or the increasing reliance of all Bloc countries on Vietnamese labour later in the decade). It was the prerequisite for COMECON becoming a space of exchange beyond bilateralism, and a key source of improvement for countries like Bulgaria when negotiating with the West, as the Politburo felt the country needed a unified Bloc approach to the European Community (with the practical proviso that this was also a way to uplift Bulgarian industry to better standards,

[118] William Butler (ed) *A Source Book on Socialist International Organizations* (Alphen aan den Rijn: Sijthoff & Noordhoff 1978), pp. 631-663

[119] Adam Zwass, *The Council for Mutual Economic Assistance: The Thorny Path from Political to Economic Integration* (New York: M E Sharpe Inc 1989), p. 82

so as to overcome its unenviable status as the only country where half of its exports to Western Europe remained in agriculture in the late 1960s).[120]

Pic. 5: Brezhnev inspecting Bulgarian computers in Moscow (Source: Dimitrova, Zlatnite Desitiletiya)

Soviet assistance was immediate once the ES series agreement was signed, and grew even further after the 1971 Program. Immediately in 1969 Bulgarian and Soviet teams met to discuss the design of the ES-1020 and storage devices,[121] while Bulgarian specialists were accepted in topics such as automation in research and design work (in Minsk) or automated control systems in cable factories (with the Cybernetic Institute in Kiev).[122] It wasn't a purely one way street, with the Bulgarians passing documentation on 640 technologies and training over 1500 Soviet specialists in key areas such as the well-received Maritza typewriters (key for office automation, and built in Plovdiv) over the previous twenty years.[123] It also noted that thanks to Soviet help, the Bulgarians had quickly implemented high quality devices and techniques in various areas, creating a virtuous cycle of increased cooperation ability. At the

[120] TsDA f. 1B op. 35 a.e. 12 l. 18-23

[121] RGAE f. 9480 op. 9 a.e. 939 l. 3, 49

[122] RGAE f. 9480 op. 9 a.e. 938 l. 19-20

[123] RGAE f. 9480 op. 9 a.e. 1198 l. 29

same time, Ivan Popov criticised the Soviets for underestimating Bulgarian science such as in new high-density wiring, which was being sold across the Bloc[124] – a continuation of earlier Soviet lack of interest in Bulgarian achievements.

The topics that were of most interest to the newly electronic nation were in the areas of cybernetics and computing, naturally. Automation of construction, correlation analysis, and enterprises; computer usage in media programming; fundamental research of use for electronics such as magnetic field manipulation;[125] the usage of Minsk-32 computers for production optimization, automation of information services and training of cadres for computer centres;[126] computer-controlled mine ventilation[127] – these kinds of questions dominated technical co-operation plans from this period onwards. The GKNT noted investment in the area of cybernetics and its applications, and were very interested in any experience in this field that Bulgaria had gained from the West.[128] However, it was coming to a realisation, too, that the smaller state was getting more of the co-operation than the USSR was. Popov and the CSTP were strongly opposed to any move of work based on contracts rather than within the co-operation agreements – research and design work was to be mutual and fraternal, not governed by markets. At the 14th Session of the Subcommission on Soviet-Bulgarian Scientific Technical Cooperation in May 1971, he was strongly opposed to any co-operation based on financial balances between the countries. The GKNT reported that he based this on decisions made at a higher level about "free transfers" of Soviet scientific results to Bulgaria, and that the fact that the CSTP had such financial agreements with the

[124] RGAE f. 9480 op. 9 a.e. 1199 l. 17-19

[125] RGAE f. 9480 op. 9 a.e. 1471 l. 12-18

[126] RGAE f. 9480 op. 9 a.e. 1725 l. 12, 20, 38

[127] RGAE f. 9480 op. 9 a.e. 1727 l. 24

[128] RGAE f. 9480 op. 9 a.e. 1474 l. 20

East Germans was of no relevance. As a result, discussion of joint developments to be based on a contract basis was removed from the agenda.[129]

The Bulgarians were not only disinclined to transfer results between the countries on a payment basis, but as the more active side in initiating topics of discussion, they usually did so in areas that "interests only the Bulgarian side".[130] Between 1968 and 1972 over 40% of all information packages and items passed over to Bulgaria were free,[131] many of them in electronics. When in the mid-70s the GKNT managed to push through such a contract agreement to put all technology transfer on a contract basis, it noted that Bulgarian documentation exchange declined dramatically, while remaining active with the non-core member states such as Cuba and Vietnam.[132] The principle of free transfer and one-sidedness was, as Popov had noted in 1971, backed up at the highest levels. Zhivkov continued to be a master of keeping on the best side of the Soviet leadership, and after Khrushchev he successfully wooed Brezhnev too. The suggestion for Bulgaria to become the 16th Republic was used once again to show allegiance, while the Soviet leader was entertained by Zhivkov at the many hunting lodges around the country. It was in one of those, in Voden in North-Eastern Bulgaria, that in 1973 he laid out Bulgaria's needs over the coming years.[133] He accentuated on Bulgaria's loyalty to Soviet socialism and interest in the Balkans, surrounded as it was by the capitalists of Greece and Turkey as well as the mavericks of Yugoslavia and Romania. He also makes it clear that his country was the most historically backward of the Eastern Bloc, while at the same time offering great technological progress due to the party's

[129] RGAE f. 9480 op. 9 a.e. 1473 l. 32

[130] RGAE f. 9480 op. 9 a.e. 1474 l. 21

[131] RGAE f. 9480 op. 9 a.e. 1726 l. 22

[132] RGAE f. 9480 op. 9 a.e. 2250 l. 6

[133] TsDA f. 378B a.e. 360 (accessible at the Wilson's Centre Zhivkov Archive: http://digitalarchive.wilsoncenter.org/document/111183l; last accessed 8th November 2016)

efforts. Brezhnev's agreement secured Bulgaria's subsequent development; but his request that the talks be kept secret from other Bloc countries reveals that while COMECON was a lucrative market, it was not one where decisions were always made by planning bodies. Zhivkov's personal politics were key in securing huge subsidies, and by 1980 Bulgaria was annually receiving 5-10 million cubic metres of oil, 6 million tons of coal, 5 billion cubic metres of natural gas and 1.5 million tons of steel, amongst a variety of other vital resources.[134] While the Soviet oil was often resold at world prices, Bulgaria was also guaranteed Soviet markets for its industrial and agricultural goods. The superpower's GKNT was thus, paradoxically, in a weaker position than its client's CSTP, allowing Popov to push through co-operation on Bulgarian terms.

The Soviets' impressive scientific research capability was thus harnessed to its Balkan ally's needs, especially in electronics. As part of the 1971-5 co-operation agreement they were to render help to 30 enterprises in creating automated systems of governance (*Avtomatichna Sistema za Upravlenie* – ASU), and transfer codes and algorithms for Minsk-22 computers.[135] Glushkov's huge Cybernetics Institute in Kiev, with around 3200 researchers,[136] was already co-operating with the ITCR, but this was to be stepped in areas such as automation of city planning and mathematical modelling programs.[137] This was not a one-way street completely in terms of science, as throughout the 1970s Bulgarian capabilities grew in line with the industrial sector (as will be explored in later chapters). Bulgarian specialists were already helping in computer-aided design of the Soviet road network in 1970,

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[134] Hristo Hristov, *Tainite Falit Na Komunizmai* (Sofia: Ciela 2007), p.104

[135] RGAE f. 9480 op. 9 a.e. 1726 l. 12-23

[136] The Kiev institute was indeed much larger than its Bulgarian counterpart; but as we will see in Chapter 6, the Sofia institute grew to around 1300 workers by the end of the 1980s, while Glushkov's child did not – making the Bulgarian institute much larger relative to both population and national scientific infrastructure than its Ukrainian counterpart.

[137] RGAE f. 9480 op. 9 a.e. 1728 l. 8-10

as well as of city waterworks.[138] As the Soviets noted an increase in Bulgarian research & development departments and institutes, as well as increased funding for science in general as part of the national income,[139] over 150 Soviet and 80 Bulgarian institutes were drawn into the close co-operation under the CSTP-GKNT Subcommittee, with 2000 Soviet specialists going to Bulgaria and 900 going the other way.[140] Automation through computing – the practical application of the new technology to the problems of intensifying the economy – led to the creation of a permanent working group on ASUs in 1972, with the rationale that this was the area of most cooperation already between the two countries.[141] This close co-operation led to discussions in 1973 and 1974 of creating inter-linked, mutually compatible and fully automated systems of exchange for scientific-technical and social information by 1980. This would make coordination in all important sectors easier, and would fulfil the aims of COMECON:

> The main task of the consultations is the international division of labour in scientific and technical research with the aim of maximising the acceleration of scientific-technical progress of countries, the choice of complex multi-sector scientific-technical problems, a preliminary look at the state plans of economic development of the USSR and Bulgaria and the important sector problems that can be solved through a higher technological level of production and thus its efficacy.[142]

Electronics and automation were the scientific fields which both intertwined Soviet and Bulgarian science closely and allowed for creating the technological means of even closer integration. The exchange of information, the joint works on programs and ASUs, the technical specialists flying back and forth thickened these channels so much that by 1977 the

[138] RGAE f. 9480 op. 9 a.e. 1197 l. 33

[139] RGAE f. 9480 op. 9 a.e. 1200 l. 2-3

[140] RGAE f. 9480 op. 9 a.e. 1474 l. 6

[141] RGAE f. 9480 op. 9 a.e. 1727 l. 99-104

[142] RGAE f. 9480 op. 9 a.e. 1987 l. 1

GKNT could suggest a further step, the scientific policy fulfilment of what Zhivkov had played as an ingratiating political card with both Khrushchev and Brezhnev:

> The widening of the exchange of information of materials between the USSR and People's Republic of Bulgaria should be organised on the principles that are used in the exchange of information between the different republics of the USSR.[143]

This was the only way, the committee felt that both sides could cope with the information flows between the two countries' research and industrial communities. But unlike the Zhivkov suggestion, this was not subservience materialised but profit extracted. Soviet research institutes were key partners in creating the ASUs that would intensify the economy, the ES-1020 that would computerise information and planning, and in creating the software that would run it. COMECON's socialist integration was moribund in some areas, but was not so in Soviet-Bulgarian technical co-operation, which grew closer and closer. It played a decisive role in helping the Bulgarians mechanise and automate, as well as create and improve the ES devices they specialised in. Some countries remained cagey in co-operating, especially in electronics where the CSTP noted that the Hungarians and Romanians had to be pushed a lot – but the USSR was evaluated as showing "unlimited interest" in co-operation.[144] This was why the CSTP was fully behind adapting Bulgarian information systems that served science to the Soviet standards – using common standards and programming languages, allowing the country to use as much of the Soviet data and documentation it could: "in essence what we are talking about is for the strategy of our scientific policy to become a part of the strategy of the scientific front and policies of the Soviet Union."[145] These statements, uttered in 1973, predated the later GKNT decision to treat Bulgarian scientific needs as those of Latvia or Tajikistan. The closer links of the two

[143] RGAE f. 9480 op. 12 a.e. 585 l. 1

[144] TsDA f. 517 op. 4 a.e. 24 l. 79

[145] TsDA f. 517 op. 4 a.e. 15 l. 8

nations under the auspices of the ICCT and electronics were usually championed by the smaller state, and in their decisions they did not see a loss of independence. The opposite was true – Popov, the CSTP and indeed the Politburo all saw Soviet technical assistance as the sine qua non of rapid development. Integrating information databases, joint projects, training cadres and swapping documentation, were all ways to bolster the growing Bulgarian science establishment, especially in automation and electronics where large projects were needed to meet the demands of automating the gargantuan socialist command economy.

The post-1969 ICCT specialisations, together with the boom in computer and informational assistance, created a niche for Bulgarian production and a constant infusion of knowledge from the outside. It entangled Bulgarian science with other COMECON states, but most importantly, it carved open their markets. The CSTP under Popov had ensured that Bulgaria entered the 1968-9 negotiations over the ICCT and ES computers with an industrial organisation capable of producing whatever was won; it then used the political loyalty of Sofia to Moscow to widen channels of technical exchange to help grow the sector at speed so as to fulfil its obligations. IZOT thus had the best possible start, and its success in the 1970s and 1980s in pure economic terms was based on this solid foundation and far-sighted, clever politicking.

The Pay-Off and Trajectory Through to the 1980s

The early 1970s were a time when the factories of IZOT were being built and ramping up to full capacity. Documentation was produced and studied, technologies implemented, and cadres started putting it all into practice; the Bulgarian ES-1020 was unveiled to the world before the Soviet one, at the Plovdiv Fair in 1971, where it won a gold medal (another Popov stunt, who insisted that the Bulgarians got one over on their partners).[146] The Plovdiv factory started producing the ES-5012 magnetic tapes the same year, and ZZU-Stara Zagora’s first

[146] Shishkov, *Zvezdnite Migove,* p. 226

serial run of ES-5052 magnetic discs with 7.25 MB capacity rolled out in 1972. The same year ZMD-Pazardjik started mass producing the ES-5053 disc packs (to be re-installed in ES-5052 discs) the same year. The ES-1020, demonstrated in its null series in 1971, was put into mass production in 1973 in the ZIT factory in Sofia, together with an ES-1020B series too (the processors plus add-ons). These machines had an operational speed of around 20,000 operations per second (op/sec), with an operative memory of 256KB – equivalent to the IBM 360/40 series, already superseded by the IBM 370, but still the most modern of the kind in COMECON.[147] Some of these – the processor and disc – were developed together with the Soviet institute in Minsk,[148] but implemented in each country's factories, with IZOT pulling ahead due to its licensing. There were also novel domestic innovations, such as the use of the Balevski gas counter-pressure casting system to create the aluminium discs needed for the drives. The team that created the discs and tapes received the Dimitrov Prize in science.[149]

It was in the conditions of the 6th Five Year Plan, 1970-1975, that the industry made the jump from the drawing board to mass production, in terms of serial runs and capacity. By 1975 the reports indicated that the volume of production in ZZU-Plovdiv was 150 million levs, in ZIT-Sofia – 93 million: or in official conversion rates for the year, $210 million and $130 million respectively. For comparison, certain analogous factories in Japan produced $30 million. When measured per head, a Sofia worker in ZIT produced over 71 thousand levs worth of goods ($99 thousand in official rates; even at black market rates this would be around $31 thousand) a Japanese one – just under $19 thousand.[150] Even allowing for the massaging of numbers that is so common in socialist internal accounting, there is no question

[147] Angel Angelov & Co, *Elektronikata v Bulgariya: Minalo, Nastoyashte, Budishte* (Sofia: Tehnika 1983), pp 44-6

[148] RGAE f. 9480 op. 9 a.e. 1471 l. 33

[149] Interview with Nedko Botev, Boyan Tzonev & Koytcho Dragostinov, 23rd June 2015

[150] TsDA f. 136 op. 51 a.e. 158 l. 15-18

possible that this was the most productive branch of Bulgarian industry. Factories would pay their costs back within a year, sometimes less.[151] By 1973 the Bulgarians had implemented all their COMECON specialisations, placing thousands of discs and tapes on socialist and (to a lesser extent) world markets, and it was recognised by the party as the undisputed champion of all economic sectors in terms of efficacy.[152] Popov warned that the country could not rest on laurels – the next developments in the ES series were coming, such as the ES-1035 processor, and other countries were securing Western licenses. Bulgaria had won primacy, but it could lose it just as easily if it didn't make sure that it was ready to produce the next generation of machines before the ICCT handed out the specialisation[153] – in effect, entering negotiations already prepared, much like it had in 1968-9.

The resounding success catapulted Popov even higher, becoming the minister of all machine-building between 1971 and 1973, and then deputy-president of the Council of Ministers up to 1974, and vice-president of the State Council. By 1973, as the first serial-produced processor rolled out, the career of the erudite technocrat had reached its peak, a testimony to his success in creating the most effective industry in the country, rewarded with paramountcy over all economic and scientific issues in the country and Zhivkov's ear. In that same 1973, reflecting the importance of electronics to the economy, the sector was separated from the machine-building ministry into its own institution, headed by Yordan Mladenov, until then a deputy-head of the CSTP.[154] Its purview was the implementation of all electronic policy, and became the ministry in charge of IZOT and other related DSOs. In 1978 Vasil Hubchev succeeded Mladenov as Minister of Electronics, before in 1981 it was rolled back

[151] Interview with Stoyan Markov, 28th July 2015; Interview with Plamen Vatchkov 30th June 2015

[152] TsDA f. 1B op. 35 a.e. 4189 l. 5-6

[153] Ibid., l. 89

[154] *Durzhaven Vestnik*, issue 56, 1973

into the machine building ministry as part of the hybrid Ministry of Machine Building and Electronics (under the long-standing machine building minister Toncho Chakarov), and finally the "electronics" were dropped in 1984 when the ministry was headed by Ognyan Doynov – yet the industry remained an integral part of the activity.

Doynov was the man who had not only caught Zhivkov's eye in Japan, but was to be his tool against Popov.[155] Even though the professor had been the father of Bulgarian electronics in many way, and a revered figure in the socialist technocratic community, Zhivkov was a wily politician who was always wary of any one Politburo member being able to amass enough power and prestige to challenge him. Despite there being no indication that Popov even contemplated that, his clout was impressive by 1973, so Zhivkov was preparing his removal from the peaks of power (his subsequent positions in the Council of Ministers and especially the State Council up to 1976 can be seen as demotions). At a Politburo meeting in July 1973 Doynov (not yet a member) read a heavily critical report, which laid out needsfor changes in both the economic and scientific-technical structure. The machine-building sector had no clear strategy for the long term, underestimating investment and heavy machine-building, and lacking effective co-operative agreements with the advanced countries. Popov was aghast, but Zhivkov backed Doynov in a preview of what was to come.[156] In 1974 he replaced Popov as deputy-head of the Council of Ministers, assuming ever greater power over the economic future of the country. The 11th Congress in 1976 saw Popov kicked out of the Politburo to the relative obscurity of head of the Scientific-Technical

[155] He had also started his rise while Papazov was ambassador to Japan; from 1971 Papazov had replaced Popov as head of CSTP

[156] Ognyan Doynov, *Spomeni* (Sofia: Trud 2002)

Unions,[157] while in 1977 Doynov was a full member of the same body, where he would stay until 1988.

Despite his pet obsessions of shipping and heavy machine-building (which would lead to the disastrous investment in the huge Radomir "factory for factories" in the 1980s), Doynov was not about to give up a good thing. IZOT was on an upward trajectory, and in this he kept up and developed Popov's ideas. As the party put more and more focus on cybernetics and computerisation into its programs from the mid-1970s onwards (a discussion for later chapters), the industrial wing of electronics grew. The onus in the 7th Five Year Plan was put on new types of peripherals and processors, magnetic discs with higher memory density and capacity, the creation of MOS integrated circuits to back all this up and a wider production of mini-computers, digital controls for industrial machines, electronic telephone exchanges, tills and registers, office equipment: the full gamut of goods for export as well as the automation of society.[158] By 1977 15% of all Bulgarian exports were in electronics, and this was slated to rise. Doynov planned for 50% of all machines in industry to be electronic and digitally-controlled by 1990, while 25% of all metalworks machines to be robotic by 1985.[159] Between 1971 and 1977 the industry grew three and a half times, the export – five times.[160]

New machines entered production. The ES-1035 processors were fourteen times faster than their ES-1020 predecessors, speeding up calculation work significantly. It was capable of being connected to ES-2335 matrix processors, which boosted its power through adding analytical capabilities that could cut down (depending on how many were connected)

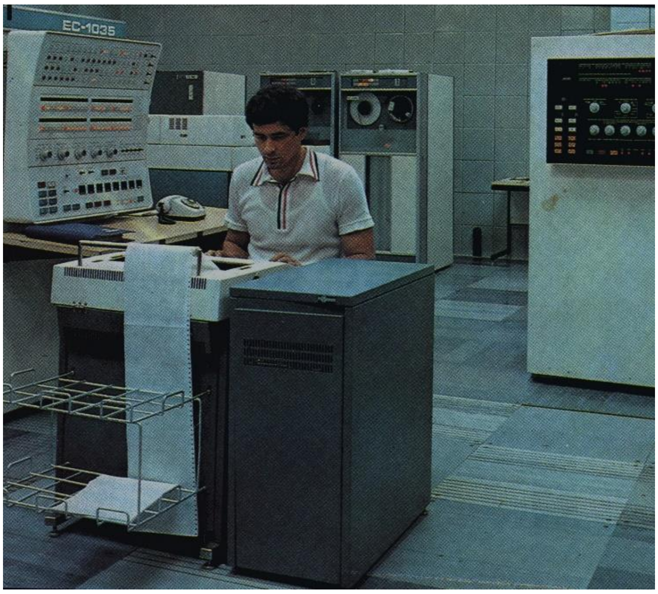
[157] As will be seen in chapter 5, this did not stop him from retaining an active and constructive role in scientific policy.

[158] TsDA f. 1B op. 35 a.e. 5176 l. 1-20

[159] TsDA f. 1B op. 66 a.e. 1303 l. 34

[160] Ibid., l. 23

calculations by up to 100 times.[161] It entered production in 1977.[162] Discs with a 29 MB capacity and their changeable packs, the ES-5061 and ES-5261, also entered production that year, a qualitative jump in this sphere too. The IZOT-0310 minicomputer, a PDP-11 clone, were also put in production that year, aimed at administrative office work and research automation. Other small machines of this type, of the SM series, were in production by 1980 – the SM-3 and SM-4, also for the purposes of automating workplaces and the laboratories of COMECON. Uniquely, these types of machines could be equipped with the ESTEL system of tele-processing, implemented in ZZU-Turnovo in 1976, and upgraded until the end of the regime (from ESTEL-1 to ESTEL-4) – these allowed users to connect to the computers through a telephone or telegraph line, creating the possibility for remote data processing and local and national information networks.[163]



Pic. 6: ES-1035 computer centre (Source: ZIT1.eu)

[161] Ognemir Genchev *Panorama na Elektronnata Promishlenost na Bulgariya: Fakti I Dokumenti* (Sofia: Ciela 2003), p. 72

[162] Boyanov, *Shtrihi*, p. 213; the years of introductions below are taken from the list the author presents between pages 212 and 230

[163] Shalamanov, *NRB V Sotsialisticheskata Ikonomicheska Integratsiya*, p. 147

The early 1980s saw concerted programs such as Elektronika-8 and Avtomatika-8 (as it was the start of the 8th Five Year Plan) to follow up on Doynov's 1979 Elektronika-S program proposed to the Politburo as a way to move to the next level of electronic production. In this report he warned of continuous problems of offering large discs of over 100 MB, which created the space for other COMECON states to compete. Other lags were also highlighted (the CSTP had calculated that difficulties in producing ES-1035 upgrades had costs of over 20 million levs per year),[164] and the country was thus in serious danger of losing its specialisations. IZOT needed a lot more capital investment in machines and especially capitalist currency if it was to make up this lag.[165] The new Avtomatika and Elektronika programs were to be nationwide priorities and were to raise the production of magnetic discs at least twice in volume, and of changeable packs – three times. The large discs were to be made according to the Winchester technology standard,[166] which would allow capacities of 200, 317, 625 MB and beyond – unprecedented on the Eastern market.

Capital investment was boosted, as it had been throughout the period. Over 465 million levs were to be invested in the Avtomatika program, expected to be paid back within three years or less by exports.[167] At the same time, capital investment had to be used better – the CSTP noted that only 68% of surveyed modernisation and reconstruction projects in different ministries, including the Ministry of Electronics, were assimilated on time.[168] Another problem that was highlighted was the ratio of investment spent on construction and expansion of factories versus that spent on new machines – the world ration on average was

164 TsDA f. 517 op. 5 a.e. 15 l. 119

165 TsDA f. 136 op. 68 a.e. 107 l. 720

166 The standard in hard drive technology from the 1970s until the 2010s; low mass and with low load heads, they allowed for much greater recording density and faster read times

167 TsDA f. 517 op. 5 a.e. 38 l. 67

168 Ibid., l. 13

20:80, in Bulgaria it was 60:40, reflecting the always growing need for more productive powers to feed the COMECON market. The aim was in the 1980s to switch it to at least 30:70, and thus quicken the pace of modernisation of plants.[169] The investment in Avtomatika-8 and Elektronika-8 thus grew massively; by 1982 it involved 58 large-scale automation projects in industry that year alone, aims to create 5 to 50 GB disc drives by the 1990s, and a gargantuan 1.8 billion lev investment over the five-year plan, with an expectation it would pay itself back within four years, but also create the basis for much longer development at a contemporary level of technology.[170] In 1980, before the growth (at that time it was envisioned that around 1.45 billion were needed, a quick revision up from the initial estimation) of the budget, 358 million were earmarked for research and development alone.[171]

The effects were there – larger discs, up to the 625 MB capacity ones, were implemented in the Stara Zagora factory, which became the largest of its kind not just within the IZOT structure, but the Eastern Bloc itself. New devices such as IZOT 1037 text-processing machines were introduced. Eventually, by the late 1980s, the IZOT-1014E (ES 2709) computer could lay claim to be a supercomputer, with over 120 million operations per second, and the ability to boost its capacity through matrix processors connected to it – faster at the time than the Soviet "Elbrus" machines which were key to the Red Army and space agency; it came to equip Soviet space flight centres, the nerve centre of the terminal stage of the Venus and Halley Comet-bound "Vega" missions. Some equipped calculation centres in China, Vietnam and India.[172] This computer was the organisational child of Stoyan

[169] TsDA f.1B op. 59 a.e. 42 l. 9

[170] TsDA f. 517 op. 6 a.e. 108 l. 198

[171] TsDA f. 517 op. 7 a.e. 86 l. 1

[172] Dimitrova, *Zlatnite Desiteletiya,* pp. 192-4

Markov,[173] the last "rising star" of the Bulgarian electronic and scientific community: deputy-head of machine building and the CSTP in 1984-5, head of the CSTP after its renaming into the State Committee for Research and Technology in 1987-8, and candidate-member of the Politburo (the youngest ever) between 1986 and 1988. A Doynov protégé, he was to forge his own post-socialist path through his role in technical policy at the end of the regime.

Listing all devices produced by the industry in the 1970s and 1980s would not tell us much as they were in the hundreds, from the large computer centres to floppy discs to specialised electronic instruments. The volumes were, however, impressive – by 1981 there were fourteen large ES-1035 CPUs, forty ES-2635 matrix processors, nearly a thousand large-capacity disc drives and 80 thousand changeable disc packs produced.[174] The nomenclature produced expanded in shapes and sizes throughout the 1970s and 1980s, adding robots, different types of drives and tapes, floppies, CNC systems, controllers for various machines, and they always indicate an upward trend – thousands of discs were being churned out, as were a good number of processors. Alongside these was the huge growth of automation systems such as robots, and especially the creation of a personal computer industry, running in the tens of thousands of machines too – key for automating the industry and intellectualising labour (their story is part of the later chapters). It is in the sheer volumes of exports and profits that the story of the Bulgarian industry's success can be seen most clearly.

Calculators were the original cash-cow of the industry, especially as the IZOT factories were ramping up to serial production in the early 1970s. As we saw earlier, they were reduced as a share of all export as discs began being rolled out, but still managed to reach a peak of over 61 million levs in sales in 1976. Overall, between 1971 and 1985, 487

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[173] Interview with Krassimir Markov, 4th February 2016

[174] TsDA f. 1003 op. 1 a.e. 22 l. 5

million levs worth of electronic calculators were exported to both the socialist and capitalist worlds.[175] This was but a drop in the water, however, in the larger IZOT boom. The table below shows IZOT production volumes and profit in millions of levs for a few select years after the industry's take-off:

Year	Production (millions levs)	Profit (millions levs)
1970[176]	55	-1.5
1973[177]	335	139
1976[178]	688	250
1979[179]	No info	435
1984[180]	1518	706
1986[181]	2100	1008

Table 1: IZOT production and profit, in millions of levs.

The next table, based on Izotimpex's accounts, shows the trend in exports also following this upward arc throughout the two decades of headlong growth. What becomes immediately and abundantly clear is the weight of COMECON in these exchanges, and especially the USSR, which was the single biggest, most important trading partner. The capitalist market, always dreamt of and the goal of all plans for increasing export, remained

175 Boyanov, *Shtrihi,* p. 231

176 Dimitrova, *Zlatnite Desiteletiya,* p. 48

177 Ibid

178 TsDA f. 1003 op. 1 a.e. 16 l. 1

179 TsDA f. 1003 op. 1 a.e. 19 l. 8

180 TsDA f. 1003 op. 1 a.e. 27 l. 1, 26

181 Dimitrova, *Zlatnite Desiteletiya,* p. 49

always out of reach. The developing world started becoming a market for electronics from the mid-70s but the accounts were often kept separate, ran through the Ministry of Foreign Trade, so the table gives an imperfect picture of the scale – however, it could never approach the socialist market, for which this industry was built and on which it lived. It would be an important avenue for different forms of advancement, such as business practices and marketing strategies, rather than in terms of pure cash as the Second World was.

Year	Socialist Export (of which USSR)	Capitalist Export	Developing World	Total Export
1968	2.6 (2.57)	3.7	-	6.3
1969	9.3	0.6	-	9.9
1970	22.1 (15.5)	0.55	-	22.6
1971	-	0.78	-	56
1972	113 (95)	0.9	-	114
1973	238	1.4	-	239.5
1974	312	4.2	1.8	318
1975	353 (294)	2.1	2	358
1976	476 (364)	2.9	2	481
1977	(312)	8.4	-	544
1979	706	15	-	721
1981	-	11.5	-	953
1982	-	-	-	1040
1984	1290 (1000)	10.8	-	1301
1985	1554 (1195)	10	-	1564
1986	(1446)	12	-	1831
1987	(1636)	13.7	-	2078
1989	2212 (1869)	11.9	-	2240

1990	1329 (1236)	3.7	-	1332

Table 2: Izotimpex exports in millions of levs. A "dash" indicates no info available on the exact number, rather than necessarily "no export".[182]

The main reason for the problems on the capitalist market remained the prices and quality of goods. Even as the original COMECON price agreements were renegotiated to be updated every two years instead of five, they remained extremely favourable to Bulgaria. The paramount reason was the nature of the electronic industry – throughout the 1960-1990 period (and beyond), it was fast moving and always innovating. Things created one year could be obsolete the next. While this was one of the reasons for the increasing lag in quality, it was also a reason for the immense value of the freezing of prices for years in advance – no Western firm had that advantage anywhere in the world, while IZOT was guaranteed to sell its 7.25 MB discs at the same price even five years later, when they were hopelessly out-of-date; even two years was enough to rack up enormous profits. The COMECON pricing system played right into Bulgarian hands. The CSTP's internal reports were very clear about this – a 1981 report to Papazov on the next stage of memory device development stated that:

> In relation to the leading capitalist firms in these areas we will have a lag of around 4-5 years. Cutting down this distance is impossible, and a possible faster fulfilment relative to the developments of ES series of the socialist countries wouldn't make economic sense.[183]

The logics that worked for profit worked against innovation. The closed world created by the Iron Curtain in economics was the boon that made the IZOT complex so powerful and profitable. The pricing of the ELKAs was a clear example of this – one ELKA-22 cost the Soviet, Romanian or Polish user 969 levs but the French customer paid 593 levs for it.[184] The

[182] Statistics are from f. 830: for years 1968-1976 they are from op. 1 a.e. 89-96; for 1977-1987 they are from op. 2 a.e. 20-28; for 1988-9 it is from op. 2 a.e. 36-37

[183] TsDA f. 517 op. 6 a.e. 21 l. 42

[184] TsDA f. 830 op. 1 a.e. 89 l. 2

price could drop down to 200 levs, as it did in Turkey.[185] Even different COMECON members were charged differently, depending on negotiations and volumes – an ELKA-25 could cost the Romanians 1345 levs but the Soviets 910.[186] These pricings meant that into the 1980s IZOT's returns were much higher in the socialist than capitalist world – an average of 111.51% profit in the socialist market as against (the still significant) 41.4% in the capitalist. Certain factories, such as ZMD-Pazardjik, could reach 256% for some of their goods; others – such as certain floppy drives – were down to 15% profitability in certain markets, due to falling world prices.[187] Some devices, such as the IZOT-1036S computer, were very expensive to produce, due to imported elements that had to be installed, sometimes up to four times more than planned – meaning none were produced in certain years such as 1985.[188] Others, however, fetched enormous prices – a single 635 MB disc cost the Soviet economy 580 thousand levs; a 317 MB one – 604 thousand.[189]

It was clear that the industry, operating within the logics of COMECON, was going from strength to strength. Despite lags and difficulties, it was introducing new technologies such as Winchester drives, tele-processing systems, personal computers and matrix processors, which were sought on the Soviet and other markets. As long as those logics operated, the sector could boom. It meant that sites such as ZZU-Stara Zagora became behemoths of industry, sometimes giving around half of all the sector's exports in the late 1980s (as the industry underwent a transformation in organisation, which is addressed in later chapters).[190] It was the undisputed leader in the Bloc from the very start, responsible for

[185] TsDA f. 830 op. 1 a.e. 90 l. 6

[186] Ibid., l. 2

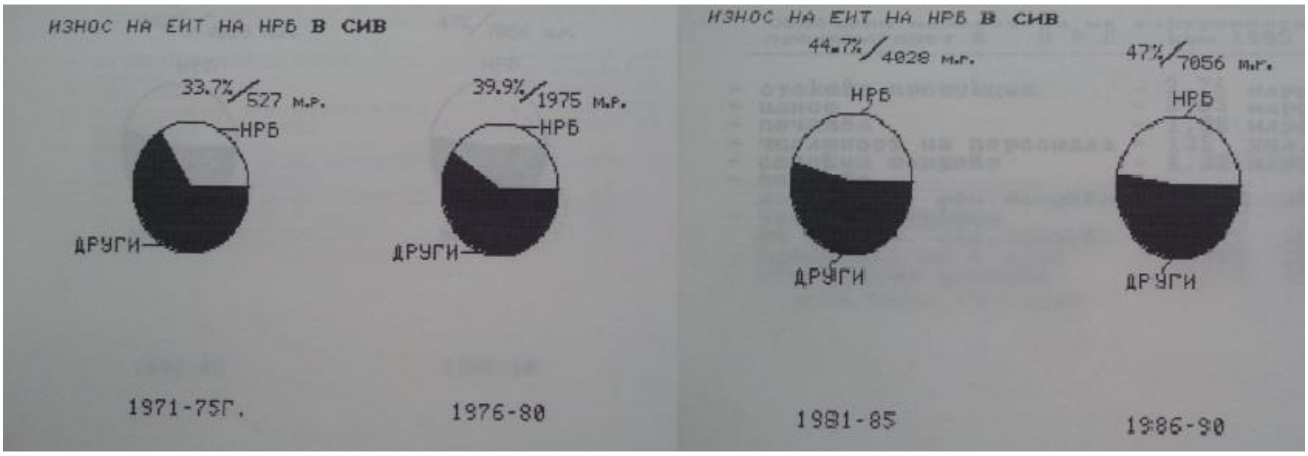
[187] TsDA f. 830 op. 2 a.e. 25 l. 13

[188] TsDA f. 830 op. 2 a.e. 26 l. 6

[189] TsDA f. 830 op. 2 a.e. 34 l. 11

[190] TsDA f. 830 op. 2 a.e. 28 l. 1

33.7% of all exports in the COMECON during the 6th five-year plan (1971-5), rising to 44.7% in 1981-5 and projected to reach 47% in the 1986-90 period, as a 1986 Politburo report noted. In 1979 the ICCT had planned that IZOT would produce 45% of the Bloc electronics by 1985,[191] and this had been achieved with the huge investment under Doynov. The Western media was also taking notice, even when it was prone to exaggerate the Bulgarian share – *Der Spiegel* reported that Bulgaria was responsible for 70% of all Eastern Bloc advanced electronics![192]



Pic. 7: The growth of the Bulgarian share of COMECON electronic exports 1971-1990. The white area of the pie-chart is the Bulgarian sector.[193]

Concerted state policy and clever manoeuvring in COMECON, taking advantage of its logics and internal mechanisms, meant that Bulgaria had created the most powerful such sector within the socialist bloc. The USSR above all had helped Bulgaria train its specialists, set up the first enterprises and develop the first devices – and then continued to supply Bulgaria with resources in exchange for finished goods of inferior quality and hiked-up prices. British foreign secretary Geoffrey Howe recalls Zhivkov's boasts that "Bulgaria is

[191] TsDA f. 1003 op. 1 a.e. 71 l. 12

[192] "Milliarden Dollar Schulden in Moskau" in *Der Spiegel*, 46/1982

[193] TsDA f. 1B op. 68 a.e. 1836 l. 200-1

[doing] well, because it has colonies and the biggest one is the USSR".[194] The computer exports are testimony to the fact that this was not really a joke. Bulgarian electronics' successful march across the East was down to a far-sighted strategist who could convince the Politburo that this was the golden ticket out of agricultural backwardness, a political leader willing to listen, and an international market closed off to world trends and operating on its own terms.

Even when Popov fell from favour, there was no question of changing the road that the economy was on, and Doynov chose to add rather than subtract from IZOT. From the Vitosha and ELKA to the supercomputer and personal desktop, the Bulgarians managed to catch up in principle if not always in quality to the world level in electronics in just over two decades. The disc drives were less reliable, the computers slower, the monitors fuzzier – but the full gamut of devices was now available to the Bulgarian and Czech user thanks to the COMECON's specialisation program and IZOT's role in it. The dependence on that market is borne out in Table 2's figures for 1990, the last year for which there were contracts left over from 1989, before the changes swept the continent. The industry was predicated on such logics and such a captive market. However, as the story of industrial, economic and trade growth has been told, a question has arisen – what were the mechanisms through which this technology, originating in the West, make its way to Bulgarian factories and research institutes? Soviet help, indigenous developments and multilateral joint projects, as well as the few licenses mentioned such as from Japan could not be enough for IZOT to develop such a wide range of goods so quickly. The channels through which Western technology and practice made its way back through the Iron Curtain were numerous, often illicit, and key to understanding the politico-social impact this story of industry and economy had on the Bulgarian landscape.

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[194] Quoted in Ivailo Znepolski (ed) *NRB: Ot Nachaloto do Kraya* (Sofia: Ciela 2011), p. 314

Chapter 3. Access Denied: Spying and Technology Transfer Across the Iron Curtain

Bulgaria, needless to say, was not the homeland of the computer. Nor was it the USSR or any of the other Eastern Bloc states. The machines that would shape economy and society in the second half of the twentieth century and beyond were born in the USA and UK in the 1930s and 1940s, and the lead that the West built up in and immediately after the Second World War was never seriously assailed. Even Japan, the source of know-how for Bulgaria in the 1960s, was not the usual originator of new core technologies and practices in the field. Von Neumann architecture, the microchip revolution, the hard drive technology of Winchester-type discs, the personal computer, the software languages, peripherals and digital controls for industrial machines – all these and more were the purview of Western firms and institutes. Thus, Bulgaria was dependent on gaining access to such technologies in its quest to catch-up to world levels. Domestic innovation was always a part of the industry, but if a state with the resources (both human and financial) of Japan went down the route of reverse engineering, then smaller and poorer Bulgaria would have to bet even more on that horse.

The Iron Curtain was a real impediment, however, as the Western states set up a myriad of barriers between the socialist states and the high technology created in the capitalist world. This was especially true for dual-use technologies – those areas which could have a military as well as a civilian application. Computers and electronics fell squarely in this area, as both tools for calculation and planning in the space and nuclear race, and, with the advent of miniaturisation, as integral parts of the most advanced weaponry in avionics, missile head seekers, tank fire control systems and others. There were times and ways that this could be circumvented, through joint work, UN-sanctioned programs, or in some areas which were not closely linked to military matters. Times of détente such as the early and mid-1970s were also fruitful for legal means of technology transfer. However, most technology and know-how that the fledgling Bulgarian industry required remained embargoed, especially with the tightening up of COCOM in the Second Cold War of the 1980s. The Bulgarian intelligence services, *Durzhavna Sigurnost* (DS; State Security), were thus an integral part of the story of Bulgarian computers.

Through their Scientific-Technical Intelligence (STI) section (and then directorate), they became one of the main conduits of knowledge and technology transfer between West and East. Their story, however, is not one of just pure industrial espionage. Colonising all areas of Bulgarian foreign and technology trade organisations, their attempts (and successes) in setting up joint firms in the West to go around the embargo restrictions entangled legal and illegal channels by the 1970s. More so, their complex relation with the civilian economy and planners sets their actions apart from the other directorates of DS, tasked with political espionage or the repression of dissidents. The Iron Curtain did indeed create the closed worlds of Paul Edwards' work, especially through the consciously crafted mechanisms of technology embargos.[1] However, these closed worlds of socialism and capitalism interpenetrated to a much bigger degree than expected, and through DS's work on joint firms later in the period, the boundaries of what was "inside" and "outside" in the socialist world began to blur.

Spying was a channel through which Bulgaria could catch up to the West in key areas of computing, but it was also a channel for the practicing of non-socialist business transactions and behaviour. The channels it created with the West were key for the managerial class that controlled STI's goals and practices, allowing them to become part of wider world networks – a story for later chapters, but indispensably linked to espionage. Penetrating COCOM was the sine qua non of STI work, and one of the main ways in which the Bulgarian computer industry became a truly internationally embedded area of the

[1] For Edwards' ideas on the closed world metaphor see *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, Mass: MIT Press 1996)

economy. Facing East for its markets and assistance, it also faced West for its technology and much of its practice.

Putting Up the Barriers: COCOM and the Rationale for STI

The creation of the Coordinating Committee for Export Controls (COCOM) is tightly linked to the origins of the Cold War, the antagonism with the USSR and increased US links with its Western European allies. The Marshall Plan and promised military assistance to Europe drove a number of acts in the late 1940s, among them the NSC Decision of December 1947, the Cabinet decisions of March 1948 and Section 117 (D) of the Economic Cooperation Act of 1948.[2] This was a new step in US history, as the request for strict trade controls was unprecedented in the country's economic history, but it was something pushed for by the military at the end of the war as they geared up to confrontation with the communists. Peace-time export control was sanctioned by the NSC against State Department proposals after the USSR had opposed the Marshall Plan, proving themselves to be "a threat to world peace and US security". Others had criticised continued trade with the Soviets, especially in oil, as akin to trade with Japan in the run-up to 1941.[3] This ban was not just on the USSR, but on all satellite nations too, as the US recognised how they could easily become a channel for the restricted technology that Moscow so desired.

As the coup in Czechoslovakia sharpened enmities, and dock workers in New York refused to load ships to the USSR, the Marshall Plan negotiations included the request that all Western European nations also stop trading in the embargo areas (the "R" list) with the East. Dollar shortages and reliance on military aid, as well as domestic recognition of the Soviet thread, pushed the British (identified as the most important European ally to sway on the

[2] Yoko Yasuhara, "The Myth of Free Trade: The Origins of COCOM 1945-1950" in *Japanese Journal of American Studies*, 4 (1991), p. 128

[3] Ibid., p. 130

issue) to support this by late 1948.[4] Opposition remained, however, especially in the case of the Dutch who did not a permanent group to be created that could oversee embargoes, while Luxembourg sent no representatives.[5] The consensus was reached only during the course of the Korean War, which brought cohesion to the Western bloc in opposition to the Soviet-backed threat, as well as US agreement to help re-arm Western militaries, ensure export of vital goods and a permanent presence in Europe – as it was estimated that European acceptance of the trade restrictions would lead to a loss of one-third of exports and one-third of imports in vital areas of trade with Eastern Europe (around $1 billion per year, or 1/3 of the Marshall Aid value).[6] The compromise was reached in late 1950, even as the Dutch were disheartened at the British-French collapse before American pressure – but the shadow of Korea had helped in the ossification of the two camps as antagonists. Over the decades, COCOM's restrictive tendencies would ebb and flow, its lists grow and shrink, dependent on US-Soviet relations – the late 50s and early 60s, the period of thawing and peaceful co-existence was a particularly marked "lax" period (especially after the early 50s) as the accent was moved from military matters to bridges in the economy and culture; the period of détente also saw some relaxation.[7] But overall COCOM remained an effective and powerful obstacle in the way of Eastern technological development.

Some Bulgarians frankly saw COCOM as a tool to bankrupt the socialist world. Alexander Tzvetkov, as head of the ZMG Razlog factory, often had to deal with acquiring embargoed goods in the manufacture of magnetic heads. For him, COCOM was "a way to make us pay $1 million for a technology that cost $200 thousand on the open market. They

[4] Ibid., p. 135

[5] Ibid., p. 139

[6] Ibid., pp. 143-4

[7] Evgeniya Kaloyanova & Iskra Baeva *Bulgarskite Prehodi 1939-2005* (Sofia: Paradigma 2006) pp. 187-8

knew someone would always sell it to us, but it just ensured we paid a higher price!"[8] COCOM could not stop every firm or every businessman to sell to Bulgaria or the East, but it was a reason that the already struggling socialist economies often had to pay many times over market price for their technologies. Coupled with the fact that some technologies were just not available, or foreign trade firms could not find someone willing to sell, the high costs of grey market purchases pushed the state to seek out a different route to the acquisition of high technology.

A scientific-technical department was created as part of the First Directorate (foreign intelligence) of the DS as far back as 1959, but in the first years of its existence it didn't record almost any kind of activity.[9] The early to mid-1960s were a watershed, as in many other areas of Bulgarian life, as the DS moved from overt repression to setting up agent networks and became an increasingly professionalized service rather than just a tool to exert party control over the bourgeoisie and society (which the repressions of the 1940s and 1950s had achieved).[10] In 1963, the KGB's own First Directorate section on scientific-technical information was raised to the level of Directorate ("T"), under the command of the Military Industrial Commission which set its goals and priorities, almost all aimed at the American military complex at the start of its work (90% of tasks, according to Hristov).[11] The Bulgarians were hot on the heels of the KGB, as was often the case – in the intelligence services, co-operation with and tutelage by the Soviets was a deep and continuing tradition.[12]

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[8] Interview with Alexander Tzvetkov, 6th April 2015

[9] Commission on the Dossiers, *Durzhavna Sigurnost I Nauchno-Tehnicheskoto Razuznavane* (Sofia: KRDOPBGDSRSBNA 2013), p. 6

[10] Momchil Metodiev, *Mashina za Legitimnost: Rolyata na Durzhavna Sigurnost v Komunisticheskata Durzhava* (Sofia: Ciela 2008), p. 18

[11] Hristo Hristov, "Durzhavna Sigurnost. Chast 2.1: Nauchno-Tehnicheskoto Razuznavane" in *Kapital,* 29th Aug 2010

[12] For great work on that issue, see Jordan Baev *KGB v Bulgariya* (Sofia: Voenno Izdatelstvo 2009)

In 1964 the 13th section (the founded in 1959, on economic and scientific intelligence) was transformed into the 7th Department of the First Chief Directorate, raising its profile immediately and signalling the start of much more concerted work in the area. Its first head was Raicho Asenov (taking over from Georgi Kalakolev's 13th section leadership), then Ivan Ivanov from 1965 to 1971, Angel Dimitrov from 1972 to 1979 and reaching its peak under Georgi Manchev from 1979 to 1990 – a period in which it was raised to the level of Directorate, even if still under the auspices and structure of the First Chief one.[13] The reorganisation was based on the service-wide restructuring of 1963 on the order of the BCP, when the whole intelligence community received its first normative acts that defined its activity.[14] The Minister of the Interior, Dikov, noted that now there were concrete tasks for STI, necessitating its more important role. These were seen as "gaining scientific-technical informations[15] of practical usage for the economy of Bulgaria and socialist members of COMECON" as well as fundamental research questions and above all, military innovations of the West. While the military was to take precedence, on paper, at the inception of the department, the head of the CSTP was also required to send annual plans in order to inform STI of what the economic priorities of the country would be.[16] Very quickly, this civilian side would overwhelm the military direction of intelligence work. As Hristov notes in his articles on the issue, the growth of STI and its priorities were always tied from the start with whoever led the CSTP and set its agenda. In the early 1960s that was Popov, and STI's growth during

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[13] Metodiev, *Mashina za Legitimnost*, p. 113

[14] Orhan Ismailov & Tatyana Kiryakova (ed), *Durzhavna Sigurnost – Struktura I Osnovni Dokumenti: Dokumentalen Sbornik* (Sofia: KRDOPBGDSRSBNA 2010), p. CHECK PAGE

[15] "Information" was the catch-all term that STI used to designate any document or item that was acquired; it could thus be anything from a material good to a research plan. The acquisition and implementation of "informations" was at the heart of its activities.

[16] Hristov, "Durzhavna Sigurnost. Chast 2.1"

the decade and beyond is inextricably tied to the growth of the Bulgarian electronic industry, which would become the main client and user of "informations" from the directorate.

The Rise of the Spies

The beginnings of this huge operation were modest, with just ten operative agents and some support and technical staff in 1964.[17] As its purview and importance grew, it underwent a number of expansions, with another thirty officer and two sergeant positions created in 1966,[18] thanks to the deputy-head of DS Mircho Spasov who pointed out to a number of successes already achieved in its short life.[19] By 1980 it had 98 operative officers and ten technical personnel,[20] before it underwent its biggest expansion which solidified its importance for the socialist economy as it was raised to the level of an intelligence directorate within the First Main Directorate with a secret ministerial decree.[21] The same decision expanded its staff to 187, with a full 160 officers working abroad, but over the next five years the plan was to create 105 extra staff to work in the STI centre full-time, another fifty to be attached to various organisations in technology and economics within the country, a further 95 to work outside the country and 27 extra technical staff to help with the analysis of information.[22] Overall, by the early 1980s the STI directorate thus expanded to over 300 full-time staff (some hired in 1980, others in the following couple of years), with hundreds of

[17] TsDA f. 1B op. 64 a.e. 313 l. 30

[18] Arhiv na Komisiyata za Razkrivane na Dokumentite I Obyavyavane na Prinadlezhnost na Bulgarski Grazhdani kum Durzhavna Sigurnost I Razuznavatelnite Sluzhbi na Bulgarskata Narodna Armiya-M (henceforth AKRDOPBGDSRSNBA-M/R; Archive of the Commission for the Uncovering of Documents and Notification of Belonging of Bulgarian Citizens to State Security and the Intelligence Services of the Bulgarian People's Army) f. 66 op. 1 a.e. 70 l. 1

[19] Metodiev, *Mashina za Legitimnost*, p. 117

[20] Ibid.

[21] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 589 l. 21

[22] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 466 l. 35

operatives abroad and deep links to most trade and scientific organisations in the country, including the CSTP.

The military focus of the service, however, quickly failed by the wayside. Its 1960s program documents always paid lip service to it, but more and more of the pages of the annual plan and mission were dedicated to specific questions linked to the national economy. For example, by 1967 the main themes for acquisitions would be atomic energy, radio-electronics, some avionics, much in the way of chemistry and biotechnology and new methods in the "organisation of production and the application of mathematical methods and computer technology to the governance of labour". [23] By this year there were 62 staff, with twenty being trained in Soviet academies on scientific-technical operations abroad.[24] As the staff expanded, and as the STI became more and more important, this was enshrined in every annual plan, with the language becoming completely tied to national economic interests rather than any wider Warsaw Pact military matters. A 1976 instruction for STI work during the year is a clear indicator of this and representative of all plans after the mid-1960s. Its first bullet points are worth citing in full in order to show the complete absence of military preoccupations for the Bulgarian STI service. In 1976 the priorities would be

> [The] Acquisition of secret scientific-technical information fundamental for scientific investigations, having a key role for the development of science, technology and economics.
>
> The acquisition of constructive and technological information for the solution of concrete problems linked to the development of our industry and the introduction of new effective productions.
>
> Acquisition of scientific-technical information and models in the area of agriculture.
>
> The acquisition of scientific economical information, needed for the long-term and perspective planning of the development of the national economy.
>
> The acquisition of concrete economic information for the economic position, foreign-trade and price politics, financial and credit relations; financial, trade and industrial

[23] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 412 l. 13

[24] Ibid., l. 69

> integration of the major countries under investigation, as well as on questions of industrial co-operation and scientific-technical co-operation.[25]

The STI was oriented towards what was best for the Bulgarian economy, and most importantly, it was to be the agency to inform the nation's foreign trade organisations of how they were to position themselves vis-à-vis capitalist companies and governments. The "informations" it gathered were not just items or technical specification documents, but also business plans, market prognoses, insider trading information – everything that could help the small and relatively isolated state get ahead in the game of international trade. This was driven by the BCP's own precepts of the 1960s and 1970s, as competition was moved to the sphere of production rather than military and geopolitical confrontation:

> The development of international relations, the transfer of the main struggle of the two systems into the sphere of economics, science and technology, the decisions of the 10th Congress of the BCP and the following party and state decisions created new, extremely important and responsible tasks for our intelligence.[26]

This necessitated this closer integration of economic intelligence with scientific-technical information, as the party sought to make science a productive force, a slogan that reflected the hope it placed on electronics and cybernetics to kick-start the command economy. As such, economic intelligence was to also be the purview of STI explicitly from 1974, even though it had been the de facto case since its inception as a section in 1959.

> Almost without exception all operative workers in the STI line can actively gain economic information too and vice versa – workers in the economic department have the possibility of gaining scientific-technical information. It is objectively wrong to divide one type of information from the other. Scientific-technical information cannot be complete if it also doesn't include production-economic information. The division of the tasks and leaderships in carrying them out, the division of the information itself, the difficulties in coordination of this activity that exist in the current structure and so on objectively hinder the raising of the effectiveness of intelligence work.[27]

[25] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 367 l. 1-2

[26] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 418 l. 20

[27] Ibid., l. 21

Such structural changes were reflecting the changes from traditional geographic focuses to an economic sectorial focus, in line with the party's economic direction. In 1976 four sections, grouped around specific technologies, were separated to organise agent work – one on military technology, machine building, metallurgy, energy, transport and construction; one specifically on electronics and computer technology; one on chemistry, microbiology, agriculture and light industry; and one on economics.[28] It is worth noting that while two groups were responsible for a huge number of technologies, such as anything from military to transport and building materials, only the electronic industry had its own branch of the STI, dedicated entirely to serving its needs. The geographic scope was also slightly different than the traditional political intelligence, with a bigger focus on countries such as Japan and the Third World as areas that were either sources of high technology or outside COCOM restrictions. Countries such as Japan and Sweden, which played looser with COCOM rules, were grouped with India, a huge market for technologies from the First world, and thus a good source of know-how unrestricted by embargoes.[29] STI also activated its work in countries that were the focus of Bulgarian interests, such as Nigeria, Libya or Iran, due to the logic above – Bulgarian enterprises needed to know how to position themselves vis-à-vis the local market.[30]

The operation also became more and more professional, with clear guidelines and organisational discipline to keep its work focused and in line with economic needs. Regular evaluations on work done were due every three months, while agents were required to give weekly reports on activities and monthly reports on results from their information gathering activities. The most interesting "finds" were to be inventoried every three months, and every

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[28] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 367 l. 2

[29] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 466 l. 38

[30] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 149A l. 67

six months the agency was to report on its co-operation with other socialist intelligence services – an area that allowed it to share experience and successes with its allies.[31] This growth in paperwork meant that STI and the intelligence services as a whole were one of the first computerised organisations in Bulgaria, putting in practice their increasing electronic focus. By the early 1980s the STI was using the ISKRA (Spark) system, the catchier name for the "Automated Information System of Counter Intelligence", the conglomerate of computer means and programs for gathering, storing, processing and retrieving information for intelligence agency users. It collected and stored information from the full variety of activities of the Bulgarian intelligence community, from the agents to cover firms and information gathered within the country, with the aim of creating a "unity of information", combating the increasing avalanche of STI informations.[32] It drew on the KGB's own "Photon" systems, operating since 1966, but undergoing constant modernisations, and allowed for the distribution of information to the right users, cross-referencing of information, and a classification system that would allow the agent to see lists of sources (be they existing informations acquired, or actual informants) that are suitable to particular tasks (such as electronic ones). The Bulgarians aimed at creating complex algorithms rather than linguistic-based databases, in order to simplify and streamline the searching process. The system was based on a central computer at the main Computer and Calculation Centre of the Ministry of the Interior, linked to local STI officers by a series of satellite SM-4 computer terminals, through encrypted lines. A volume of "false" information was created in order to test the whole system's programming and search functions, as well as the Bulgarian made DES-NET software that facilitated the network connections – something the KGB were

[31] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 432 l. 125-7

[32] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 462 l. 124-6

sufficiently impressed with to try out themselves.[33] The STI, servicing the computer industry, thus became one of the most cutting edge and networked organisations in the country.

This growth of the purview and size of the STI expanded its operations to areas in Africa, East Asia, the Middle East and Latin America. Its focus on civilian matters became more and more apparent, and its successes and scope were known in the socialist intelligence community through the process of regular cooperation. As such, Bulgarian STI grew in stature, especially given the relatively small size of the state. By 1983 it was helping Mongolia set up its own STI section, as the state wanted to follow the Bulgarian road of civilian rather than military focus – the Mongolians were interested in mining and geo-survey technologies, befitting its own economic profile. The Bulgarians not only passed information on organisation and structure, but also offered three-month training for police cadres to get to grips with the basics of agents' duties in the scientific sector, to be followed by ten months in the fuller Soviet academies.[34] Other smaller socialist states' agencies also availed themselves of the Bulgarian experience, such as the Cubans who studied the organisation of STI activity *within* Bulgaria, aimed at foreigners and technical experts who visited or worked in the country.[35] The Vietnamese STI, newly created in 1980, also sought documents on the organisation of the Bulgarian one, as well as specific help in reconnecting with Vietnamese agents in a number of countries, as their capabilities were smaller and had prevented them from keeping regular track of all their operatives.[36] By the 1980s, thus, the state's STI was modern, extremely active and in a position to mentor smaller and newer intelligence services. This was a far cry from its tutelage under the NKVD and KGB in the 1940s and 1950s, and

[33] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 453 l. 305-7

[34] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 527 l. 1

[35] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 476 l. 9

[36] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 528 l. 1

once the directorate started focusing more on the computer industry, its co-operation with "fraternal" agencies, especially the USSR, shows a much more independent path than is often assumed of the DS as a whole. While it is not in doubt that the Bulgarian intelligence services as a whole remained extremely closely linked with the KGB until the end of the regime, the STI's policies of civilian supply and its annual co-operation talks with other agencies reveal a surprising path, reflecting the computer industry's rise and operation within COMECON.

Co-Operating In an Electronic Key

Co-operation between all Eastern Bloc agencies both amplified the amount of technology gained by each state, as they sought to coordinate plans (as they did in COMECON), and revealed the national interests of each nation, which often ran against Warsaw Pact commitments, actual co-operation, or primarily – Soviet wishes. The dealings of the Bulgarian STI with the Soviets, above all, revealed the clear importance of the nuclear umbrella and military aid provided by the USSR, which created the space for the Balkan state to focus on computers and other profitable items. As Charles Tilly put it in the mid-80s

> As the twentieth century wore on, however, it became increasingly common for one state to lend, give, or sell war-making means to another; in those cases, the recipient state could put a disproportionate effort into extraction, protection, and/or state making and yet survive. In our own time, clients of the United States and the Soviet Union provide numerous examples.[37]

The Bulgarian armed forces were armed by the USSR, and had no need to develop the most expensive and cutting edge military equipment with which to face NATO – its MiG fighter jets, surface-to-air missile complexes, precision artillery, frigates and submarines were produced by the Soviets and sold or even gifted to Sofia. The Bulgarian military industry grew massively during the socialist regime, becoming another golden sector, but it was also export-oriented – its assault rifles, armoured vehicles, shells, bullets, missiles, were sold to

[37] Charles Tilly "War Making and State Making as Organized Crime" in Evans, Rueschemeyer & Skocpol (eds) *Bringing the State Back In* (Cambridge: Cambridge University Press 1985), p. 184

national liberation regimes and friendly developing states, especially in the Arab world. By the early 80s the positive trade balance with the Arab states was $1 billion per year, mostly because of the weaponry exports.[38] While many of these weapons also equipped the domestic armed forces, the Bulgarian military industry did not have to produce the full gamut of arms needed by a late 20th century military – it could simply rely on the Soviets. Thus, STI had no incentive to concentrate as much of its focus on military matters as the USSR did, carrying the burden of Warsaw Pact military research and production. The Minister of the Interior in 1972, Angel Tsanev, summarised the directorate's thinking and its goals most clearly by expanding on this:

> What political processes there are in a capitalist country – I have no affinity for that, maybe I am mistaken. And for our intelligence workers to circle around these questions only, that is playing at intelligence. That is a waste of power and means. There are new times in intelligence work in the world. Gone is the time of separate intellegences, where each country aimed at knowing the secrets of the other. Now other powers solve big questions. That is the USSR, the socialist camp, economic power. In questions of war – that is the rockets of the Soviet Union. They solve the questions.[39]

Other officers felt that Bulgaria should have its own military intelligence focus, but this was shot down: "Let's look at things realistically. How will we gather information for military production? How do you enter into a military factory, how is it guarded?" (a passage which the STI reader underlined and marked as "Correct! Realistic!" in his handwriting).[40] Under the protection of Soviet nuclear warheads, and the vast military power of the Warsaw Pact, Bulgaria could focus on using its STI to "create a mature socialist society and develop Bulgaria as the leading socialist country in the Balkans, so it can be an example to other Balkan countries. Our task is also the fuller satisfaction of the material needs of our

[38] Evgeniy Kandilarov, "Elektronikata v Ikonomicheskata Politika na Bulgariya prez 60te-80te Godini na XX Vek" in *GSU-IF*, vol. 96/7 (2003/4), p. 461

[39] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 408 l. 38-9

[40] Ibid., l. 40

people."[41] Such logics drove the focus in co-operation with other socialist intelligence agencies, with an increased focus on the high technology, and especially computers, which interested the Bulgarian civilian economy.

The KGB was, understandably, the biggest and most important partner. Between 1966 and 1971 alone they passed on 816 "informations" totalling over 155 thousand pages of documentation, in exchange for 687 Bulgarian ones (57 thousand pages) and 44 chemical and microbiological strains.[42] The Bulgarian STI establishment also possessed a key asset for the Eastern Bloc, agent "Delon" (named after the French heartthrob) who was a great source for American and French military secrets, and at least for a time worked through the Swiss residency.[43] Together with agents "Hans" and "Frederick", he was moved to exclusively military tasks "of interest to the Soviet comrades" in the early 1970s, who praised him highly.[44] In 1974 he alone sent 554 informations to the Soviets[45], and another 500 in 1975.[46] By 1976, after another 505 key informations gained by him, he was passed over to the Soviets, allowing him to send his findings straight to the KGB[47] – an extremely valuable asset which earned STI valuable points with the Soviets. He gained valuable info straight from the American Department of Defence such as "instructions to the US Army and Navy, materials on the developments of the aviation industry, as well as fundamental and military developments in electronics, chemistry and nuclear energy", while agent "Frederick", another key asset, passed on info on polymers applicable to aviation technology, info on instruments

[41] Ibid., l. 38

[42] Ibid., l. 14

[43] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 378 l. 67

[44] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 375 l. 54-6

[45] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 376 l. 57

[46] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 366 l. 56

[47] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 378 l. 67

in NATO warplanes, artillery and anti-aircraft specifications, heavy tank armour designs and other valuable material.[48] These were important, but even though "Delon" and others were of such value to the Soviet military establishment, they were still not enough – the 1976 internal STI report states that their achievements, vis-à-vis Soviet expectations, "are still not enough and don't fully cover the tasks of the information plan".[49] This was the common thread through STI-KGB relations throughout the period, reflecting local priorities. The year of Delon's highest success, 1976, was also the year in which military informations were the biggest share of the packages sent to the USSR – 35% of all[50] – an outlier to the usual years where they were much less, as little as 6% at the start of the 1970s.[51] The 1976-7 report explicitly stated that the KGB required more military informations from the Bulgarians,[52] but that was never achieved – the priorities lay elsewhere, and the Bulgarians bought themselves space with passing "Delon" over to the Soviet residents. The Bulgarian services freely admitted in internal reports that any focus on military secrets was Soviet-driven, rather than serving any tasks set by the domestic defence establishment.[53]

Instead, the Bulgarians used their focus and their extremely close links with the KGB to extract as much in electronics as possible. Reflecting COMECON specialisation, the STI called for close coordination in areas which were of common interests, mentioning computers specifically in its 1970 report, as the "USSR, GDR and Bulgaria are responsible for the creation of different in their parameters computer machines".[54] Fraternal countries were noted

[48] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 390 l. 19

[49] Ibid., l. 20

[50] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 433B l. 61

[51] Hristov, "Durzhavna Sigurnost. Chast 2.1"

[52] AKRDOPBGDSRSNBA-R, f. 9 op 3 a.e. 169

[53] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 171 l. 46

[54] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 441 l. 1

to have “valuable scientific-technical information related to those machine models that are being developed by other countries”, so the division of tasks in espionage, as well as the free exchange of information already gained, would only benefit all concerned. STI tasks, thus, had to be reflective of economic specialisations, the Bulgarians concluded.[55]

This was the guiding principle in Bulgarian relations with all other intelligence services. Already in 1968 the KGB passed over 1700 pages of electronic documentation, and 16 separate manuals, together with over 1000 photos and one working prototype of a computer device, all evaluated as extremely valuable by the Bulgarians.[56] By 1970 electronics was dominating the exchange with the Soviets, accounting for 147 of 212 informations received that year, far more than the second placed sector, which was metallurgy with 39.[57] In the later 1970s up to 39% of all informations received were specifically to do with electronics, a huge boost to the needs of STI.[58] During the 1980-5 period, the Bulgarians received 306 electronic informations (out of 1094), second only behind chemistry and microbiology combined. Most of the electronic informations received extremely high valuations, as the Soviets supplied documentation on Western CPUs used for the upgraded ES-1037 computer; operating systems for 32-bit machines; and database processing packages to be integrated into Bulgarian software for the COMECON market.[59] This was a two-way street, with 469 out of 2011 informations sent to the USSR also in the electronic sector, the biggest industry by share of exchanges, reflecting the vast cache of information in the field that Bulgarians had amassed.[60] In 1986 the KGB was even more

[55] Ibid., l. 1-3

[56] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 382 l. 20

[57] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 398 l. 181

[58] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 171 l. 44

[59] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 540 l. 205-6

[60] Ibid., l. 204

forthcoming, with 136 electronic informations that were all evaluated as answering key needs of the economy – new integrated circuit technology, Winchester disc prototypes, mathematical models of MOS schematics and 1.25 micron technology. However, this was not all – a separate and staggering 828 informations in "computers" were also passed to the Bulgarians. These were usually full documentation packages together with a prototype or model, easing development work massively. Important items such as M-80 processors helped for the development of the IZOT-1014 supercomputer; programs for VAX-compatible machines were key for the development of domestic mini-computers.[61] In 1987, the electronic and computing component of the KGB exchange was 1044 out of 1233 materials[62] – Soviet technical assistance was cover as well as overt.

Such close and fruitful ties were also had with the East Germans. Similar to the Bulgarians, the Germans too focused heavily on electronics at the expense of military secrets, and as soon as large-scale STI co-operation was agreed on in 1970 the two sides agreed to not even exchange such informations, passing them straight to Moscow instead. The Germans also trained Bulgarian STI operatives on the use of their own computerised network in the early 1970s.[63] The closeness of the two services was rivalled only by that with the KGB, as the Germans even suggested joint financing of expensive purchases from foreign traders who were willing to circumvent the embargo – something never suggested by the Soviets.[64] They were extremely open with whatever computer informations were purchased or stolen, getting much in return from the Bulgarians in the electronic sector – all work was evaluated highly

[61] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 556 l. 166-172

[62] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 576 l. 166

[63] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 449 l. 227

[64] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 150B l. 27

by both sides as very mutually beneficial.[65] By the early 1980s the Bulgarians' own efforts were bolstered by the GDR passing on discs in the 317 to 800 MB range,[66] as well as valuable prognoses on West German computer developments.[67] In 1982 the GDR passed on 216 electronic informations alone – out of 258 total – reflecting both their own focus and the Bulgarians' successful steering of German co-operation towards their object of desire.[68] A 1985 internal STI report, reflecting on the statistical reality over the past decade, informed the higher-ups that "the information exchange with STI of the GDR is developing mainly in the direction of 'Electronic and Computing Technology' as agreed by the leaders of the two STIs", with future developments laying in microbiology and chemistry, as well as certain sectors of machine-building – all areas that the Bulgarians were trying to focus on in the 1980s as part of a drive to intensify the economy.[69]

The Czechs were also seen as helpful by the Bulgarian establishment, despite concerns over the quality of their cadres after the 1968-70 purges, leaving many of the new workers under 35 and with little professional experience.[70] Yet they, too, were responsive to Bulgarian requests and focuses, with just under a quarter of all informations delivered in 1982, for example, being in electronics, including complete terminals, processors and operating systems – a real coup for any of the services involved.[71] By the mid-1980s, Czech co-operation was evaluated even more highly, especially in the area of microchips and robotics, where they delivered documents on the latest industrial machines in the USA, Japan,

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[65] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 433B l. 76

[66] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 451 l. 101

[67] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 487 l. 36

[68] Ibid., l. 150

[69] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 543 l. 153

[70] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 181 l. 42

[71] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 489 l. 33-4

and Sweden.[72] In Latin America, where the STI network was less developed, the Bulgarians developed close links with the Cuban intelligence services. Their allies had wide networks among Cuban emigres in the USA, including some working in electronic institutes, as well as a well-developed operation in Mexico, which was a safe haven for meeting American sources – all this made the Cubans a great source for computer informations, which made up the bulk of exchange between the two services.[73]

However, these close links with the services of the USSR, GDR, Cuba and Czechoslovakia, were not the whole story. Bulgarian STI troubles with the Poles and Hungarians testify to the internal COMECON struggles between the various countries to get the best position on the market. Sending too much of what you had in the electronics sector to your fraternal states who were also producing computers was at best done with reluctance, and at worst not at all. The Bulgarians' own policy of sending back less informations than they received was marked. While in dealings with the KGB that can be explained by their lesser capability and smaller worldwide reach, with a service like the Czech one – weaker and ravaged by a post-1968 agent clear-out – it is indicative of a concerted policy to extract as much as possible from the allies while giving as little in return: in 1983 the Czechs got barely 50% of what they sent the Bulgarians (77 to 143 materials),[74] in 1985 – even less (78 to 162).[75] The Hungarians and Poles, however, played the same game, and were more problematic.

[72] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 508 l. 62-71

[73] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 476 l. 5-8

[74] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 508 l. 31

[75] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 535 l. 60

Throughout the 1970s and early 1980s the Hungarians were not very interested in exchanges with the Bulgarians, sending a mere 15 informations in 1971[76] and 11 in 1976 for example,[77] and just 33 in 1980[78] – in return for at least triple that amount from the Bulgarians in each case. The Bulgarian STI's persistence in sending more, however, worked, with bilateral meetings noting the shortcomings of the Hungarians and increasing the tempo of exchanges in the 1980s – 210 informations, including important contributions on computer monitors, were sent in 1981.[79] The Hungarians, who in the 1970s were often opposed to Bulgarian proposals in the ICCT and were trying to set up a rival industry (these relations are explored in later chapters), had by the 1980s switched their tactic to instead encourage the transfer of technology and information, and benefit from the experience of an STI that was explicitly aimed at computers – around a third of all informations they sent from 1983 onwards were in electronics, including important program source codes,[80] to spur reciprocity. The Polish intelligence services, however, remained obstinate. Since the 1960s their own STI had made electronics a priority area,[81] serving the country's own attempts to develop the sector. This resulted in only 5 informations being passed to the Bulgarians in the entire 1969-1973 period, when although the specialisations had been passed out, no country had yet set up the productive power to fulfil its ICCT obligations yet.[82] Poland's reluctance, much like Hungary's during this period, can be attributed to these early days of rivalry, when the Bulgarians had not yet started mass production – any STI co-operation could help them,

[76] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 450 l. 172

[77] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 150V l. 4

[78] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 473 l. 32

[79] Ibid., l. 129

[80] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 507 l. 41

[81] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 156 l. 11

[82] Ibid., l. 125

while delays and failures could potentially help the small state lose its specialisation and open up the space for others to profit. The Bulgarians tried the same tactic that they were trying with the Hungarians, upping their own exchange in order to foster closer ties and encourage answers – 85 informations were sent in 1971, to no Polish response.[83] When after 1974 they started to respond, computer information that was offered was not that which the Bulgarians requested,[84] thus inflating the exchange numbers with items the Poles knew were useless for their colleagues. This remained a one-way street throughout the Cold War, with the Bulgarians bitterly noting in 1984 that "the information exchange doesn't correspond to the real capabilities of both countries" and both sides had supplied each other with "too little of those [informations] that can solve a specific task fully".[85]

Overall, thus, the fraternal STIs mirrored both the COMECON specialisations *and* the philosophy of pooling resources and coordinating plans in order to better use their limited assets in the game of catching-up with and overtaking capitalism. Close technological and economic links with the USSR and GDR were reflected in STI co-operation, competition with Poland or Hungary, too, had an impact on the agencies. The Bulgarian intelligence establishment benefited from a much larger pool of knowledge and acquisitions than its admittedly formidable efforts could achieve. In these ways it also facilitated technology transfer inside the Eastern Bloc that was often at a volume rivalling or exceeding that of the usual technical assistance channels, with hundreds of thousands of pages and hundreds of items circulating between Sofia and the other agencies each year. However, its focus, squarely on that which would benefit the national economy, also reflected a surprising amount of civilian control. Despite being within the hierarchy of the Ministry of the Interior,

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[83] Ibid., l. 203

[84] Ibid., l. 193

[85] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e .525 l. 87

the Bulgarian STI directorate was not the sword and shield of the party as much as the sharpened scalpel of the CSTP.

In Service of the Nation

The name of Ivan Popov is often connected not just to the birth of the electronic industry, but that of the scientific-technical intelligence service too.[86] Yoked from the start to the needs of the economy, the STI service passed on informations to a special section of the CSTP which was tasked with evaluating this and implementing it into the economic and research plans of the country. However, it started with just a single worker in the early 1960s, hampering its activity.[87] Popov's reorganisations of this CSTP section in 1965 was part of the larger plan to create the technology sector in the economy, as explored before. In a secret report to Zhivkov he highlighted the importance of STI to breaking the embargo and enriching enterprises with the latest Western technology – using "the experience of leading capitalist firms and research institutes…for the needs of socialist construction".[88] The CSTP expanded this analysis section from 1965 onwards, aware also that they needed more people not just to process information, but "efface" it before it reached Bulgarian users, to obscure the channels through which it was obtained.[89] Popov's own status in the intelligence community was high enough that the East German security services specifically asked some documents on computing to be passed to him personally, rather than to be analysed by the in-house STI or CSTP sections.[90]

[86] Hristov, "Durzhavna Sigurnost. Chast 2.1"

[87] Ibid.

[88] Ibid.

[89] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 368 l. 26

[90] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 449 l. 228

Under Popov, STI work was moved in the direction of electronics as part of the wider CSTP policy of the same. In 1968, the annual work report of the service highlighted the fast pace of the contemporary scientific-technical revolution and progress, which led to the constant restructuring of national economies. Every country sought to protect its secrets even from its allies in this competition for the quickest possible growth. This created a hunger for cadres in many European countries, who sought short-term researchers and contract workers, who often accepted lower wages – a great and easy way to place Bulgarian scientists and technicians abroad for periods of time in order to extract the latest developments. The CSTP's strong encouragement of scientific co-operation as a cover for STI work was born out of both necessity and a particular understanding of the nature of the profession:

> The wide scientific-technical exchange and cooperation on an international level to a large extent removes the nationalist character of many scientific-technical achievements. This leads to a lessened feeling of moral and patriotic responsibility among the people who have to share or pass on these innovations to the representatives of another country (even when it is a socialist one). They don't feel that this action harms the interests and security of their own country.[91]

Science was an international language, and the eagerness of intellectual workers to share results and developments was to be exploited by the STI. Interviews with Bulgarian technical intellectuals such as the deputy director of the ITCR, Peter Petrov, reveal that this was not just STI-sanctioned, but something freely exploited by Bulgarian scientists who knew they were operating in their own version of the scarcity economy, isolated from the latest publications in the West.[92] He recalls, first of all, a much freer ability to travel and work in the early 1960s than most compatriots – both due to the internal factor of the state's encouragement of its technical cadres to gain experience on the world stage, and due to the

[91] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 371 l. 2-3

[92] Interviews regarding topics that touch on espionage are always delicate affairs. Getting people to talk more openly about the topic usually involves a measure of trust built over a few interviews, such as is the case with Peter Petrov. A number of interviews, in increasingly friendly circumstances, predisposed the interviewee to such stories. The question of his involvement with the intelligence services can always remain open, but his name has not been found on lists of agents or informants published by the Commission on Dossiers.

need of qualified workers in the West. When his wife had to undergo specific medical treatment in Austria at the start of the decade, he managed to both get government backing to work in Vienna for a year (precisely as he was a radio engineer in BAS, and this was seen as a valuable window to the West) and find work as a technician servicing the city communication network due to his skills.[93] This was a valuable source of connections too, as he made friends in the Austrian and West German technical communities. In 1963, when he was sent to specialise in East Berlin, he utilised these to visit an IBM computing centre in West Berlin, where a German friend took him around the premises, showed him the mainframes, introduced him to technicians. He recalls the visit as based on his curiosity and his friend's enthusiasm to show him where he worked, a shared passion between two professionals. With amusement he notes that it took some time before he was asked where he was from – upon learning he was Bulgarian, he was ushered out of the building quickly, but not sternly.[94] His friendship had thus got him inside a building which would have been much harder to access for an agent. These connections also helped him in the late 1960s, at the Hannover Fair, where he visited the Texas Instruments stand but was denied a catalogue of modules due to COCOM restrictions. He simply sought out a friend who was manning the Siemens stall, who ten minutes later delivered the catalogue to him, circumventing the embargo without a second thought.[95] Professional friendships and networks were, as the CSTP suspected, channels open to exchange where personal relations could trump political restrictions – in Petrov's case, such considerations don't seem to enter the mind of his Western friends until another engineer points out the person he is taking around IBM is from

[93] Interview with Peter Petrov, 19th March 2015

[94] Interview with Peter Petrov, 11th December 2015

[95] Ibid.

the enemy block. STI activities were thus parallel to an undocumented but wide-ranging personal exchange system between Bulgarian technicians and their "capitalist" colleagues.

Under Popov's leadership of the CSTP and thus STI, electronics understandably became the biggest single sector of activity. It was the service that delivered magnetic memories that were part of the national specialisation in 1969, creating a reliance on STI from the very start of the industry – that year's report from the CICT states that "the stance of CSTP is to not carry out own scientific research work":[96] the institute would, throughout the years, do original research in magnetic discs, but it remained hugely dependent on the intelligence apparatus. By 1970, 164 informations were acquired in electronics and computing, and a further 124 in closely related communications and radio engineering, while chemistry was a distant third with 65 – and only two military secrets were acquired.[97] In 1973-4, at the end of Popov's presidency of the CSTP, the whole State Security apparatus underwent a re-structuring and renewal of its normative documents, enshrining the direction charted by the professor – among the main tasks were not just the protection of law and order, and the defence of the socialist state, but also to help "with its means, forms and methods for the development of the national economy."[98] These precepts were continued under the next supremo of economic strategy, Ognyan Doynov, who expanded STI work greatly, seeing it as a key component of the Elektronika and Avtomatika programs of the late 1970s and 1980s. He re-affirmed the focus on computing,[99] also expanding intelligence work to focus even more on robots and other automatic means of production.[100] He praised STI on behalf of the

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[96] TsDA f. 37A op. 1 a.e. 2 l. 31

[97] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 373 l. 33

[98] AKRDOPBGDSRSNBA-R, f. 1B op. 64 a.e. 438 l. 5

[99] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 139 l. 24

[100] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 137 l. 130

whole Politburo, and was key in raising it to the position of a directorate.[101] What started under Popov came to its natural conclusion under Doynov – STI as the purchasing department of the national economy.

The successes were numerous and essential to the electronisation and automation programs of the state. One of the first was in 1965, when a French engineer – object "Bor" – was recruited while in Bulgaria as technical assistant to the construction of the semi-conductor factory in Botevgrad. He passed on key information on transistors, as well as matrices for mass production, which were not part of the official Bulgarian-French agreement. Another French engineer, "Turkovski", was willing to show the latest semi-conductor schematics to a Bulgarian agent, who would copy them.[102] The element base of Bulgarian electronics was thus already inextricably tied to STI work. Building on this, STI also targeted new countries, beyond the usual Western European ones. By 1967 three dedicated agents were operating in Japan on scientific-technical matters, parallel to the contracted training of Bulgarian scientists by Fujitsu.[103] Britain and Austria were other areas where agents managed to make breakthroughs in electronic acquisitions by 1970.[104] Bulgarian agents gained experience and widened their networks, targeting not just engineers and technicians but also secretaries, librarians, people working in scientific archives and repositories – anyone who could acquire plans and blueprints.[105] There was increasing professionalization of spies working in computers too – by 1972 most operative agents in the leading countries were graduates of electronics or physics-related university courses.[106] Over

[101] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 443 l. 264

[102] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 379 l. 9

[103] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 370 l. 32

[104] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 373 l. 25

[105] Ibid.,

[106] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 408 l. 5

60% of them had also gone through the KGB school in Moscow, while the rest had graduated the three-month accelerated course in Bankya in Bulgaria, based on Soviet methods; 93% of them could work in at least one foreign language.[107] Such improvements meant that by the early 1970s STI was working on a different scale than the 1960s – in 1971 it acquired sixteen times more information than in 1966.[108] Twelve acquired informations (among them magnetic memories) alone were expected, upon implementation, to create an economic effect of around 60 million levs – new production, updating existing factories, and savings in domestic research.[109] Work was now being extended to non-capitalist countries, as STI recognised that these developing markets were areas where embargo goods and knowledge could easily be acquired. The Indian residence became one of the key ones by 1980, supplying more informations in key areas than Spain, for example.[110] Others operated in Iran, Mexico, Tunisia, and beyond.

The memory device industry, IZOT's biggest export, was highly dependent on the embargo goods that STI could provide. In 1974 alone, in order to upgrade production for the upcoming five-year plan and ensure Bulgarian primacy in COMECON, STI delivered everything that CSTP had listed as important in its annual plan – 29 MB discs, 2x100MB disc prototypes, and even over 4000 magnetic reader heads to cover domestic shortfalls and ensure the production of over 400 magnetic discs already contracted to Eastern Bloc users.[111] Sometimes, the operations went beyond single agents and prototypes, as was the case of the 1977 wholesale shipping of material from Portugal. An unnamed American company producing discs and magnetic heads in the 29 MB range (most probably IBM) had left its

[107] Ibid., l. 7

[108] Ibid., l. 12

[109] Ibid., l. 13

[110] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 443 l. 271

[111] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 376 l. 56

factory in the country in the aftermath of the Carnation Revolution, and the new government was offering it for auction. An inventory was made by a local agent, who passed it onto IZOT. It turned out to be a goldmine, as two cargo planes from Spain had to be chartered, as well as a 15-ton truck, in order to ferry back embargo equipment to Bulgaria. Some was even smuggled out in a diplomatic car by Bulgarian officers, bringing the total to 286 informations of various types in this operation alone[112] – certainly the most audacious and large-scale one in electronics that has been recorded in the archives.

The annual reports are running lists of goods and documentations that were implemented in IZOT and other factories. Full documentation on 200 MB discs; the newest integrated circuits; manuals for microcomputers; testing equipment and software; whole printed boards – this is just the snapshot for 1978, with each item checked against the Elektronika-S program.[113] Over 700 informations relating directly to the program were passed on in 1979, while IZOT had nearly 1300 acquisitions in total through STI.[114] By Elektronika-S's end, the services' own actions (not counting that acquired from partner agencies) had acquired over 38 thousand pages of documentation and 102 working models of embargoed Western technology, indicating the success of the concerted efforts.[115] Overall, by 1980, STI had acquired a massive 4416 informations in electronics, out of 5409 total – a full 64% quota for the newest Elektronika and Avtomatika programs under Doynov's guidance.[116] In 1982 STI managed to acquire a matrix processor which was under heavy embargo, with only sixteen of the kind existing – it became a key input for the ES 2335 domestic processor. The total effects for the electronic industry for that year were calculated

[112] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 140A l. 79-80

[113] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 139 l. 108

[114] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 140V l. 8

[115] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 139 l. 131

[116] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 449 l. 1-4

at around 20 million levs, in savings and updated production.[117] IZOT's aims for the mid-1980s, in creating 635 MB capacity discs, the largest in the Eastern Bloc, were also supported by STI successes; as were savings in the physical costs of smaller discs, leading to up to 25% higher profits through upgraded production technologies.[118] The fledgling microcomputer industry of the 1980s also depended on STI efforts, which supplied the latest microchips, processors, and operating systems.[119]

There were failures, of course. Canada, for example, was an important area for STI operations, as it was

> …the most favoured partner of the USA and there are practically no limitations in the trade and scientific-technical exchange, as well as in border or visa regimes between the two countries. The level of research activity is extremely high and doesn't lag behind the USA at all.[120]

Its scientific and industrial market offered all the advantages of sought-after American technology, with less of the risk. By 1980, however, the residency there was hit by a successful police operation, and it never recovered.[121] Yet it is without doubt that STI grew to become the national economy's lifeline to the West – demonstrated by the fact that it gradually took over the control of major residencies such as those in Milan, Frankfurt,[122] Japan and Canada,[123] with overwhelming participation also in the Norwegian, Austrian, Swedish, Indian, Mexican and Singaporean residencies.[124] The security services' activities, however, reached beyond their pure intelligence work. Subordinated to the strategists of

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[117] Ibid., l. 12, l. 102

[118] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 482 l. 143-151

[119] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 555 l. 48-9

[120] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 418 l. 41

[121] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 442 l. 77

[122] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 483 l. 75

[123] AKRDOPBGDSRSNBA-R, f. 9 op.3 a.e. 139 l. 26

[124] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 548 l. 38

Bulgarian industry, its entanglement with the civilian sector was increasingly complex. The embargo meant that it had to use more and more covers in ministries, foreign trade organisations, institutes and the CSTP itself – a veritable colonisation of these institutions. Its limited numbers of operatives, as well as its imperfect knowledge of what it was dealing with, also necessitated a different way to work with the scientific community, without overtly hiring thousands of technologists into its ranks. This civilian entanglement was so thorough that we cannot speak of Cold War technology transfer as purely the scope of spies or of professionals – both existed in an increasing symbiosis throughout STI's existence.

Colonising the Civilian Economy – and Vice Versa

The CSTP had one main problem from the start of its usage of the STI apparatus, as already mentioned above – a difficulty in coordinating the plans and then implementation between its technology institutes and users, and the intelligence services. Its in-house section was too small and too poorly staffed to be able to deal with the huge tasks that the national economy required. The intelligence services themselves did not have enough qualified candidates either. It is true that the agents that worked in the electronic sector, as a whole, were above the average level of the usual DS officer, and by the 1970s the vast majority spoke a Western language and had some technical education. In fact, this became a problem for the rest of the intelligence services, and other sectors of STI focus, as a 1974 report noted that more and more qualified young agents sought work in the section, making it slant heavily towards English-speaking electronic specialists[125] to the detriment of other areas and languages such as chemistry or French.

Despite this electronics focus, the overall level of training in DS often left much to be desired. A recent study of the professional biographies of 47 officers in leading positions by Momchil Metodiev and Mariya Dermendzieva reveals a continuity between the supposedly

[125] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 388 l. 32

more professional services of the late socialist period and the politically chosen one of the 1940s and 1950s.[126] Political loyalty and the right class background remained key for a rise through the ranks. Some professionalization was evident – by the end of the 1970s the officers who had some sort of higher degree were more than those who had graduated school only; around 475 of those, however, came from the higher police academy, trained in an intelligence skillset but not in a technical one that was key for STI. The most glaring problem, however, was that by 1978 only 2027 officers knew a foreign language (this number included the most prelevant – Russian), against 5263 who didn't know any![127] This led to grotesque mishaps such as an agent not understanding the meaning of "doctor honoris causa" and reporting that a target was to travel to the USA to meet a Dr. Homoris Causa.[128] However, it is clear from STI's own reports that the situation was slightly better in their section, which attracted more young and trained professionals.

Pic. 1: Major General Georgi Manchev, head of STI 1979-1990. (Source: Metodiev & Dermendzhieva, Durzhavna Sigurnost)

[126] Momchil Metodiev & Mariya Dermendzhieva, *Durzhavna Sigurnost – Predimstvo Po Nasledstvo: Profesionalni Biografii na Vodeshti Ofitseri* (Sofia: Ciela 2015), p. 15

[127] Ibid., p. 62

[128] Ibid., p. 63

The professional biography of Georgi Manchev, director of STI at its peak in the 1980s, is an indicator of the relatively better picture among the leaders of the service, showing why it was seen as more professional than other sections. Born in 1941, he had the right background as his family had taken active part in the communist resistance during the war. He was active in the Komsomol youth movement while at school, and graduated the school for reserve officers in Shumen, completing his national service as the senior sergeant of a reconnaissance platoon in the army. However, he also had the technical training often lacked by his future colleagues, as he studied precision engineering in the Kiev Polytechnic Institute between 1960 and 1965. He spent a year after his return actually working in BAS, at the Institute of Electronics, a part of the nation's scientific community. The following year, however, he became an officer in the First Main Directorate of DS, sent to work straight away to the STI section, where he led a residency in West Germany at the rank of lieutenant. After completing the KGB school in Moscow, he worked embedded in foreign trade firms, and by 1971 was in the New York residency, the most coveted placement. After 1976 he worked as the STI representative in the Ministry of Electronics, playing a key role in the Elektronika-S programs. Around this time, US counter-intelligence had uncovered him, so he was moved to work within the Sofia HQ, where his career took an upward trajectory. Fluent in English and Russian, with technical training and practice, as well as experience in intelligence work both in the leading capitalist countries and the ministry responsible for electronics, he became head of all STI by 1979. Under his tenure, the Bulgarian services expanded their electronic program, and his professionalism as well as the directorate's importance were attested to when he became deputy head of the whole First Directorate in 1986. For a brief period after the fall of communism, he was the deputy-director of the whole re-structured service.[129]

[129] Ibid., pp. 733-737

STI was thus both led by a competent officer who understood the nature of intelligence work in the fields of science and technology, and as a whole attracted more agents with education and language skills. However, even after its 1980 expansion, it never had enough officers and analysts to deal with the whole avalanche of informations it acquired through various channels. Not only was the volume overpowering, but the variety too – STI was acquiring not just computer know-how, but secrets in nuclear energy, construction, metallurgy, chemistry, pharmaceuticals, microbiology, communications – all the way to agriculture and new breeds of livestock. As STI's importance grew in the 1960s and early 1970s, it had become clear that a new institution was needed to both help direct the targets for acquisition and evaluate that which was attained. The solution was found in 1973 with the creation of the Centre for Applied Information (CAI – *Tzentur za Prilozhna Informatsiya*), described as "a holistic system for scientific-technical and economic data", to organise the work of the First Directorate, orient its future plans and ensure the rational usage of gathered information.[130] It was also slated to ease the work of foreign trade organisations through gathering data on the "enemy's" financial and credit situations, putting them in a better situation when negotiating import, export, and licensing.[131] CAI would go on to enlist the help of the leading lights in Bulgarian science as evaluators of the incoming informations, allowing for their better distribution and calibration of which were valuable leads and which weren't. It would also create positions for STI operatives within each ministry (starting with the key ones – Electronics, Machine Building, Chemical Industry, Agriculture) to liaise better with the ministry in terms of annual plans. CAI thus ensured that the STI section would have constant access and communication channels to Bulgarian research institutes, research and development sections of enterprises and ministries, and universities and the Academy of

[130] AKRDOPBGDSRSNBA-R f. 9 op. 2 a.e. 418 l. 5-6

[131] Ibid., l. 7

Science. To mask its real pedigree, its institutional home was to be the CSTP's own Central Institute for Scientific and Technical Information – the state's paramount information service in the field of science. Peter Petrov states that many at the higher levels of institutes knew CAI's real pedigree and function, but never saw it as a particularly interesting fact – it was just the way things were in the realities of the Cold War.[132]

Operating at the start with just 25 staff, its network of specialists in Bulgarian science was initially 666 by 1974,[133] but that underwent a rapid expansion – by 1976 there were 4256 specialists on the CAI books, with over half cleared to work on the most sensitive and top secret informations.[134] The last information we have of CAI's network of specialists comes from the 1984 report, listing over 7000 specialists involved in work every year,[135] and given the its growth rate, we can assume it was even higher by 1989. These specialists were engineers, researchers, professors and graduate students, technicians and other specialists in their respective fields. Their task was to receive information from CAI – and thus STI – and evaluate it, and participate in annual plans for next year's targets. They were to grapple with one of the recurring problems of the socialist economy – the shortening of the road from acquisition of technology (be it foreign or a domestic development) and implementing it into the economy.[136] By 1976 it had developed a well-evaluated subsystem of information, streamlining this path and striving to put more of the innovations into production.[137] It became a valuable asset, helping in the plans for acquisitions in the ambitious Elektronika and Avtomatika programs, getting rid of superfluous or obsolete technologies from the STI

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[132] Interview with Peter Petrov, 11th December 2015

[133] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 376 l. 58

[134] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 378 l. 70

[135] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 518 l. 28

[136] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 388 l. 28

[137] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 379 l. 72

lists, and upping the acquisition of goods related to the state plans by, for example, 46% in 1979.[138] After the ISKRA system's completion, CAI's computerised "subsystem for information for limited distribution" was evaluated as the widest-ranging available to any intelligence service in the Eastern Bloc, reaching the vast majority of interested users.[139] STI was at times at odds with CAI, seeing the centre as evaluating things too differently to them, and as a whole as having too much power. The 1986 report on the matter betrays a feeling that the spies are in service of the civilians too much, and operative agents themselves have no power over CAI directives. This was, it felt, even more galling seeing that CAI was often late on its deadlines, with some agents feeling that "if you wanted a certain material to fall through, run it through CAI".[140]

This professional relationship went two ways, however, as the centre had the superior position in evaluating goods and assigning plans, backed by the CSTP and Politburo directives, but was also ultimately beholden to the institutes and scientists it turned to for its expertise. Indeed, CAI was envisioned in its inception as a "feedback mechanism" for the clients in Bulgarian science.[141] Using the documents of CICT one can see how the leading computer institute of the country treated CAI as its in-house information service. While thanking them for their 1981 deliveries, CICT requests a long list of IBM products and devices in 1982 – even those incompatible with the ES series of computers. Some, such as 635 MB disc technology, is requested with an explicit reference to the need to retain Bulgarian primacy within COMECON, and present a new model at the next meeting of the

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[138] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 137 l. 127

[139] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 518 l. 30

[140] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 554 l. 20-21

[141] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 572 l. 41

Head Constructors in socialist computing.[142] In 1983 it reports to CAI requests to account for its implementations since 1976, but continues with an even large volume of requests throughout the year for PC design technologies which will allow it to circumvent patents in the way that CAI allowed them to circumvent Siemens patents in certain communication devices.[143]

CICT was not afraid to criticise STI efforts through its evaluations of the quality of CAI work – in 1986 it reprimands the Centre for sending lists with generic names for programs such as "Graphics" or "Pulsar", which do not tell the specialists anything about what the program actually is.[144] The same year's documents also give a glimpse into the financing interlinking of both the civilian and intelligence sectors – CICT requests certain programs and devices for VAX systems (a computer system architecture that was designed by DEC, the Digital Equipment Corporation), and notifies STI what it will cost and how much Western currency CICT will render for the purchase of such equipment.[145] CAI, and thus STI, also thus functioned as the chief procurement officer for the institute. It was often subject to very urgent requests, to be executed within the space of a couple of weeks, such as 1987 requests for microcode loaders and diagnostic equipment. At the same time, it was often roundly criticised also for the prices it was listing in its monthly information bulletins, with CICT feeling that they didn't match world prices – ignoring wilfully the extra costs STI had to pay given COCOM restrictions and the cost of operations.[146]

In general, however, CAI was always improving in its ability to supply its users with information. In 1988, CICT thanked it for providing many key technologies for free, allowing

[142] TsDA f. 37A op. 10 a.e. 12 l. 122

[143] TsDA f. 37A op. 10 a.e. 13 l. 30-226

[144] TsDA f. 37A op. 10 a.e. 16 l. 313-314

[145] Ibid., l. 59

[146] TsDA f. 37A op. 10 a.e. 17 l. 19, 200

the Bulgarian computer industry to remain competitive and win new market niches in the USSR and Czechoslovakia, as well as furthering the intellectualisation of the national economy. Key equipment was also delivered for the upgrades of the ESTEL teleprocessing system, a staple export good to the USSR, GDR and Hungary.[147] CAI itself was always mindful of its image among its users, acknowledging the symbiotic relationship it enjoyed with the specialists who were both its users and evaluation staff – in 1978 it criticised local police departments who co-operated in intelligence work for providing information to the users that was already openly available within the country and thus undermining the prestige of the whole STI system as an "information supplier".[148] The system of gathering, evaluating and distributing information also made a name for itself, being the subject of many questions in the annual coordination plans with other Eastern Bloc agencies. It was the focus of a full-scale study of its organisation and practices by the Hungarian Ministry of the Interior in 1981, in preparation for creating their own such system,[149] as well as the Poles who wanted to import this practice of evaluating and implementing information, due to the lack of such an organisation within their intelligence community.[150]

STI itself had deep relations with the civilian economy in a more direct way, through the usage of positions within various ministries and organisations, and indeed institutes, as covers. CSTP was one of the first to be "colonised" in such a way, with its trade, scientific exchange, and international relations departments being used as places for STI operatives since 1967. Also positions were found at the Ministries of Machine-Building, Energy, Chemistry, and Foreign Trade; within institutes ranging from automation and radio-

[147] TsDA f. 37A op. 10 a.e. 18 l. 29-30, 187

[148] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 139 l. 100

[149] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 473 l. 32-33

[150] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 150D l. 11

electronics to car engines; the foreign trade organisations of a number of economic sectors.[151] Those working abroad were as "economic advisors" or "deputy trade representative".[152] By 1971, thirty operative workers were placed within the country too, as significant amounts of information gathering was done during visits by foreign experts to enterprises, or scientific conferences. To this end, BAS, CICT and Izotimpex had an officer each embedded.[153] This helped the section keep CSTP informed of which of its scientists were not suited to travel abroad due to loose tongues, who were in contact with Western agencies, who were potential leaks[154] – it must not be forgotten that STI was, in the end, also a tool of repression, having much power to block travel and even career developments for those of the technical intelligentsia deemed unsafe. Dimitur Stoyanov, the Minister of the Interior between 1976 and 1990, saw STI work as different from other intelligence work due to the fact that often it had to rely on technical intellectuals without party experience and "blooding" in disciplined party work – demanding an application of the rich "Soviet Checkist" experience.[155] It thus had was part of the evaluation committees for who was to take advantage of the coveted specialisations abroad – partly down to security reasons, but also down to who could best help the overall annual plan in informations gathered. CSTP covers allowed six STI agents to go abroad in 1980, but also a further nine secret co-operators – the term for civilian specialists willing to work for STI purposes. All of them were selected due to their specialisations falling in important areas, such as electronics – one went to specialise in the computer faculty of Columbia University, another to the corresponding department in Aachen Technical University, a third to the Illinois Institute of Technology, and a fourth to Japan on a

[151] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 412 l. 63

[152] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 364 l. 15

[153] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 415 l. 14

[154] AKRDOPBGDSRSNBA-R, f. 9 op. 3 a.e. 140A l. 74

[155] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 410 l. 15

computer specialisation; others went to SUNY, CUNY and on a Leverhulme stipend in other high-technology areas.[156]

As Manchev's biography shows, there were also positions created within the main economic ministries, where STI agents played the role of "advisors" in order to serve as liaisons between the civilian and intelligence plans. There had been resistance, especially by the Ministry of Electronics in 1974-5, which felt that CSTP and CAI were sufficient channels through which to co-ordinate plans. The original agent proposed, Major Milcho Gachev, was rejected as unsuitable for an advisor to the minister but sufficient as a "senior specialist", something they felt would have ended the matter. DS, however, was fine with that, surprising the ministry, which sought other ways to stall the appointment of a spy within their higher ranks. The Soviets had had similar problems with their ministries, depending on a Ministerial Council decision in order to sway them, which was applied to the Bulgarian case too.[157] Secret decision 141 of June 1975, created the positions of "advisors" in the ministries of electronics (which Manchev took), machine-building, chemical industry, and agriculture. They were to help with "questions concerning foreign expertise in the areas of science and technology".[158] Doynov himself had an agent assigned as an advisor at the Council of Ministers itself, further embedding STI into the highest echelons of economic thinking.[159] The services were part and parcel of all levels of the scientific and economic community, directed by it but also actively participating in its structures, from the research laboratory to ministry management.

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[156] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 438 l. 6

[157] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 366 l. 19-20

[158] Ibid., l. 1-2

[159] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 410 l. 11

One of the key aspects of this cross-colonisation by the economy and the intelligence services was that by the 1970s it is extremely hard to disentangle what is a legal and what is an illegal source of technology transfer and activity in Bulgaria. STI operatives, with their experience of foreign markets, were instrumental in the creation of what Hristov calls the "empire of foreign firms" from the 1960s onwards, reaching 450 companies by 1990.[160] Joint enterprises, firms and projects were a way for Bulgaria to circumvent the embargo, both in acquiring but also selling technology for hard capitalist cash. This story is part of the narrative of the rise of a managerial class which was increasingly operating in the West, in search of the manna that would boost the Bulgarian economy into the age of prosperity through programs such as Elektronika-S; while CAI and the lower-level embeddedness of STI is part of the parallel rise of a professional computer class that was part of world developments. These stories are part of the last chapter, but must be mentioned here, as they would be impossible without the concerted effort to create a directorate that was aimed squarely at national economic interests, and above all – at computing.

STI did run into problems in the later 1980s, as the détente consensus broke down over Afghanistan and then the election of Reagan. A 1981 defection by an agent – Colonel Vetrov – who worked in KGB's Directorate T (the Soviet STI), revealed the scale of Eastern Bloc espionage in the technology sector, something that was strongly suspected for years. The resulting "Farewell Dossier" revealed over 200 Soviet residents as part of this operation, and led to CIA assessments that US science was supporting the enemy defence industry. A deception operation of immense scale was undertaken, feeding the Soviets false information and faulty designs through the known agents, as well as rounding many of them up.[161] Urban legends surrounding this operation abound, including a 1982 gas-line explosion in Siberia,

[160] Hristo Hristov, *Imperiyata na Zadgranichnite Firmi: Suzdavane, Deynost, I Iztochvane na Druzhestvata s Bulgarsko Uchastie zad Granitsa 1961-2007* (Sofia: Ciela 2009), p. 15

[161] Gus W Weiss "The Farewell Dossier: Duping the Soviets" in *Studies in Intelligence* 39-5, (1996), pp. 124-5

supposedly caused by a computer virus embedded in a component sold through Canada.[162] What is certain is that there was a tightening up of COCOM restrictions, especially in dual-use technologies such as computers. While Bulgaria was not as affected as the KGB was by the Vetrov defection, as it did not focus on military targets, it was blacklisted as the Eastern Bloc state closest to the USSR, and the Bulgarian ministries suddenly found it much harder to trade legally. The US Customs Service launched Operation Exodus to intercept high technology products to the Soviet Bloc countries in late 1982, operating both reactively (reviewing export documents and searching cargo) and in an anticipatory manner (active investigations of trade deals). By 1985 it has seized over 4400 cargos worth over $302 million.[163] These moves had the desired effect, making STI operations more costly, more likely to fail and in general retarding Bulgarian – and Soviet Bloc as a whole – development. In June 1989 the US Office of Scientific and Weapons Research prepared a report for the CIA Directorate called "Soviet Bloc Computers: Direct Descendants of Western Technology". It concluded that the region was likely to remain dependent on acquiring Western know-how into the 1990s, compensating for domestic shortcomings, and that in some areas such as disc peripherals and super mini-computers they were up to 15 years behind.[164] The report notes a multitude of problems such as the inflexibility of Soviet planning, the compartmentalization of knowledge which restricted the flow of information, poor co-ordination between institutes, and intra-bureaucratic disputes, all factors in slow implementation.[165] However, its fifty six pages are also a comprehensive list of the Western

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[162] This story, most likely false, can be found in Thomas C Reed's *At the Abyss: An Insider's History of the Cold War* (New York: Presidio Press 2004)

[163] Bruce B Weyhrauch "Operation Exodus: The United States Government's Program to Intercept Illegal Exports of High Technology", *Computer/Law Journal,* 7-2 (1986), p. 212

[164] OSWR Report CIA/SW 89-10023X, June 1989, pp. iii-v (Available at the CIA FOIA Electronic Reading Room https://www.cia.gov/library/readingroom/; last accessed 21st November 2016)

[165] Ibid., p. 1

technology that the East has copied, such as "many critical parts illegally imported from the West" for Bulgarian IBM-compatible PCs.[166] No matter how much work STI succeeded in, there was simply too much to get, and it was increasingly difficult to do so throughout the 1980s.

Metodiev's analysis of the failure of STI to significantly improve the Bulgarian economy is in the poor implementation of technologies by the actual enterprises and industrial sectors – there was simply only so much the spy could do before the valuable acquisition got stuck between the gears of the creaking system. The economic system was so hyper-atrophied that STI could not help but be ahead of it – it was civilian failure that makes the intelligence community seem so paramount.[167] Yet, it is apparent that through the mechanisms of CAI and close civilian co-operation, STI was key in creating the computer industry and had a myriad of successes in implementation of key technologies which sold well in the COMECON and Global South. More so, through its wide usage of technical evaluators and planners, beyond its agent apparatus, as well as its enmeshment in foreign enterprises, it was a channel for technology transfer on a much wider scale than previously envisioned. The Iron Curtain was not so porous for those in the avant-garde sectors. They had much freer access and recourse to something that essentially functioned as the acquisitions department of an expansive business – in this case, state security was the department and the Bulgarian national state was the business. COCOM made things harder, but never impossible.

Understandably, many surviving participants in the computer industry are reticent to talk openly about any links with the State Security apparatus – a fear of being implicated as an informer of friends and a participant in political repression. However, if the talk is turned towards the role of STI to their work, there are more candid responses. Alexander Tzvetkov,

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[166] Ibid., p. 6

[167] Metodiev, *Mashina za Legitimnost*, p. 114

the director of the ZMG-Razlog, the factory that produced write/read heads for magnetic discs, admits the huge importance of STI work for his own production – "After all, they [the West] was ahead of us while we were ahead of the USSR", and to maintain those positions, intelligence work was crucial. He recalls how his factory acquired Japanese heads that could read on a micron level, something unheard of in the USSR, and the amazement of his Soviet colleagues when he demonstrated it to them – how could the Bulgarians have it while we had no such prism?[168] Stoyan Markov, the last head of the CSTP in the last years of communism and thus the last strategist of Bulgarian socialist science, dismisses any question of STI work as a sensitive topic with the comment that "we all did it", referring to all sides in the Cold War.[169] This view is shared also by specialists not in managing positions as the two above. Nedko Botev and Boyan Tsonev, the lead developers of CICT's sections on magnetic discs and tapes (and winners of the Dimitrov Prize, the highest state prize in the fields of science and art, in 1971 and 1974 respectively), also shared the view that STI activity was natural and not shameful in the conditions of superpower confrontation. "There was the embargo and COCOM…I could read COCOM lists, but we could only buy the lowest capacity discs and devices…and this, in fact, in this isolated system, created the conditions for this market. Because, after all, it exists objectively as progress carries on regardless." Tsonev says.[170] COCOM was thus an enabler for a closed world of socialist market exchanges where Bulgaria could carve its nice among other late-starters to the electronics game – something that would have been impossible if it had gone toe-to-toe with the USA and Japan in the 1960s. At the same time, COCOM could not stop the march of history, as computing technology was the core of the Third Industrial Revolution or the Information Age. Thus, STI

[168] Interview of the author with Alexander Tzvetkov, 6th April 2015

[169] Interview of the author with Stoyan Markov, 28th July 2015

[170] Interview of the author with Nedko Botev & Boyan Tsonev, 23rd June 2015

was a natural approach for any country operating in the Cold War world and which wanted to create a modern economy and society, as the Bulgarian communist regime did.

By the late 1980s, as Zhivkov found that Gorbachev was not willing to play the role of Brezhnev and reduced the flow of assistance to Bulgaria, an internal report reveals how certain analysts viewed the potential of STI work in these changed circumstances. In a 1987 report in which the KGB thanks the Bulgarians for invaluable help in many fields,[171] the Bulgarian writer evaluates this as recognition of the country's achievement, and suggests further investment in this field, in line with the decisions of the 13th Congress of the BCP and 41st Session of the COMECON. By assigning more spies in this field, Bulgaria would increase the professionalization of its cadres and allow it to control the flow of technology between West and East. In fact, surprisingly, he suggests that such a lead allows Bulgaria to keep its eye on the developments not just in the USA but Soviet industries too. In such a way, Bulgaria can guess the future direction of Soviet technology and politics, and pre-emptively change its course, garnering more and more support and praise from Moscow. The surprising report could superficially read as that of a child seeking approval from its parent, yet the writer's interpretation of Soviet need for Bulgarian intelligence was a recognition that STI's close ties to the most advanced Eastern computer industry allowed the country both space for its own endeavours and a lever to extract more support from Moscow.

In a world with obstacles to the free flow of information, technology was highly political. STI was a tool to transfer technological know-how on a huge scale, but the choices made in what to focus on and in what ratios to co-operate with allies were tied to government goals that were very different to normal intelligence work on political developments or internal repression. Under Popov and Doynov this section and then directorate became a window to the West, and an extension of the national economy. It was highly responsive to

[171] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 596

scientists and technicians, putting manuals, source codes and whole computers on their desks, despite embargoes. Its obstinate refusal to care too much about military secrets shows that even the most loyal ally could make its own choices as to what its objectives were. By the 1980s, Moscow was seen as yet another market to keep an eye on, as well as a way to multiple the number of informations gathered. Legal and illegal were, in the end, useless categories for the Bulgarian scientific community. The Iron Curtain was a geopolitical fact, so it had to be punctured. The degree to which this was done, and to which the civilian establishment had a role in it, was unprecedented however. The technological transfer ensured Bulgarian dominance within COMECON, its own closed world with its own rules, a world created in part by COCOM restrictions. But what was created with this acquired know-how operated very differently as a commodity to be sold in the East, West, or the Global South – and what was learnt through these interactions, especially in the sphere of business dealings, was just as important as what was learnt through the STI agents. It was in the emerging markets of the developing world that the Bulgarian computing industry opened another window to the world of global economics, and to that we turn next.

Chapter 4. Entangled Electronics: Bulgaria in India, and the Global South as a Space of Exchange

The international socialist market may have been the most important for the Bulgarian economy, but increasingly de-colonization and the growth in world trade created another space where the state could seek profit. The regime also had ideological reasons to entangle itself in the Global South,[1] driven by a rhetorical commitment to supporting national liberation and anti-imperialist movements. Becoming a major player in the area was the sign of a developed and important society, an obsession for many socialist states. While Zhivkov never harboured the grandiose dreams of his neighbour Ceausescu who fantasised of a Romania as a great world power, he courted, hosted, and bankrolled many anti-colonial leaders and movements, and non-aligned states. Bulgaria would engage the world now that it had industrialised, urbanised, and developed.

Bulgarian technicians and engineers increasingly became a common sight in construction and technological projects throughout North and parts of sub-Saharan Africa, the Middle East, and Asia. Often they were engaged in urban and infrastructure development, agricultural modernisation, and industrial and military enterprises. However, as the computer industry grew, it too turned to the developing world as a space in which to prove itself. The regime was always looking to improve its non-socialist trade, and Bulgarian computers found it hard to crack the Western market, where competition was stiff, technological demands were great, and the embargo already put them at a disadvantageous position from the start. The developing world, however, was a different matter. Regimes and users there still sought the best technology, but for political and financial reasons the inferior Bulgarian products

[1] The term I use is different to how the Bulgarian documents often address the region – Third World and developing world were terms often employed by the analysts. However, Global South captures a wider sense of the newly liberated countries, who differed hugely in their development. It also allows me to include the less developed socialist countries, or those who had socialist regimes for a time, who were not strictly speaking "Third World" in the geopolitical sense, but battled many of the same development problems.

could make their impact in places with less traditions in the electronic sector, which so many of the newly independent countries were. This was even more marked in explicitly socialist states outside of the immediate Eastern Bloc, which favoured Bulgarian computers as the most easily available on the socialist market.

The Global South, however, was not just a place where the regime could sell more computers, and in any case, it could not – in the short term at least – rival the huge and guaranteed COMECON market. Newly independent states were largely committed to projects of industrialisation and development which required technological and economic assistance from whoever offered a beneficial arrangement. They were thus spaces where both West and East competed. As Nick Cullather summarises it:

> Projects were designed for 'display' to produce statistical victories or as carefully staged spectacles dramatizing the fruits of modernity. They were also composed, usually from inception, as 'models', formulas to be replicated at later times and other settings. Finally, narratives defined lines of conflict in development politics. Models were pitted against each other as tests of allegiance and modernizing prowess.[2]

Socialist modernisation was a competitor, something to be proven correct and beneficial for all humanity, and thus a source of prestige. However, the more important facet of this competition was that the West was present in the developing world too. The Global South was a space of potential fruitful exchange, where the Second World could meet the First on the ground of the Third. Despite the looser nature of the Iron Curtain that the previous chapters demonstrated, with significant exchange occurring in the West, Bulgarian technicians were always working in a restricted environment there. In the developing world, however, specialists from the USA, Britain, West Germany, France, Japan and even their own socialist allies, were competing for the same market, and often conversing or observing each other. Bulgarians could thus compare themselves with the most powerful companies and

[2] Nick Cullather, *The Hungry World: America's Cold War Battle Against Poverty in Asia* (Cambridge, Mass: Harvard University Press 2010), p. 5

newest practices in the world of business and computing, and this had a significant impact on domestic thinking too.

The regime had a number of places where it concentrated much of its efforts, above all the Arab world – a great market for Bulgarians arms and construction technicians. However, in Asia it put enormous importance on its developing relations with India. The huge South Asian state was a gargantuan potential market, a playground for the whole world's development experts, and a regime with its own pro-socialist but fiercely independent programs. Zhivkov recognised the country's importance from the 1960s, and fostered extremely close links with it, especially under Indira Gandhi's reign. The experience of the Bulgarian electronic industry in India, a country they increasingly tried to crack and where computers were seen by the socialist state as a way to increase trade and demonstrate Bulgarian economic prowess, shows the deep global connections computing created, and a feedback channel back into the regime's thinking. India had a powerful scientific community, and was heavily protectionist in its attempt to stimulate its own industries. It was also courted by all the globe's leading computer firms, from IBM to Fujitsu, and thus was as difficult as it was lucrative to the inexperienced Bulgarians. The Indian experience, its failures and successes, as well as the engagement with the Global South in general, was a veritable school for technicians, engineers, foreign trade representatives, and managers in the Bulgarian electronic and trade communities. What started as a desire for both profit and prestige developed into an entanglement of ideas, experiences and new techniques of marketing, negotiation and customer relations, that were lacking in the different reality of the socialist market. Electronics, potentially the most profitable field, was also the one where competition was among the fiercest and where new ways of production and presentation were developing throughout the 1970s and 1980s – this made it one of little Bulgaria's most fruitful entanglements with the global community.

Facing South

De-colonisation throughout the 1950s and 1960s created a fertile ground for an avowedly anti-imperialist socialist state, which had itself rapidly modernised and industrialised in the two decades after the Second World War. Bulgaria could now offer finished machine goods but also importantly credits, technical assistance and expertise, and education, to any newly liberated state. This was part of a wider socialist bloc international development effort, led by the USSR with its huge aid to and involvement with many newly liberated states. The small Balkan state started more modestly and slightly later than its more industrially developed partners such as the Czechoslovaks, who were delivering arms worldwide since the late 1940s (most famously, to Israel). Following a similar logic, a 1960 Politburo protocol stated that the first job of an independent state is to form an army, and thus set out a future aim for finding ways to export arms to Iraq, Indonesia, Tunisia, Guinea, Ghana, Morocco, North Korea, Vietnam, China, Mongolia and the United Arab Republic. Such a move would help Bulgaria with its hard currency problems, and the acquisition of Bulgarian arms would capture a market which can then be expanded with other goods, and specialists.[3] This helped pave the way for the creation of "Texim" in 1961, a foreign trade firm founded in Vaduz, Liechtenstein, becoming the behemoth of Bulgarian trade during that decade, mostly on the back of arms.[4] Through it, Bulgaria became the first country to deliver arms to the Algerian national liberation movement, with a 10,000 ton ship arriving in the

[3] TsDA f. 1B op. 64 a.e. 268 l. 3-5

[4] The history of Texim is worthy of a work on its own. Headed by Georgi Naidenov, a trade representative in Turkey and Egypt, as well as a State Security agent, it became a veritable empire of trade and logistics, worth hundreds of millions by 1969, when it was closed under pressure from Moscow. Its assets became the core of the Bulgarian Merchant Fleet, while Naidenov was tried and found guilty of embezzlement, serving 5 years out of a 20 year sentence. In 1992 he re-founded the organisation as Texim Bank, branches of which dot Bulgaria. In many ways, Texim was a capitalist company par excellence operating within a planned economy – precisely the reason Moscow was opposed.

country after a Council of Ministers division in April.[5] Weaponry thus opened the way for wider Bulgarian trade with the South.

Throughout the following years, Bulgarian involvement became wider, more far-ranging and more specialised. Plans were made for a permanent exhibit of Bulgarian produce in Port Said in order to facilitate trade with Egypt, one of the biggest markets;[6] while Bulgarian engineers, technicians and medical professionals became a common sight in North Africa – by the mid-1960s there were over 230 in Tunisia and 700 in Algeria, mostly medical officers.[7] Construction, agricultural and civil engineering projects also became areas in which the state offered more and more help, deepening its connections and exerting influence. For example, Bulgarian engineers and urban planners won contracts in Afghanistan over competing Polish and Czech experts, and Kabul had a marked preference for Sofia's technicians, due to factors such as high professionalism, punctual work and, of course, competitive pricing.[8] Throughout the 1970s, Bulgaria moved beyond its focus on the Middle East and North Africa, engaging more and more countries and becoming a bigger part of the international development markets. Bulgarian specialists were helping Angola in agricultural reform of their Portuguese-inherited fazenda coffee plantations, as well as setting up medical and education services, canning and other food industry factories, metalwork shops.[9] Tanzanians were helped with setting up metal cutting plants, irrigation pump factories, and technical schools;[10] Ethiopia was requesting specialists in civil planning, public health, higher

[5] TsDA f. 136 op. 86 a.e. 523 l. 1-2

[6] TsDA f. 259 op. 17 a.e. 80 l. 1-2

[7] TsDA f. 259 op. 17 a.e. 81 l. 38-43

[8] TsDA f. 259 op. 19 a.e. 382 l. 1-4

[9] TsDA f. 259 op. 44 a.e. 408 l. 2-7

[10] TsDA f. 1B op. 66 a.e. 1950 l. 59

education planning, agricultural and industrial development.[11] A short walk through the archives would throw up the names of most newly independent African and Asian states – there is no need to enumerate them. However, it is important to note the party's thinking in this opening up to the world. It intermingled ideological and economic concerns, as the states "freed from colonial yoke" were seen as serious allies in the struggle against world imperialism but also "beneficial economic partners and in practice should occupy second place [after the socialist world] in our foreign economic and trade activity."[12] The Global South was an ideological battleground but also an economic goldmine – sometimes literally. Bulgaria sought economic benefit from its relations with the developing world, which was also more open to goods that were not as competitive on the capitalist markets. Supporting these states was a prestigious task – it also trumpeted the achievements of Bulgarian socialist modernity, which in a couple of short decades had created a society that could build schools and factories in Africa. The engagement with the Global South was a self-fashioning exercise too.

This was especially evident in the credit and education policies of the state. Despite its debt problems, it became a creditor to the developing world – examples include 5 million levs to Mongolia in 1968,[13] or 3 million dollars to Tanzania in 1972 (in order to finance the delivery of complete sites such as factories).[14] India got a $15 million credit in 1967, too, as part of the attempt to present Bulgaria as a prosperous and important partner to the huge South Asian state (as will be discussed further below).[15] Altogether, between the sort of "inauguration" year of 1961 which marked a more active turn towards the developing world,

[11] TsDA f. 259 op. 44 a.e. 16 l. 115-123

[12] TsDA f. 1B op. 35 a.e. 704 l. 59

[13] TsDA f. 1B op. 35 a.e. 106 l. 2

[14] TsDA f. 1B op. 35 a.e. 3010 l. 45

[15] TsDA f. 259 op. 20 a.e. 501 l. 4

and mid-1976 (the cusp of increased involvement in Africa, especially Angola), Bulgaria extended $600 million in credits to the developing world, $390 million of which to Arab countries. Only 27% had been utilised, however, by 1977,[16] leading the Ministry of Foreign Trade to push for stricter controls of what purchases could be covered by the credit agreements, as well as prioritising machine building exports over surveying and construction work. This indicates the problems of what socialist enterprises could offer and deliver as well as developing countries' own planning problems, but also the fact that credit was also in many ways more important as demonstrating Bulgarian development and internationalist credentials. Alongside credits flowing out of the country, students were flowing in from the developing world, taking advantage of bilateral agreements and Sofia's encouragement of such exchanges. Bulgarian higher education had been one of the biggest success stories of the regime, and this was reflected in the fact that by the early 1970s it led COMECON in the admissions of foreign students to its universities relative to population – in 1972 there were as many foreign students in Bulgaria as there were in the much bigger Poland, and twice as many as Romania.[17] A special school for accelerated Bulgarian language training had been set up – the Nasser Institute – and students were accepted into programs according to what their native country had indicated as priority areas: engineers for Algeria, Peru or Guinea; medics for Yemen and Bangladesh; agricultural specialists for Iraq or Afghanistan.[18] Bulgarian education would not just pass on the specialist subject skills, but also inculcate the right worldview in these students

> The main goal for us with regards to the foreign students is to prepare good specialists, creatively thinking personalities, ready to actively fight against

[16] TsDA f. 259 op. 44 a.e. 129 l. 44

[17] TsDA f. 517 op. 2 a.e. 74 l. 28

[18] Ibid., l. 27

imperialism and neo-colonialism in the name of the national independence and social progress of their countries and nations.[19]

Sometimes, this would have the opposite effect in many ways, especially when concerning students from the poorer socialist countries, like Mongolia. A 1973 Politburo report states that much of their new intelligentsia is trained in the European socialist countries, where they live in good conditions; once they go back they give themselves to drunkenness due to the bad conditions, and develop anti-Soviet and anti-party feelings: "the difference between those who sit on the camel all day, drink kumis and live like how their ancestors did, and those who educated themselves in the capital of an European socialist country, is huge".[20] Yet, overall, education of foreign students (which grew in the later 1970s and 1980s, especially with the influx of Vietnamese students) was both an indicator of increased Bulgarian confidence in their position as a developed state, and a channel for the increased engagement with the world.

This was reflected in the increased trade, which exceeded a combined 1 billion levs by 1978, with over 760 million being Bulgarian exports.[21] Trade was particularly strong with countries who exported commodities that Bulgaria needed, such as rare food items or metals, and above all oil: Algeria, Iraq, Iran each took in over 100 million levs of Bulgarian exports in 1980, with Libya leading the way with over 350 million.[22] The developing world as a whole never managed to become the second biggest group for trade, however, but into the 1980s it developed into a significant trading partner – in 1985 it was to account for just over 2 billion levs of Bulgarian exports and 1.09 billion levs of imports, as part of a total export of

[19] Ibid., l. 38

[20] TsDA f. 1B op. 35 a.e. 4459 l. 52

[21] TsDA f. 259 op. 45 a.e. 351 l. 86

[22] Ibid., l. 139-140

13.7 billion and 14 billion of imports.[23] Despite still trailing trade with the capitalist countries, the balances were positive for Bulgaria (which they weren't when dealing with the West). Bulgaria was increasingly a part of world trade, and was finding success in southern markets which was denied it in the West due to embargoes and the quality of goods. In the south, Bulgaria could profit financially, and politically present itself as an advanced, developed society that could offer expertise, education and cutting edge technology. Computers, as the crowning glory of Bulgarian socialist science, were increasingly a part of this strategy.

Profit, Prestige, Popularisation: Bulgarian Electronics in the South

Electronics followed the path trodden by guns, construction workers, engineers, and medics as the industry took off in the 1970s. Bulgarian computers were exported to a wide variety of developing countries, whether socialist or not – by the 1980s the IZOT files bear witness to such a presence in Algeria, Egypt, Iraq, Iran, Syria, Libya, Mozambique, Angola, Zimbabwe, Nicaragua, China, Vietnam, North Korea, Cuba, and many others.[24] A simple listing would not tell us too much, so the focus on a few deals will show the general aims, developments and effects more fully.

Profit was the over-riding principle in entering many of the markets which the country already had a foothold in. The Ministry of Foreign Trade made the entry of electronics into the Syrian and Libyan market a priority in 1977, after Bulgarian development experts had been in the countries for a number of years assisting on construction and infrastructure projects.[25] The report states that machines must become the over-riding export to them, and computers are to take the lead, tapping into an existing but unfulfilled potential. "Our

[23] TsDA f. 259 op. 45 a.e. 353 l. 44-46

[24] TsDA f. 1003 op. 1 a.e. 28

[25] TsDA f. 259 op. 44 a.e. 131

products must be realised against convertible currency", it goes on to say, as this was one thing that the regime lacked the most while needing it to purchase the latest technology from the West.[26] Egypt, too, is targeted in the same report – trade must reach 220 million levs by 1980, but due to the fact that Bulgarian electronic machines had been there for a number of years, the strategy was to be not plain export but the setting up of joint bureaus to service and upgrade the ES-1020 computers delivered, with the view of fostering increased confidence among local users and the creation of further computer centres with the machine and the newer IZOT-310, thus expanding an already existing market.[27]

New markets opened up in sub-Saharan Africa too, and beyond. In 1981 an ES-1035B computer centre was sold to Mozambique.[28] The driving force behind the sale of the newest processor that Bulgaria produced was to garner profit, and to create a market where there wasn't yet one – the sale of the computer would mean continued profiting from spare parts, peripherals and disc drives.[29] Bulgarian foreign trade officials had noted that the country had just created a Centre for Data Processing, and they jumped in to make sure that their machines would be the ones to equip it. Immediately, the Mozambicans were flown out to Sofia to meet representatives of KESSI, the Bulgarian committee for the creation of a nation-wide information network of social data. It seems to have worked, as the ES-1035 sale went through, despite problems that will be addressed further on. A similar tactic was employed with the Nicaraguan regime,[30] who also bought an ES-1035 computer centre in 1981.[31] With others, Bulgaria was even more proactive – in 1983 it gifted Zimbabwe an IZOT-1007S

[26] Ibid., l. 44

[27] Ibid., l. 78

[28] TsDA f. 37A op. 10 a.e. 11 l. 8

[29] TsDA f. 259 op. 45 a.e. 848 l. 6

[30] TsDA f. 259 op. 45 a.e. 203 l. 12

[31] TsDA f. 37A op. 10 a.e. 11 l. 8

computer, coupled with free training in Bulgaria for some of their specialists.[32] This was a move calculated both due to internationalist support of the regime, but also – as in Mozambique – to basically set up a market segment that could be expanded from then on.[33] This was a success, as by 1987 Izotimpex was the best performing foreign trade organisation there, selling 3 million deutschmarks worth of computers and copiers, often at three times the price it would fetch on the capitalist market. All this was also seen as a good springboard for expanding operations into neighbouring Tanzania, where contacts had already been made.[34] Angola, Afghanistan, and Nigeria were also seen as potential cases for similar expansion, to be done through the offering of SM-4 minicomputers; the ES-1035 systems were seen as good ways to enter these as well as the Ethiopian and Yemeni markets.[35]

In all these cases we can see the interlinking, however, of prestige and profit motives, with both having a role to play. Positioning itself as the country to equip these developing countries with high technology tools for data processing, Bulgaria was also trumpeting its own socialist success. The scientific-technical revolution – a term that had become by the 70s the ideological content of Soviet and Bulgarian socialism as we will see in the following chapter – was at home in Sofia, this demonstration showed, and if Mozambique, Zimbabwe and Nicaragua wanted to enter the new age where computers would be key to national development, Bulgaria was perfectly placed to pave the path with electronic expertise. This entanglement had been evident in previous Bulgarian efforts in Africa, when telecommunications experts were sent to Angola in addition to irrigation and medical experts which were requested by the government in order to set up the basics of its economy and

[32] TsDA f. 830 op. 2 a.e. 3 l. 4

[33] TsDA f. 830 op. 2 a.e. 27 l. 28

[34] TsDA f. 830 op. 2 a.e. 28 l. 6-7

[35] TsDA f. 830 op. 2 a.e. 87 l. 5-6

social provision: Bulgaria insisted on being well placed to provide it with the most modern radio and TV stations, too, which would be key to consolidating the regime.[36]

With the increased sophistication of Bulgarian machines into the 1980s came also more domestic applications for the machines, such as in industrial robotics and automation as well as the creation of information systems in banks, libraries, universities and social ministries. Thus, the foreign trade ministry increased its onus on electronics as a display of the regime's technological prowess. When it became clear that the Bulgarian Trade and Commercial Chamber was planning on presenting no electronics at the 1980 National Exhibit in Tripoli in Libya, IZOT, supported by the ministry, insisted on revising the project. Given free reign, the computer union flooded the Bulgarian exhibit with ES-1035 machines, the newest version of the ESTEL system of tele-processing (a key export to the USSR), the minicomputers of the SM-4 type, and various means of "engineering labour automation" such as CAD systems.[37] This focus reaped benefits in Libya throughout the 80s as by 1987 IZOT was readying the export of complete electronic labs to local colleges and research institutes, while hosting Libyan specialists in computing and automation.[38] Furthermore, the two sides signed an agreement for the joint development of programs and "means of information technology", with the Bulgarians taking the lead role in training local Libyan experts.[39] By the end of the socialist era, Bulgarian experts in informatics were wide-sought in the socialist-aligned world, with Vietnam requesting their technicians (rather than Soviet ones)[40]

[36] TsDA f. 378 op. 1 a.e. 1101

[37] TsDA f. 1003 op. 1 a.e. 14 l. 34

[38] TsDA f. 259 op. 45 a.e. 832 l. 2

[39] Ibid., l. 25

[40] As we have already seen, IZOT and CICT files show the heated debates within COMECON, where Bulgarians often defended their positions vis-à-vis Moscow successfully. This will be picked up again in later chapters.

to come and investigate ways to apply microprocessor systems to the national economy in 1985.[41]

However, these foreign markets were not just a place to earn money and to raise socialist prestige. In two significant ways the market of the developing world was linked to the domestic one – in both technological and business terms. Bulgarian socialism was much more open to experiences with these countries than with Western ones – usually not by choice, thanks to COCOM. But going out to develop technologies with local clients often overlapped with the developments of the same technologies back home too. Bulgarian computing, despite being conceived as an export industry, spawned a veritable intellectual boom back at home too, with the vistas of automation and computerisation opened up before the regime as well as experts (the subject of the following chapters). These were, of course, part of world-wide trends. Two cases can illustrate this point. The first Bulgarian computerised supermarket opened in 1977 in Sofia, with a central computer connected to electronic tills.[42] Its threat to the socialist "grey" economy is part of next chapter's story but it wasn't just a domestic story in isolation – in 1975 Bulgaria had signed a contract to build 54 supermarkets "with a high degree of automation" in Libya. The Ministry of Electronics was to participate and seek ways to create the most modern shop for the Libyans, complete with automated inventory tracking and accounting.[43] The planning and building of this massive contract in North Africa was thus connected to domestic computerisation – Libya was a field to try out the new technology, and a test of what could be done at home too. Bulgarian computerisation of logistics in warehouses and inventory was a priority area from the very inception of the industry, and was already making the country a preferred partner in such

[41] TsDA f. 37A op. 9 a.e. 8 l. 102

[42] Albena Shkodrova, *Sots-Gurme: Kurioznata Istoriya na Kuhnyata v NRB* (Zhanet 45: Sofia 2014), p. 176

[43] TsDA f. 259 op. 44 a.e. 449

projects – since 1971 it had concentrated on creating the IZOT-0310 (analogous to the Western PDP-8/11 series of computers) for uses in such enterprises, together with dedicated program packages.[44]

Similarly, in the 1980s, Bulgarian education became increasingly computerised – classes in programming entered most schools, while the DKMS (the Dimitrov Communist Youth Union, the country's youth organisation) opened up a network of computer clubs in all major towns, aimed at education children and training adults to use this new technology (again, more on this in the following chapters). In this case, these domestic programs were exported abroad as both a showpiece of the power of the Bulgarian personal computer and its accompanying education possibilities, and as a model for education in the new age in general. Programmers and teachers employed by the DKMS clubs were sent to set up such a computer centre of 20 Bulgarian PCs for the Hanoi branch of the Vietnamese Communist Youth Union, and specifically for its Central Committee. With Bulgarian support it grew to be the biggest in the area, and the only one that the Vietnamese party deemed good enough to train programmers, concentrating all software development education in it. At the request of the Vietnamese leadership, the contracts of the Bulgarian experts was renewed for a year in order to create a bigger cadre of local programmers that would create the basis of computer education in the city. They delivered 52 lessons per course through a local translator, teaching local students the basics of computer languages such as BASIC, DOS operating systems and Bulgarian specialised software. While the computers themselves worked well, only one of twenty floppy drives were delivered in working condition, so often they had to improvise while awaiting the technical documentation that would allow local repairmen to service them. Still, it was a success, testified to by being given the task to automate certain internal

[44] TsDA f. 37A op. 4 a.e. 11 l. 10

administrative duties for the party's Central Committee.[45] A similar club was set up in Pyongyang.[46] In a similar vein, Bulgaria was also contracted to equip up to 4800 modern classrooms for the study of electrical technology, automation and mechanics in Nigeria, a reflection of IZOT's growing prominence as a trusted supplier of advanced education equipment too.[47]

Other socialist states outside of Europe also proved willing recipients of Bulgarian technology. The North Korean leader Kim Il Sung had, in a 1973 meeting with Zhivkov, had stated that small states such as theirs had to concentrate on their relative scientific strengths rather than attempt the multi-faceted development of large states such as the USSR, and thus technical co-operation between the two countries should complement each other.[48] By the end of the decade, North Koreans were thus importing whole computer centres from their Balkan socialist brothers.[49] By 1985, when the DPRK wanted to create a domestic electronic base, it was specialists from IZOT and CICT who were sent to help in plan four factories for the regime.[50] The huge Chinese market was also cultivated, with specialised IZOT advertising brochures in Mandarin being prepared,[51] as part of a push to become a partner of the PRC's electronic industry in the few years before the fall of Zhivkov and the events of Tiananmen Square. From 1985 Bulgarians were to participate in developing computer-controlled telephone exchanges, printed boards, automated warehousing, and the production

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[45] Arhiv na Ministerstvo na Vunshnite Raboti (Archive of the Ministry of Foreign Affairs; henceforth AMVnR) f. 20 op. 43-5 a.e. 136 l. 7-17

[46] Ibid., l. 19

[47] TsDA f. 830 op. 2 a.e. 90 l. 23

[48] TsDA f. 1B op. 35 a.e. 4459 l. 34

[49] TsDA f. 830 op. 2 a.e. 21 l. 5

[50] TsDA f. 37A op. 9 a.e. 8 l. 48

[51] TsDA f. 830 op. 2 a.e. 91 l. 78

of computer keyboards.[52] Problems of poor planning and different expectations by both sides hampered and slowed down work, as the Bulgarians felt the Chinese wanted just to get their hands on documentation and specifications without giving anything in return[53] (never mind that many of those documents were copies of Western ones). Still, in the last months of 1989 Bulgaria was preparing to co-operate in ferrite materials for magnetic memories as well as integrated microprocessor systems for automation in industry.[54]

A final, and key, element of the opening up to the South was the possibilities of getting high technology and especially cheap, Western-type elements to supplement the creaking and poorer quality Soviet and East German ones. No computer architecture innovations or software brilliance could offset the poor reliability of socialist integrated circuits and transistors, often meaning the machines ground to a halt through no real fault of the engineers. The 1980s rise of the Asian Tigers, however, meant that Bulgarian trade with them could circumvent COCOM more easily, as these states were even more willing to trade with the communists than Japan in the 1960s. By 1986, Izotimpex was looking to Singapore above all as a potential deliverer of $13.5 million worth of Japanese FANUC elements for the use in processors and robotics. They were seen as great partners due to competitive prices, the ability to deliver goods that were in the embargo lists, a wide range of available equipment and short delivery times,[55] often key for resolving production bottlenecks in the last months of the annual plans. The Global South was thus a market from which to buy too, especially once some of the economies became highly industrialised suppliers of cheap electronics themselves.

[52] TsDA f. 259 op. 45 a.e. 677 l. 3-31

[53] Ibid., l. 53

[54] Ibid., l. 68

[55] TsDA f. 830 op. 2 a.e. 91 l. 69-71

These scattered examples, however, are best seen through the prism of a single case study. The Indian market was the biggest developing market identified by the Bulgarian regime, and was a rich but also challenging environment for the computer industry. Relations between the two countries received a huge boost with the Indira Gandhi visit of 1967, soon after she came to power, which inaugurated extremely close relations between the two countries right up to the 1980s. Until 1984 there were 14 visits at the highest level (minister of foreign affairs and above), including repeated Zhivkov and Gandhi visits to each other's countries. For Bulgaria, Indian trade sometimes was eclipsed by trade with North African and Middle Eastern countries (where oil revenues inflated the trade figures hugely) but the country retained a deep draw to the Bulgarian regime and experts. A look at the successes and failures of the computer industry there ties together many of the threads explored above, while revealing how Bulgarians had to learn to interact with new actors: a self-consciously protectionist state that aimed at fostering indigenous production in a labour-rich economy; a range of Indian firms; and Western companies operating in India too.

The Rose Meets the Lotus[56] on a Computer Field

The first treaties concerning economics and trade between the two countries were signed in 1956,[57] but the links between the two countries became more active following 1967. On the 2nd of May that year both the Bulgarian CSTP and the Indian Council for Scientific and Industrial Research (CSIR) signed an agreement on Scientific-Technical Cooperation, which established a joint committee to coordinate research and exchange in the area, during

[56] The motif was repeated often in Bulgarian-Indian relations, including in Indira Gandhi's speech at the official dinner during her 1981 visit to Bulgaria; AMVnR f. 20 op. 38 a.e. 1171 l.45

[57] TsDA f. 259 op. 20 a.e. 501 l.95

the visit to India of Tano Tsolov, the then executive director of the CSTP.[58] Its Article One stated that

> The signatory countries will help and spur the development of scientific and technical cooperation in the fields of industry, transport, building, agriculture, medicine, fundamental sciences, nuclear research and other [areas].[59]

There were also provisions for personnel exchanges between institutes and universities. The agreement also provided a $15 million Bulgarian credit, and a promise to increase trade massively by 1975, the year in which India projected it would take $19 million in Bulgarian machines alone (more than all trade between the countries in 1967).[60] That same year, an exposition in New Delhi for the first time advertised Bulgarian technology to the Indian market. The key display was of telecommunication devices and large computers for factories, and this was followed by a similar exhibition in Madras in 1968.[61]

Pic. 1: Gandhi's visit to Bulgaria, 1967 (Source: Spomeni.bg)

[58] Ibid., l. 98

[59] Ibid., l. 106

[60] Ibid., l. 7

[61] Ibid., l. 96

This was part of increasing links between the two countries at the highest level, as the newly elected Indira Gandhi made Bulgaria one of her first ports of call on her first international trips abroad, visiting Sofia in the middle of October in 1967. India became a priority area for Bulgarian propaganda in Asia from the following year, being put in first place among the countries on the continent,[62] reflecting the leadership's desire for closer links with the huge state and access to a growing and potentially gargantuan market. Overall, until 1984, there were fourteen high-level visits between the two countries, at the level of foreign minister or above, the largest such commitment by Bulgaria to any non-socialist country, and that is without counting seven separate visits by the chairmen of the Indian National Congress to Bulgaria too. The meetings between Zhivkov and Gandhi inaugurated close links in political and economic terms, with both leaders commenting that in their view the two countries shared many similar economic obstacles and challenges, stemming from the challenge of development, and that close co-operation and a division of labour would benefit both.[63] This became the general line held between the two countries throughout the period, pushing for more and more of a division of labour, in which Bulgaria sought raw resources and luxury food materials it sorely lacked. In return, the Bulgarians strongly pushed through their electronic goods, making them the centrepiece of every fair and marketing campaign in front of Indian businesses, bolstered by a 1974 "Program for Long-Term Co-Operation in The Area of Computing Technology".[64]

At the start of such co-operation, Bulgaria faced a major challenge. Here it was dealing with a country with its own history of developmentalist politics. The Indian National Congress's decision to follow socialist-style national development dated to its third congress

[62] TsDA f. 1B op. 35 a.e. 138 l. 16

[63] TsDA f.378 op. 23 a.e. 1107

[64] TsDA f. 378 op. 30 a.e. 1205 l. 9

in 1938,[65] while the British Colonial Development Act of 1940 had also set the newly independent state on a commitment to state involvement in the economy, which it would reverse fully only in 1991. The Indian government had created a "List No.1" which listed imports that were to be rejected outright under its 1951 Act of Industrial Development and Regulation, with the paramount item on this list being any electronic and computational device.[66] At the start, thus, Bulgarian technical exports were mainly in the field of agricultural machines, such as tractors. However, from the very start, the Bulgarian side tried to find loopholes and ways to get its "golden" export onto the Indian market. In its 1967 long-term program for foreign trade with India, it noted the lack of involvement by "Elektroimpex", the state union charged with exporting electrical goods, and stipulated it should form its own long-term plan to break onto the market.[67] "Elektroimpex" exploited the slow progress of India's own electronics and electrical industry from 1969, managing to export its first televisions there and signing an agreement with the Indian telecommunications company "Telefunken-India" to export radios and communications equipment.[68] The Ministry of Foreign Trade noted this favourably and suggested that the company should seek to create further links by asking for payment not in cash, but Indian component goods or ferrite materials needed for the construction of these devices, thus creating a return avenue for more completed Bulgarian goods. Bulgarian technical diplomacy in the late 1960s thus, at least partially, aimed at subverting India's protection of its domestic producers in order to secure larger profits.

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[65] Sugata Bose "Instruments and Idioms of Colonial and National Development: India's Historical Experience in Comparative Perspective" in Frederick Cooper & Randall Packard (eds), *International Development and the Social Sciences: Essays on the History and Politics of Knowledge* (Berkeley: University of California Press 1997)

[66] TsDA f. 259 op. 20 a.e. 501 l. 60

[67] Ibid., l. 18

[68] TsDA f. 259 op. 19 a.e. 385 l. 7

Furthermore, from the 1967 co-operation agreement onwards, the two countries did achieve concrete results in their "division of labour", talked about by Zhivkov and Gandhi. The program proposed to and accepted by the Indian representatives set out plans for specialisation of industries on both sides as to complement each other. Documents from the Foreign Trade Ministry list electronics elements produced in India that can be imported into Bulgaria and ease the work of the fledgling computer factories. In 1970 a document titled "Co-Operation and Specialisation 1971-75" set out that "Kintex", the premier Bulgarian export conglomerate, could agree specific areas in telecommunications and computers, where each country would agree on importing specific items from the other for a period of up to five years (with an option to renew at the end), and thus stop specialising in that particular area. Bulgarians sought imports in radio technology from "Siemens-India", but carved out a bigger niche for their own return exports, especially components for televisions, transistor and analogue computer technology, in order to make Bulgarian factories indispensable to the Indian electronics industry.[69] This was part of a wider Politburo move, discussed in 1970, towards seeking a partial division of labour with India and the Arab countries, which were seen as both major trade partners and ones with more promising economic capabilities, especially in possessing key raw resources. The strategic aim with such states was to "create the basis for long-term binding of some of our sectors of economic activity on the basis of partial division of labour between our country and the interested developing states".[70] Little by little, Bulgaria was thus cracking the Indian market and creating the space for its own exports.

The South Asian state was morphing into an obsession for Politburo's foreign policy and international trade thinking, much as it had been a part of its turn towards supporting

[69] TsDA f.259 op. 19 a.e. 341 l. 134

[70] TsDA f. 1B op. 35 a.e. 1202 l. 204

national liberation. This was helped by India's closer links to the socialist bloc following the war of 1971, when Bulgaria and the rest of the Bloc backed India and recognised Bangladesh immediately – as the US State Department put it immediately after the conflict, the USSR (and the rest) had backed the preeminent power in the region, and were now to reap increased clout.[71] As Gandhi noted later, in a meeting with Stanko Todorov in 1974, "friendship is felt in such heavy moments, and we were assured that in this difficult for us moment Bulgaria remained true to its principles".[72] Moving to capitalise on the geopolitical significance of the Indian victory and socialist support for it, in 1972 the country was placed at the centre of the Asian cluster of countries, links with which were to be strengthened due to their huge populations and relatively high development in some industrial sectors.[73] India specifically was the main aim of Asian trade and the long-term plan was that

> …trade with the Republic of India in the next 10-15 years will be aimed at the embedding into the Indian market and the expansion of sales of our machine industry, including items from the electronic industry, electro-technology, chemicals, pharmaceuticals, complex objects and others.[74]

More so, India was one of the potential countries that could provide certain machinery and equipment that Bulgaria desperately needed from the capitalist countries, but at better prices and with less problems.[75] All this would require closer co-operation and new forms of joint work, in order to circumvent the customs barriers that developmentalist states put up.

By 1974, Bulgaria was still however only exporting miniscule amounts of electronics - $43 thousand in the first eight months of the year.[76] In general, Elektroimex had managed to

[71] Washington National Records Office, OSD Files; FRC 76-0197, Box 74, Pakistan 092 (Aug-Dec 1971), Memorandum for the Secretary of Defense

[72] TsDA f. 259 op. 36 a.e. 520 l. 14

[73] TsDA f. 1B op. 35 a.e. 3079 l. 98

[74] Ibid., l. 99

[75] Ibid., l. 139

[76] TsDA f. 259 op. 36 a.e. 522 l. 41

make some inroads such as covering parts of the economy's needs for cables through India,[77] but Izotimpex had not managed to capitalise on these links in the sector. Ivan Popov had already made it his aim to rectify this, taking particular interest in co-operation with India. In July 1974 Professor MGK Menon, the head of the Indian Department of Electronics,[78] visited Bulgaria in response to Popov's invite, and the two discussed a deeper and more fruitful co-operation in computing. They finalised the precise details of the co-operation program handed to the Indian government by Todorov during his March visit, working out relations between institutes, the possibilities of joint production and entry into third markets, and complimentary areas of science, while Menon was familiarized more closely with the Bulgarian computer nomenclature. He called the country's achievements "imposing", and assured Popov that India would take its side of the co-operation seriously – the beginning stages were always the most difficult while "we can build up inertia".[79] This only strengthened Menon's general support for Eastern European machines over those from the West, and especially IBM, which was communicated to Indira Gandhi during 1974.[80] This was driven by a particular government policy in electronics, stemming from earlier protectionism, but also was part of the very different socio-economic environment that the Indian electronic industry operated in. India's electronic policy was tied to its own development goals, and we must look at they were in the late 1960s and early 1970s, the

[77] TsDA f. 259 op. 36 a.e. 524 l. 345

[78] Menon was the premier scientific administrator in India during the 1970s, the perfect counterpart to Popov. He was a protégé of Homi Bhabha, the founder of atomic research in India, and succeeded him as the head of the Tata Institute for Fundamental Research upon his mentor's death in 1966. From 1971 he was the head of the Department of Electronics, and eventually head of CSIR itself. His last administrative position was in 1990 as Minister of Science. He was the man who took on IBM in India, and the one who set up the foundations of the Indian electronic industry. At the start of 2016, his personal archive has been handed over to the Nehru Memorial Museum and Library, but it has not yet been processed sadly.

[79] TsDA f. 1477 op. 30 a.e. 1210 l. 14

[80] National Archives of India (henceforth NAI), List 193; 17/855/1974 PMS, pp. 8-9

moment when the two states were still struggling to find the best way to trade with one another.

The Computer versus the Worker: India's Electronic Landscape

The Indian government had its own set of different problems when faced with computerisation and the implementation of electronics into the economy. In a labour-rich country which added around one million new workers per month in the early 1970s,[81] any devices that could lead to labour-saving were difficult to square with the need to find gainful employment for the growing population. The Gandhi administration was frank about such problems in its internal reports – the pace of development had slackened by 1970, inequality of wealth was widening, monopolies were growing and accentuating unemployment, which was even more marked among the educated and technical personnel. Such people had to be employed by giant schemes of rural improvement, such as the electrification of villages, yet money was lacking as the government also faced huge tax evasion problems.[82] At the same time, like many other states including Bulgaria, India looked to its scientific institutes as a source of technological solutions to economic problems – CSIR's research had to be an integral part of the country's development plans,[83] led by someone

> …who should be able to visualise the critical role that science and technology have to play in the economic development of this country and, in addition, be capable of translating this vision into practical schemes of research and development.[84]

This man was to be Menon, who pushed for a more active role of the CSIR and the Department of Electronics in national life. A 1972 ministerial meeting recognised the country's significant developments in scientific capability, which sadly lacked a national

[81] NAI, List 193; 17/635/74 PMS, p. 1

[82] NAI, List 193; 17/635/70 PMS, pp. 1-4

[83] NAI, List 193; 17/802/71 PMS, p. 1

[84] NAI, List 193; 17/3/71 PMS, p. 17

scientific technical plan that would lead to increased self-reliance.[85] However, attempts to decide what such a plan was to prioritise had to face the problem of the abundant labour force in India, where automating jobs was not necessarily what the government, or society, wanted.

Often, this led to unrest as was the case of the Indian Oxygen Ltd. Company, which tried to install a British ICL 1900A computer in its Calcutta offices in 1974. The workers' trade union protested, going as far as writing to Indira Gandhi to state that it

> …has warned the company of the inevitable labour unrest if the scheme for this full-fledged automation was not abandoned. The workers in the fold of the Congress-led union IOSKC have also expressed strong resentment against this sinister move on the part of the Company-management. The installation of a giant computer like this is bound to affect the interest of the entire workmen, endanger the security of their service, and substantially reduce the employment potential. At a time when the people of the country and the Govt. of India are seized of the grave and acute unemployment problem, how could this Company go in for full-fledged automation?...May I request you to take immediate steps so that the said Company is restrained from installing the computer, in the larger interest of the nation?[86]

This problem was already seriously considered a few years before, in a book by two trade union activists and MPs with links to the independence movement, who were also experts in electronics.[87] The book tackled a problem that was serious for the government (Kulkarni was a member of the government's Automation Committee; and the Finance Minister wrote the foreword) and argued that computerisation in developing countries must proceed differently to how it as in the developed world. Fear amongst workers arose due to the "unknown and the displacement of labour", much like the Luddites reacted to mechanisation.[88] Toeing a careful line between a recognition of the fact that these machines were the future, the book sounded a warning that the increase in productivity they would lead

[85] NAI, List 193; 17/1702/1972 PMS, p. 3

[86] NAI, List 193; 17/855/74 PMS, p. 10

[87] K R Bhandarkar & Raja Kulkarni, *Computer and Labour Problems in India* (Bombay: United Asia Publications 1971)

[88] Ibid., p. III

to can lead to "greater hardships for a large number of people, till such time the super profits are utilised to multiply industrial activity with the avowed objective of absorbing surplus labour".[89] In this period, at least, the government must be closely involved in computerisation, in order to defend labour interests in the face of the profiteering management class. This was especially important in a country like India which was at the same time undergoing, in their view, the change from a rural and extremely backward society ruled by traditional customs to a scientific and individualistic society, and the government was not taking this seriously: "the challenge of a rapid change from a traditional, custom oriented society, to an individualist and cooperative economic oriented society required for the growth of modern technology, is still not reckoned with seriously."[90]

At the same time, the country's protectionism that the Bulgarians had ran into in the 1960s, was turned towards other areas too. Gandhi herself commented in 1972 that "our experience of foreign collaboration has not been a happy one", with import of technology that was meant to improve Indian export capacities often failing to do so as the foreign collaborators failed to establish a substantial home base in India. "The capacity to design and prepare engineering drawings is at the heart of any nation's industrial capacity", yet the country had not seemed to build up this sector, instead letting many engineers languish without work.[91] Cabinet discussions concentrated on precisely the issue of whether the foreign firm was aiming to establish production capacities within India, and to train local workers. Factories set up in the country should also present research and development plans that showed how they would benefit the local workforce and know-how.[92] These discussions

[89] Ibid., p. 61

[90] Ibid., p. 102

[91] NAI, List 193; 17/1596/72 PMS, p. 6

[92] Ibid., p. 4

were strengthened by the presentation of an UNCTAD study on multinational corporations, which

> …only reinforces the evidence which has been accumulating from many different sources over the last few years, that the activities of multinational corporations are inherently inimical to the self-reliant advance of developing countries.[93]

Foreign involvement, and the use of foreign technical expertise, the government was starting to feel, was creating dependence on external assistance – a view shared by Gandhi herself, creating the environment for a concerted protectionist push.

One of the ways to solve these problems was the passing of the Foreign Exchange Regulation Acts, passed in 1973-4 but not taking until 1977-8 to be put into full effect. Requiring foreign companies to reduce their equity in subsidiaries in India to 40%. The high-profile casualties of this regulation were Coca-Cola and IBM. The Indian government criticised IBM for the fact that its appearance on the Indian market in 1952 did not result in the introduction of high technology into the country, often bringing in obsolete equipment that was in fact second-hand and "re-purposed" but still sold at the original price.[94] IBM preferred to rent computers to local users, building up its assets into a monopoly, and its suggestions to comply with the FERA acts were insulting in their brazenness – they wanted to maintain 100% of their export unit and 80% of all foreign currency earnings.[95] "Dumping obsolete equipment in the country"[96] was a charge that IBM was not usually faced with, but the ongoing debate about the company's practices created the space for Eastern European computers to find markets in India. For example, in 1974 the purchase of an ES-series computer from the USSR for Roorkee University was justified as the fact that the Soviets

[93] Ibid., p. 1

[94] NAI, List 193; 17/855/77 PMS, pp. 2-3

[95] Ibid.

[96] Ibid., p. 39-corespondance

were offering a brand new system, with a price that included training and a spare parts package. The IBM offer, of an IBM 360-44, was in fact for a second-hand Belgian machine that was no longer in production, so the slightly lower price would come back to harm the university as spare parts were no longer in production and would be extremely costly to purchase. The Eastern machine also came with a full set of program packages, and at the end of the day, it used the same internationally accepted programming languages that American machines did so there would be no need to retrain specialists[97] (in fact, the ES series was envisioned in part as an IBM clone precisely for such reasons).

This turn to Eastern Europe in general was helped by the setting up of the Electronic Trade and Technology Development Corporation (ETTDC) in 1973, in order to explore what the Eastern market could offer India. The aim was to switch imports from hard currency areas to Eastern European sources, and the Department of Electronics (DoE) was to

> …see that products which <u>can</u> be imported from Eastern European sources <u>are</u> imported, even if the public sector corporation wishing to make the imports <u>initially</u> indicates a Western source of supply [their emphasis].[98]

Eastern European computing benefited from this new policy and focus precisely because it didn't operate like the multi-nationals. It was not yet setting up production plants within India, and its offers were always aimed at joint development and mutual deliveries of products, encouraging Indian participation and improvement. The delivery of training, joint projects, and promises of taking in India electronic imports were a far cry from the strategy of companies such as IBM, which were pushed out in the 1970s, leaving a huge and obvious market niche for the socialist states. Despite India aiming to spur its own computer development, it still did not produce the sort of computers it needed and had just kicked out of the country.

[97] NAI, List 193; 17/855/74 PMS, pp. 1-3

[98] NAI, List 193; 17/1533/74 PMS, p. 2

The Bulgarian Entrance: Developments in the 1970s

The Bulgarians took advantage of such developments immediately. In 1973, they managed to score their first "hit" on the Indian market – the sale of an ES-1020 system to equip the new computer centre at Jawaharlal Nehru University (JNU) in New Delhi, the leading university in the country. The sale was finalised in 1974, complete with disc packages and other peripherals.[99] Electronics was seen as a key part of the expanding volume of trade between the two countries (starting in the mere thousands of dollars in the 1950s, it had reached over $60 million in 1974, a significant number for Bulgarian non-socialist trade).[100] The computer centre was to be the thin edge of the wedge, so to say, as Bulgaria was to study the Indian need for large and middle computer machines up to 1980, and Izotimpex was to set up its first computer-only exhibit in New Delhi in 1976.[101]

In fact, as part of the 1976 Zhivkov visit to the country, it was only electronics that was called the "strategic" sector for further trade development between the two nations, in order to secure a "permanent placement" on the Indian market.[102] However, to do so there were problems to overcome. The Indian embassy was one of the most active in promoting the need for advertising and technical service reforms since the activation of bilateral links in the late 60s. In 1968 it wrote to the Ministry of Foreign Affairs to ask them to "convince" the Ministry of Foreign Trade to put aside more money for advertising, as competition in India is overwhelming; articles and advertising materials were to be of high quality and written by specialists and to reflect our latest technological advances.[103] Priority was to be given to the

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[99] AMVnR f. 20 op. 32 a.e. 1335 l. 63

[100] Ibid., l. 56

[101] Ibid., l. 63

[102] AMVnR f. 20 op. 32 a.e. 1338 l. 9

[103] AMVnR f. 20 op. 24 a.e. 1300 l. 6

machine building and electric sectors.[104] It also criticised responses to Indian firms and unions as "too formal", with no attached documentation, which was unacceptable for the market.[105]

These critiques had some result – IZOT did fix some of the machines in the same year, "upholding the prestige of your enterprise and of Bulgaria."[106] The embassy itself stepped up its promotion campaign, making Bulgarian engineering products and electronics the centrepiece of its magazine "News From Bulgaria" which until then was dominated by cultural and political news.[107] The late 70s saw a steady improvement in Bulgarian deliveries and services, with timely tests for the new disc drives and ESTEL tele-processing system requested by the embassy, noting that the first sales to JNU had to overcome so many problems, not least stiff IBM competition:

> Keeping in mind the nature of the good and its complexity, the Indians were hesitant to import them from Bulgaria. Many times it was stated that they are importing trial runs and singular items and the future orientation of India towards import from Bulgaria will depend on the quality of work during the testing period, the service quality, documentation, the data of the devices during their usage etc…It was in the interest of Bulgarian electronic export to India to note that our departments must look for ways to realise the import of Indian electronic goods as was decided in the protocols of the joint subcommittee between the two countries in this sector. It is obvious that this country is looking critically at the inertia of the Bulgarian partner in importing Indian electronics into Bulgaria.[108]

This was in fact a key request of the Indians – continued Bulgarian imports were dependent on Bulgarians taking in more Indian computer products. In effect, this often meant components, cables and, above all, software. The second meeting of the Joint Bulgarian-

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[104] Ibid, l. 4

[105] AMVnR f. 20 op. 24 a.e. 1305 l. 27

[106] AMVnR f. 20 op. 32 a.e. 1388 l. 11

[107] AMVnR f. 20 op. 32 a.e. 1375 "News From Bulgaria" Issue 11 of 1976, p. 13

[108] AMVnR f. 20 op. 32 a.e. 1417 l. 30-31

Indian Committee on Scientific-Technical Cooperation had already identified Indian software that was fit for Bulgarian needs, as well as items such as oscilloscopes, computer relays and other electronic instruments which Bulgarian labs could use. IZOT was ready to buy the first batch of software, costing around forty thousand roubles, seeing it as partial compensation for Bulgarian deliveries.[109] This policy continued in the following years, allowing IZOT to place its ES-5053 disc drives and ESTEL system on the market with timely demonstrations in exchange for $50 thousand worth of software purchases.[110] In 1975 already there were orders for 250 discs of the ES-5053 type, and 20 for ES 9002 magnetic tape units – part of a general 77% growth in trade between the two countries in the 1972-5 period.[111] IZOT also vowed to study Indian firms' abilities to produce various components, elements and applied software in order to expand purchases from the country.[112] The aim was "coordinating the redirection of import of some components from the 2nd line towards India" (the "2nd line" was the regime's parlance for import/export to the capitalist world), which would be cheaper and less problematic, and in keeping with the 70s plan for an international division of labour between the two countries.[113]

Bulgarian trade in electronics grew steadily. Despite continued problems with technical servicing of machines, IZOT was discussing the organisation of production of magnetic tapes in India, based on Bulgarian know-how.[114] Discs and tapes of various sizes were sought after by Indian firms, especially after IZOT organised demonstrations of them in

[109] AMVnR f. 20 op. 32 a.e. 1387 l. 15-27

[110] TsDA f. 1003 op. 1 a.e. 128 l.2-11

[111] TsDA f. 259 op. 39 a.e. 343 l. 41

[112] TsDA f. 1003 op. 1 a.e. 128 l. 18

[113] Ibid., l. 19

[114] Ibid., l. 5

various cities.[115] The growing importance of the market is testified to by the Izotimpex plan for exports during the 7th five-year plan, between 1976 and 1980 – in it India is second only to West Germany as a priority "capitalist" market: despite being a developing, non-aligned and socialist-friendly state, it was still seen as a country ran by the free market and all that went with it. As such, Bulgaria was to target it with sales, and ensure it bought any basic elements and software that it could from them.[116] The plan called for exports totalling 3 million levs in 1977, with over half in peripherals.[117]

The embassy also kept pointing out to IZOT and other enterprises that the Indian market was saturated with foreign technology, often incorporated in domestic designs.[118] Purchases of Indian technologies would thus be a back-door to gaining access to embargoed Western achievements. This was one of the driving factors behind the State Security intelligence residence in India being taken over largely by the Scientific-Technical Intelligence (STI) Directorate by the early 80s.[119] India was a rich source base for the intelligence services to access Western technology and companies' expertise in a much freer area. The intelligence angle is important in showing the Third World and India in particular as a space for accessing the First World on the ground of the Third. As was standard practice, the CSTP representative in major embassies was the worker in charge of STI activities in the area.[120] The CSTP representative in India by the early 80s was Svetoslav Kolev. His monthly "economic information bulletins" highlighted Indian developments and companies that would be of interest. In 1983 he received the embassy's highest evaluation for his work, especially

[115] Ibid., l. 16

[116] TsDA f. 830 op. 1 a.e. 15 l. 9

[117] TsDA f. 830 op. 2 a.e. 84 l. 9

[118] AMVnR f. 20 op. 32 a.e. 1397 l. 15

[119] AKRDOPBGDSRSNBA f. 9 op. 4 a.e. 548 l. 38

[120] AKRDOPBGDSRSNBA f. 9 op. 4 a.e. 438 l. 5-7

in facilitating sales of Bulgarian automation know-how, and was suggested for promotion to the rank of the embassy's economic advisor.[121] In fact, by 1986 he was the resident who took over as chief of the embassy when the ambassador was away on business.[122] The STI angle is one way to see the importance that the Indian technology market had for Bulgarian access to the science that interested it in developing its own sector.

The embassy was insistent on pointing out the developments of Indian science that could be helpful to Bulgaria. This was especially true in the "tropicalisation" of Bulgarian machines, allowing them to function in demanding climatic conditions, and thus making them more competitive in the Global South where ES-machines often failed due to insufficient air conditioning and dust contamination.[123] The Delhi trade representatives harangued Bulgarian producers for replying to Indian requests with "there is no tropical version", rather than working on the issue. Bulgarian producers often did not respond to offers that the embassy forwarded, such as tenders for Air India's electronic system; while Computronix, the Indian firm chosen to represent IZOT in the local market, was not being sent enough prospectuses.[124] The Bulgarian representatives in India insisted that Bulgaria was constantly underestimating Indian science (curiously, the same complaint was often voiced from the 70s onwards in the Soviet version of the CSTP – GKNT – bemoaning the underestimation by Soviet factories of Bulgarian scientific achievements),[125] which would hinder the chimaera of Bulgarian-Indian economic relations in the 1970s – the creation of joint enterprises for the entry into third markets, where the two countries would offer computer services and hardware

[121] AMVnR f. 20 op. 40 a.e. 1587 l. 34-6

[122] AMVnR f. 20 op. 43-5 a.e. 150

[123] AMVnR f. 20 op. 33 a.e. 1277 l. 108

[124] TsDA f. 259 op. 36 a.e. 513 l. 10-14, 176

[125] RGAE f. 9480 op. 12 a.e. 244 l. 32

jointly.[126] This continued until the end of the decade, as software – which the Indians insisted on selling – continued being bought up by the Bulgarians in small quantities, hampering their efforts to sell more disc drives to a country that they themselves had identified as having huge needs for storage.[127] This was especially pressing as disc drives such as the ES-5053 were proving, in tests, to be completely compatible with India's domestically produced computers, the TDS-312 series, indicating further market possibilities – if only the Indian factories could be persuaded to switch over to the Bulgarian discs, and overcome their previous Western bias (something that advertising was to help with in the absence left by IBM). Another potential gap was in industrial electronics, as India produced none of its own. [128] Overall, by the end of the 1970s, Bulgaria was identifying more and more ways to enter the local market, while refining its approach.

By 1980 Bulgaria had also become the only socialist country besides Hungary to move its trade with India to hard, convertible currency rather than rupee balanced payments. This was seen as the only way to increase trade and put it on a profitable basis, as there were constant balance-of-trade problems with Bulgaria not purchasing enough India produce in rupees. It was seen as a part of the plan to raise trade to around $200 million after the 1980 visit by Peter Mladenov, the Foreign Minister.[129] In the previous couple of years, IZOT had helped with the transfer and setting up of the production of disc drives of the 30 to 100 MB range, and had set up a dedicated engineering bureau there.[130] Such developments and the IBM exit from the Indian market in 1978 had catapulted Bulgaria to occupy second place,

[126] Ibid., l. 80-81

[127] TsDA f. 259 op. 44 a.e. 284 l. 10

[128] TsDA f. 259 op. 44 a.e. 287 l. 55-57

[129] AMVnR f. 20 op. 36 a.e. 1249 l. 18

[130] AMVnR f. 20 op. 34 a.e. 1210

behind the USSR, in electronic exports to the country by 1980,[131] and dovetailed with the electronic enterprises' wish to hold onto hard currency that was mentioned in the previous section. The report praised the entrance of Bulgarian disc drives and CPUs into the Indian market, noting favourable that in the conditions of autarky that the nation aimed for in electronics, it was high praise indeed that Bulgaria managed to secure co-operation in the production of peripherals, as that was promised only to those of exceptional quality.[132] However, this was no cause for complacency – Bulgaria was facing stiff competition in the open market by British and Japanese firms, its ES-1022 system was outdated and unlikely to win any new tender competitions, and due to lack of coordination, its socialist allies were in fact its competitors.[133]

The balance of payments was maintained only by the USSR and Bulgaria would find it ever more difficult to maintain good trade with the Indians in the conditions of currency trade. Continued presence depended on new pricing policies, full and proper documentation in English, newer computers, sales through local private firms and individuals, specialised exhibits and "a substantial improvement in our work in the advertising and propaganda sphere." The Indians also were continuing, the Ministry of Foreign Trade noted, to insist on increased imports – the Bulgarian export/import ratio was 2:1 in the socialists' favour.[134] As the Indian government was facing problems that were unsolvable without computers, this was the best chance to solidify the position in the market.[135] This was however only possible if, as

[131] AMVnR f. 20 op. 36 a.e. 1277 l. 15

[132] Ibid., l. 7

[133] Ibid., l. 16

[134] TsDA f. 259 op. 44 a.e. 292 l. 10

[135] AMVnR f. 20 op. 36 a.e. 1277 l. 17

the embassy continued to note, there was unity between foreign policy goals and advertising realities.[136]

The 1980s: Personal and Super Computers

The early years of the decade saw redoubled activity of Bulgarian marketing in India. This was helped by a general rise in Bulgaria's profile throughout the country, facilitated by the cultural diplomacy of Lyudmila Zhivkova, the daughter of Zhivkov, Politburo member, and minister of culture. Her fascination with India was one of the cornerstones of her unique cultural policy that opened Bulgaria to the world, and her trips to the country were numerous, paralleled with close links with Indira herself. Indeed, India was one of the last countries she visited before her untimely death in 1981.[137] Such efforts had resulted in the 1977 creation of a Bulgarian cultural centre ran by the embassy in Delhi, with a rich program of cultural popularization.[138] This diplomatic offensive was welcome for an electronic industry that had grown and matured in the 1970s, and by the early 80s a host of new machines was coming into production – the Pravetz series of PCs, industrial robots, computer-aided automation lines for factories and enterprises, the new Winchester type of magnetic discs with increased capacity.

The previous decade had seen the ironing out of some production problems and annual improvements thanks to licensing, training abroad and massive levels of industrial espionage. By 1981-2, thus, the Bulgarians felt much more ready to offer the Indian market the latest in their technology. Izotimpex started much more targeted campaigns in specialised

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[136] AMVnR f. 20 op. 38 a.e. 1168 l. 1

[137] For more on Bulgaria's cultural links with India, see Violina Atanasova "Akcenti na Bulgarskata Kulturna Politika po Otnoshenie na India (60te I 70te godini na XX vek)" in *Istoricheski Pregled,* 1-2 (2011), pp. 174-193

[138]Violina Atanasova, "Bulgarskiya Kulturno-Informatzionen Tzentur v Delhi – Istoriya I Deynost" in *Svetilnik,*14 (2002), pp. 30-34

Indian publications, to show its clout,[139] putting in practice all that it had learned in its close relations with Indian and Western firms during its entry to the Santacruz Electronics Export Processing Zone (SEEPZ) in Mumbai.[140] SEEPZ was set up in 1973 and offered tax benefits and other business incentives to promote foreign investment and technology. It was a place for Izotimpex to try out its new visual and advertising material before pushing it beyond Mumbai into new heights (for it) such as participation in a three-page spread on Bulgarian engineering in the *India Express*.[141] The embassy also pushed for, and got, the whole November 1981 issue of the specialist journal *East European Trade* dedicated to Bulgarian economic development, to coincide with the country's orchestrated campaign to celebrate its 1300th anniversary. It presented the country as an advanced industrial state, and a world leader in per capita production in electronic hardware (in fact, it was third).[142] It praised COMECON specialisation as the right way to divide labour between states, and saw its cooperation as a model for all technological dealings between states.[143] It allowed Bulgarian trade with the developing world to grow 37-fold between 1960 and 1980, with over 500 projects being realised by Bulgarian specialists in various countries, and 20 types of major electronics entering these markets. The mastery of the scientific-technical revolution by Bulgaria was the basis for such an advancement, especially in industrial engineering and electronics[144] – Bulgaria was now a desired technology partner.

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[139] AMVnR f. 20 op. 38 a,e, 1282

[140] AMVnR f. 20 op. 36 a.e. 1276 l. 83

[141] AMVnR f. 20 op. 39 a.e. 1282 l. 7

[142] AMVnR f. 20 op. 39 a.e. 1297 l. 9

[143] Ibid., l. 28

[144] Ibid., l. 30-31

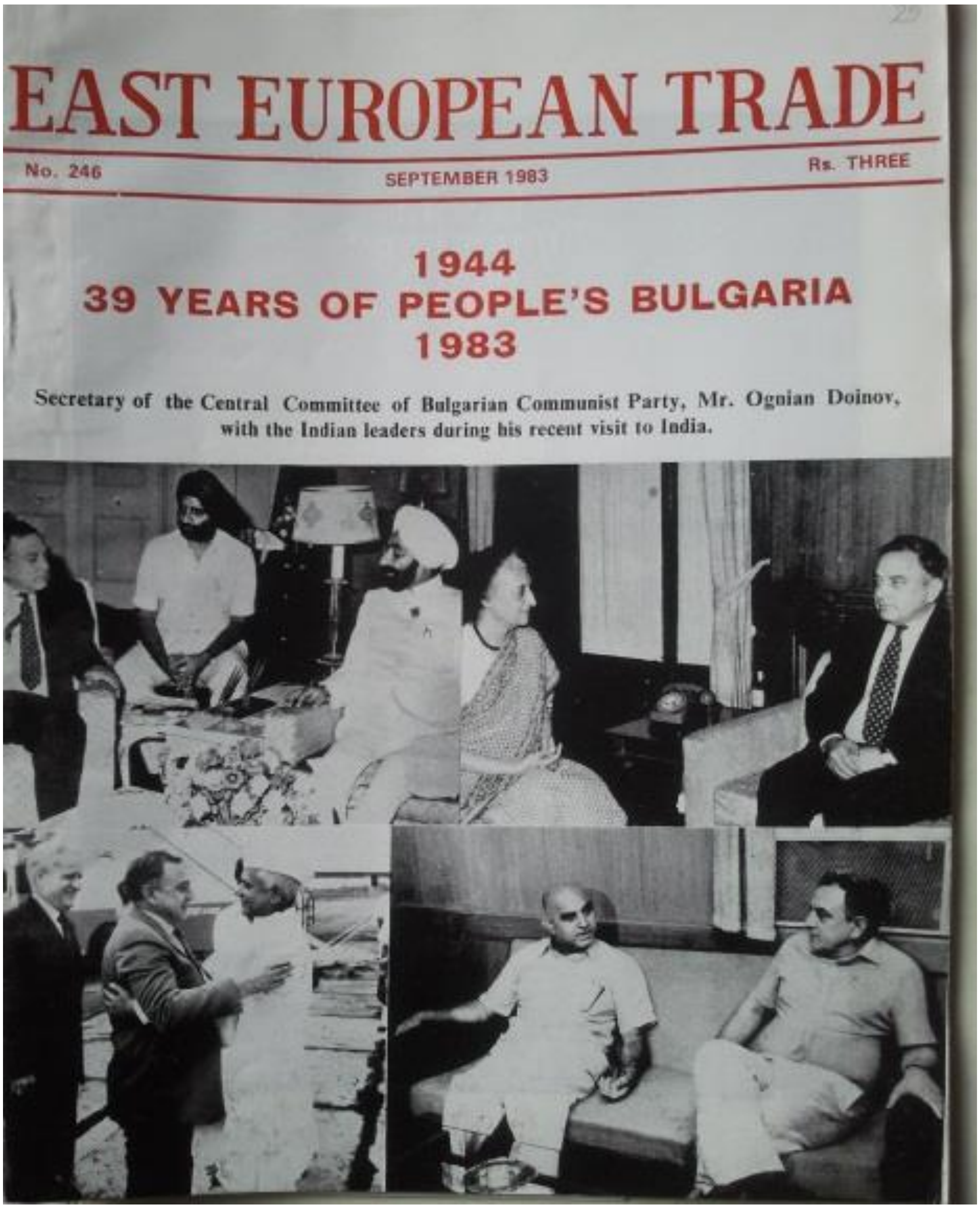
Pic. 2: Bulgaria's new image in Eastern European Trade (Source: AMVnR)

Press releases continued to accentuate on the most prestigious and eye-catching of Bulgarian achievements, such as becoming one of the world's top five producers of industrial robotics, in another issue of *East European Trade* dedicated to Bulgaria in 1983.[145] This issue, timed to coincide with the visit of Ognyan Doynov (the grand strategist of Bulgarian industry and technology after the mid-70s) also sought to reassure Indian customers of the relatively small size of Bulgaria – it was no impediment to technological progress, and in fact according to UN rankings Bulgaria had achieved 18th place out of 36 industrial states in terms of export of machine-building.[146] Such observations had been made earlier by the first

[145] AMVnR f. 20 op. 40 a.e. 1618 l. 31

[146] Ibid.,

resident ambassador to Bulgaria, Dr. Gopal Singh, who also sought to promote Indian trade with a country that at the time was still little known: “it is amazing that a country of 8.5 million people should have a foreign trade almost equal to our own”.[147]


EAST EUROPEAN TRADE

No. 246 SEPTEMBER 1983 Rs. THREE

1944

39 YEARS OF PEOPLE'S BULGARIA

1983

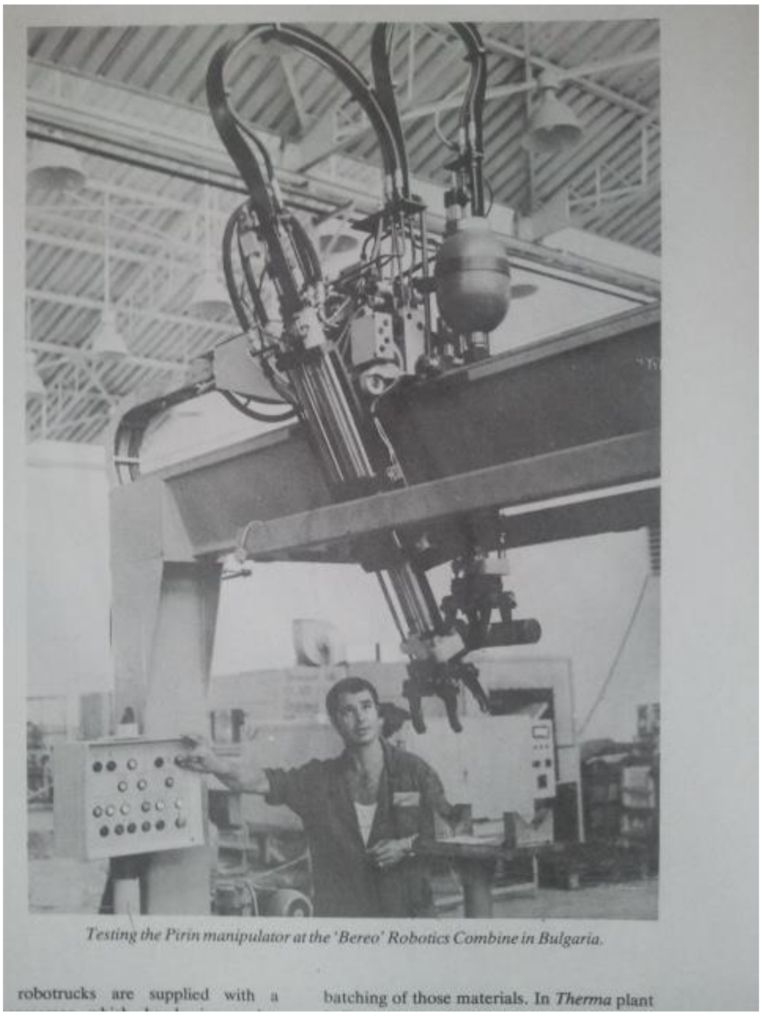
Secretary of the Central Committee of Bulgarian Communist Party, Mr. Ognian Doinov, with the Indian leaders during his recent visit to India.

Pic. 3: Scenes from Ognyan Doynov’s visit (Source: AMVnR)

Robots were in the early 80s the dominant computerised machine with which Bulgarian trade firms sought to expand their profile. In 1983 “News from Bulgaria” published extensive coverage of new robotic items in use in Bulgaria, freeing man from

[147] Nehru Memorial Museum and Library (NMML), Dr. Gopal Singh Papers, List 378; Series 2, Doc. 29, p. 304

drudgery and raising the quality of lives of workers, featuring interviews with Bulgarian specialists who praised their quality of work now that they were freed from the most menial tasks. Talking about the imminent entry of RB-232 (which were pictured) robots to their car-manufacturing plant, some stated that "if such assistants come to the workshop, especially where work is hard and monotonous, it will be lovely."[148]



Pic. 4: Robots as the face of Bulgaria in India (Source: AMVnR)

Such measures were, however, unlikely to be too successful in the protectionist conditions of Indira Gandhi's India. Often, it was the Indian side that was to blame for failed deals, such as a large Bulgarian sale of floppy disc production technology to Rishi Electronics in 1983, which was not ratified for months by the government agencies, leading

[148] AMVnR f. 20 op. 40 a.e. 1663, "News from Bulgaria" Issues 11 & 12, 1983, p. 9

to delays in setting up one of the vaunted and hoped for joint production enterprises.[149] Indira Gandhi's assassination in October 1984, however, brought her son Rajiv Gandhi to power, and a liberalisation of technology trade. Cognizant of persisting problems with Indian backwardness, he launched six "technology missions" to increase literacy and communication in the countryside, as well as pushing for the true development of nascent computerization programs started under his mother. He cut through debates about the utility of computers in a labour-rich society to lower import duties on components, allowing foreign manufacturers freer entry into the Indian market and encouraging the use of computers in offices and schools.[150] His view was that of many other educated Indians – that the country had essentially missed the industrial revolution, despite Nehru and his mother's efforts, so its only chance was to participate fully in the information revolution unfolding now.[151] This was the start of the rise of Indian IT services, helped by the country's English education, low wages, and lack of competition from IBM that gave entrepreneurs the space to develop.[152] This coincided with the start of wholescale production of the Pravetz computers in Bulgaria.

Pic. 5: Gandhi visits the electronic town of Pravetz (Source: Spomeni.bg)

[149] TsDA f. 259 op. 45 a.e. 630 l. 32

[150] Bipan Chandra, Mirdula Mukherjee & Aditya Mukherjee, *India After Independence* (Delhi: Penguin 2008), pp. 348-9

[151] Ibid., p. 350

[152] Sumit Ganguly & Rahul Mikherjee, *India Since 1980* (Cambridge: Cambridge University Press 2011), p. 77

Continued IZOT failures to advertise properly were paralleled with its failure to produce a viable mass-market PC and the transfer of some specialists and much investment to the tiny town of Pravetz, the birthplace of Todor Zhivkov. With lavish financing and the ability to draw some of the best specialists from CICT, the Microprocessor Combine there grew in the early 1980s and was poised for mass production by 1985. It was also led by the energetic technocratic manager Plamen Vatchkov, whose involvement in microcomputers had led him to stints in the Silicon Valley, meetings with Bill Gates and Steve Jobs, and a self-confessed understanding of business long before the word was used in Bulgarian regime circles.[153] The embassy in New Delhi had continued to criticise the conservative IZOT for insufficient sensitivity to the local market, not copying American and Japanese marketing and investment efforts in this sphere. “Electronics is the most dynamically developing sector with the fastest change in production”,[154] and IZOT’s history was burdening it with moribund practices. “Pravetz”, however, was new and energetic, and worked much more in the mould of the multi-nationals than IZOT ever did. It quickly identified the need for local partners, recognising the huge potential in India for the delivery of thousands of PCs after Rajiv Gandhi’s call for office and school computerisation.

In 1987, such a partner was found, but the nature of the deal bears witness to the popular saying that “bad publicity is good publicity”. Adil Shahryar had signed a deal to import ten thousand “Pravetz” PCs to India, promoting his Priyadarshini Institute for Computer Aided Knowledge. He had already outsourced a project to Apple to create a type-set for Urdu, in order to be able to help computer education in the language, and the “Pravetz” systems were Apple compatible (of course, as they were copies).

[153] Interview of the author with Plamen Vatchkov, 30th June 2015; more on this in chapter 7

[154] AMVnR f. 20 op. 41 a.e. 1918 l. 82-4

10-16 мая 1987г.

Adil Shahryar's big byte in Bulgaria

by Sunil Sethi

New Delhi, May 9: Do famous juvenile delinquents never grow up? Evidently not, going by the strange case of Adil Shahryar, 39-year-old son of Trade Fair Authority of India (TFAI) chairman Mohammed Yunus, whose latest scam is no patch on his earlier excesses of stealing a car with the late Sanjay Gandhi and, more recently, spending three-and-a-half years in an American prison for trying to set a hotel on fire, placing an explosive on a ship, frauding cheques and counterfeiting currency notes.

Since early this year, Shahryar, who runs the Priyadarshini Institute of Computer Aided Knowledge in Pragati Maidan, has been attempting to import 10,000 personal computers (PCs) worth a staggering US $6.4 million from Bulgaria over the head of the Department of Electronics (DOE), the primary authority in any matter regarding computer import. Import of PCs is strictly forbidden under the national computer policy charted by the DOE in November 1984 to protect the indigenous computer industry. However, a PC can be imported after obtaining a no-objection-certificate (NOC) from the DOE and upon payment thereafter of 158 per cent duty. In case of sophisticated computers not manufactured in the country but essential to projects, an NOC has to be further supplemented by a not-manufactured-in-India (NMI) certificate from the DOE, to reduce customs duty to 60 per cent. The elaborate set of double checks has been established to plug all loopholes and guarantee a reduction in computer imports.

But Adil Shahryar knows no rules. After successfully importing about 35 American Apple-Macintosh systems duty-free last year because they possessed Persian scripts necessary for the propagation of Urdu language, Shahryar visited Bulgaria in January.

◆ Turn to page 3 for interview with Adil Shahryar

He was received at Sofia airport by the Bulgarian Prime Minister Georgi Atanassov and the Bulgarian Deputy Prime Minister Ognian Doinov who also happens to be co-chairman of the Indo-Bulgarian Commission for Economic, Scientific and Technical Cooperation. His Indian counterpart on the commission is no less a person than the Union Minister for [illegible]culture G.S. Dhillon.

Shahryar then proceeded [illegible] sign a "protocol agreement" [illegible] the Deputy Prime Minister of Bulgaria for the import of 10,000 Bulgarian Pravetz 8 Apple comp[illegible] PCs in exchange for exporting [illegible] compatible peripherals from India. How a private entrepreneur and, moreover, a man with a [illegible] highly discredited reputation [illegible] two countries, could enter [illegible] formal bilateral agreement with [illegible] foreign country, is a question [illegible] boggles the minds of not only [illegible]dinary citizens but the senior [illegible] bureaucrats in at least two C[illegible] ministries. Officials at the high[illegible] level are not merely embarrass[illegible] but so visibly shocked at the [illegible]ings-on in what they call [illegible] "Shahryar case" that they [illegible] even considered handing over [illegible]

Please turn to page [illegible]

Pic. 6: The Delhi Sunday Mail article on Adil Shahryar, 10-16th May 1987 (Source: AMVnR)

.He complained that despite the DoE approving the sale before he signed it in Bulgaria, and it being in accordance with the Indo-Bulgarian bilateral economic and technological agreements, the Department was now going back on its word, "sabotaging the prime minister's plan to computerise the country by defaming me, especially as he is associated with my institute."[155] He states that it is untrue that there is better technology available at this price, and in fact the deal is completely in tune with the $12 million provision by the Indian government for computers of this type as planned in their joint agreement. This interview in the Delhi Sunday Mail was supplemented by an article, describing Shahryar's past which was part of the problem, especially in a political landscape where Rajiv Gandhi was rocked by numerous corruption scandals. Just a month earlier,

[155] AMVnR f. 20 op. 44-5 a.e. 182 l. 8-9

Swedish radio has blown the whistle on the kickbacks received by Indian government officials in the purchase of guns from Sweden, in the infamous Bofors Scandal. Amir Shahryar's links to the Gandhi family were thus also under suspicion. His earlier excesses included stealing a car together with the late Sanjay Gandhi (Rajiv's brother, who was groomed to be Indira Gandhi's successor before his death in an airplane stunt accident in 1980), spending three and a half years in US jail for fraudulent cheques, currency counterfeiting, placing an explosive on a ship in the Miami docks in a failed insurance scam, and a failed arson on his hotel room to cover all his tracks.[156] "Do famous juvenile delinquents never grow up?" asked the paper rhetorically, noting that his purchase of PCs was contrary to 1984 directives on PC import without a no-objection-certificate from the DoE – which was lacking in this case. It notes that he was received at Sofia Airport by Prime Minister Georgi Atanasov and Ognyan Doynov himself, and had promised them the provision of IBM peripherals as part of the deal. The paper was astounded that a private individual could do this; it also raised questions on the fact that the Computer Centre would be named after Lyudmila Zhivkova, the late daughter of Todor Zhivkov and a great friend to India, insisting on this being evidence of close connections with the regime (Shahryar's defence, which holds water, is that it was a return gesture after the naming of a Sofia school after Indira Gandhi – and the Indira-Lyudmila friendship was strong and well publicized in both the Indian and Bulgarian presses). The paper saw all this as a prelude to using his links with the government to start a domestic computer empire, using his father's (long-time chairman of the Indian Trade Fair Authority) and the Gandhi names.[157] There was precedence for this – his jail-sentence in the USA was reduced and he was released in 1985 after India

[156] Ibid., l. 10

[157] Ibid., l. 11

permitted the Union Carbide chairman, Warren Anderson, to return to the USA after the Bhopal disaster of 1984.

Despite such virulent opposition to him on part of the media, and the remaining doubts about corruption, the sale did go through – helped by the priority that was put on it by the Bulgarian government throughout 1987.[158] The pressure and choice of such a close friend of the Gandhi dynasty worked, and the Lyudmila Zhivkova centre started work soon after, the showpiece of the Pravetz abilities in the local market. A sizeable article on the centre and the Indian electronic industry as a whole was published in Bulgaria's specialised computer magazine, "Computer For You", in September 1987 – the only developing country to get such an article in the magazine's run, and in fact the only one outside the USA or Japan to get such a detailed treatment on its pages at all. In it, the author praised Rajiv Gandhi's far-sighted policies of opening the Indian market to the world, noting that already 100 computer-production firms were operating, with the leading ones showing surprisingly advanced items at the 1987 New Delhi fair. It noted Indian policy since the 1970s as predicated on technology transfer in order to stimulate domestic production, but also pointed out that it was still doing badly in peripherals – a nod to Bulgaria's role in the market. The comprehensive article posed the same question, however, that Indian officials had been posing since the 1960s – what will happen to the already terrible unemployment problem once automation started? [159]

[158] AMVnR f. 20 op. 44-5 a.e. 193 l. 11

[159] *Kompyutar Za Vas,* issue 9, 1987, pp. 9-11

Pic. 7: The back cover of the September 1987 issue of "Computer for You", showing the Lyudmila Zhivkova computer centre in New Delhi (Source: Kompyutar za Vas)

The personal computer saga was one facet of the 80s successes of Bulgarian computers in India. The other was the sale of the Bulgarian supercomputer IZOT 1014-ES 2079 there in 1988, which highlights another way that the country could exploit local and international politics to achieve its goals. The supercomputer was the fruit of a 1984 project started by Stoyan Markov, the last head of the CSTP. It was a development that allowed the modular linking of different matrix processors into a network, overcoming the relatively weak power of each one to create a machine capable of over 120 million operations per second – outclassed by Western machines, but unique in the Eastern Bloc. It was finished by 1987, finding application in large-scale scientific research, oil field exploration, as well as the needs of the Soviet Strategic Rocket Forces and space program command.[160] It would come to equip centres in China, Vietnam and India too.[161]

In the Indian case, we can see how despite being inferior to Western machines, Bulgaria could use other advantages to sell its computer. An embassy report from 1987 notes that while the Americans – the world's leaders in super computers – were willing to sell such machines to India, they insisted on military secrets protocols, wanting direct control over the end usage in order to stop the flow of information into the socialist bloc. The embassy notes, with satisfaction, that this was unacceptable to the Indians.[162] The former ambassador to the USA, Shankar Bajpai, noted in a 1995 seminar that "we were being denied a whole range of technology because it was considered either of dual use and, therefore, capable of enhancing our nuclear capabilities or that we might, willingly or unwillingly, pass it on to the Soviet Union."[163] However, as the former secretary of the environment notes in the same series of seminars, Rajiv Gandhi was willing to consider alternatives when Cray computers were denied by the USA.[164] Somewhat ironically, it was the 'free world' that proved more restrictive in its technological sharing than the 'totalitarian' one – Bulgaria, coming from the position of technological backwardness had no fears of its technology (often based on foreign expertise anyway) falling into American hands; more so, the political implications of such a potentiality were nowhere near as dire as they were for Washington. At the start of 1988,

[160] Milena Dimitrova, *Zlatnite Desiteletiya na Bulgarskata Elektronika* (Sofia: Trud 2008), p. 192

[161] Ibid., p. 8

[162] AMVnR f. 20 op. 44-5 a.e. 191 l. 11

[163] Mani Ayar (ed) *Rajiv Gandhi's India*, Vol. 3 – Foreign Policy, (New Delhi: UBS Publishers 1998), p. 116

[164] Mani Ayar (ed), *Rajiv Gandhi's India,* Vol. 2 – Economics, (New Delhi: UBS Publishers 1998), p. 108

therefore, the IZOT-1014 was demonstrated through the local firm “Computronix”, and a full delivery was completed in December of the same year.[165] Krassimir Markov was one of the TzIIT experts sent to India to install it and train local specialists. He notes how the American supercomputer then in operation in New Delhi (for one was delivered a few years before) was locked in a special room that only American technicians had access to, while the Indian scientists could only use terminals on other floors. If there was a failure, it was up to the Americans to fix it. “Our machine, they could do whatever they wanted with it!” he states, and the ability to use it for nuclear and defence research freely pleased the Indians more than the US machine’s superior characteristics.[166] In fact, American disbelief at even the possibility of the existence of such a thing as a Bulgarian supercomputer prompted the sending of the director of the computer lab at Los Alamos to Bulgaria in the autumn of 1989, to verify its existence. Real as it was, its creators were invited to American conferences in the last months of the Bulgarian regime, and there was even interest for a purchase by the University of Minnesota.[167]

By 1988 a Ministry of Foreign Trade report was gloomy about where Bulgarian-Indian trade was going. There was little potential to expand, as nomenclature in machine-building production was overlapping. India was still too protectionist and most of its technology was still too low quality, leading to too low a balance of trade – the 1988 figures were expected to be $50 million of Bulgarian export against $20 million imports.[168] Indian trade was connecting to the West, and it seemed Bulgarian goods were there to mostly fill gaps that other technology partners were not filling. Electronics, however, did not reflect

[165] AMVnR f. 20 op. 46-5 a.e. 163 l. 33

[166] Interview of the author with Krassimir Markov, 2nd Feb 2016

[167] Dimitrova, *Zlatnite Desiteletiya,* p. 200, 259

[168] TsDA f. 259 op. 45 a.e. 630 l. 116

these gloomy predictions – RB-211 robots were being installed in the Bangalore and Mogoli factories of Hindustan Machine Tools into 1989, and 70 other enterprises were interested in implementing these machines.[169] Where trade would have gone, of course, was still an open question that would receive no answer as the tumults of 1989 severed such close, government-bound economic links between the two states. However, scientific and co-operation links too continued right until the end of the communist period, indicating the much stronger success of the attempts to foster scientific and intellectual exchange between the two states. Bulgarian specialists were working on hybrid integrated circuits with Indian colleagues at Chandigarh even as the regime was crumbling in the Balkans.[170]

In 1972, Dr Gopal Singh wrote to a friend in Bombay industrial circles with a peculiar request. He was trying to help a Bulgarian man called Vesselin Stoinov to visit Rishikesh, the 'yoga capital of the world' made famous by The Beatles' visit in 1968. He was interested in Indian spiritualism and wanted to travel to such centres for three months. Requesting financial help, he was willing to offer his services as an electronics engineer for as long as needed to Indian firms in order to repay this debt.[171] The paper trail vanishes, but one can wonder whether this transaction ever went through.

While, thus, for some electronics was a facilitator for the soul, most Bulgarian computing in the Third World was a conduit of ideas as well as money, a symbol of prestige as well as business. While Bulgarian organisations by and large did not manage to reach the heights of Western marketing and business, the competition for markets taught a cadre of younger technocrats, experts and embassy officials the rules of business, marketing and negotiation. In India, the Bulgarian trade policy managed to learn from its mistakes to score a

[169] AMVnR f. 20 op. 46-5 a.e. 163 l. 31

[170] AMVnR f. 20 op. 46-5 a.e. 165 l. 3

[171] NMML, Dr Gopal Singh Papers, List 378; Series 2, Doc. 28, p. 108

number of profitable hits by the late 80s. While in the 1970s the government looked to India as a potential partner in joint development of electronics and entry to other markets, borne partly of the need to replace expensive Western components and in part from internationalist politics, it learned that it was facing a tough, protectionist country that sought to foster its own production. Changing tack in the 1980s, it concentrated on providing better technical services than it did before, utilising its new machines and growing experience in the market to push for pure profit and widening its own market share. The very language used by them by this point shows how India was one of the main conduits for the changing thinking of Bulgarian foreign trade officials who increasingly adopted Western concepts in order to compete. The nature of the electronics market, with its dynamism and domination by huge and famous American and Japanese firms, was a tough schooling for embassy, foreign trade and Pravetz or IZOT officials. However, this entanglement with the West on the grounds of the South was fruitful and is part of a larger story of the growth of a reformist, Western-influenced technocratic class. Despite the lack of documentation on STI activities in India directly (up to about 40% of files were destroyed in 1990, including many on specific people and operations), there is enough to infer the importance of India's openness to Western and Eastern technology for Bulgaria's search for innovations – at a time when the legal and illegal operations of Bulgarian foreign trade were becoming more and more difficult to disentangle, as we saw in the previous chapter. Electronics are empowered by people as much as they empower them, and they became a tool and catalyst for some Bulgarians to become part of the transnational world of business rather than just the socialist regime. Providing free usage of supercomputers, identifying the well-connected Indians that would allow them to break into the market, copying US or Japanese advertising and service bureau models, Bulgarian electronic enterprises opened up to the world market which was governed by very different rules than the COMECON one. However, the Indian case study's narrative of advertising improvement is part of the overarching change that Bulgarian business thinking underwent in its encounter with the Global South.

Learning to Advertise

From early on in the Bulgarian entanglement with the developing market, there was another effect on the regime's thinking and practices. Faced with international competition on these markets, and with the need to sell to people who were not bound by COMECON contracts, the Bulgarian Foreign Trade Ministry heeded calls by various embassies' trade representations (including the Indian one, as we have already seen), to create a modern advertising system. As early as 1973 the Ministry accepted the need for a tripartite differentiation in its advertising planning. In socialist countries they could use the full gamut of mass media, and the aim was to advertise the Bulgarian role in the socialist division of labour, its quick scientific progress, the intensification of its economy and the price competitiveness of its products. The concentration would also be on heavy industry and machine-building produce. The propaganda was aimed at the mass classes, not business strata, as its aim was to strengthen friendship between nations.[172]

With capitalist countries, the advertising must be much more flexible and targeted, avoiding "standardised" advertising (which was usually the bland, inter-changeable one used in socialist countries) and bearing in mind particular tactics and aims we have in these local markets. The accent must be on Bulgaria's growing technical abilities, with electronics being key to showing that. It was to showcase the normalisation of Bulgaria's relations with the West, and showcase the increasing quality of produce which would be of benefit to both sides. Special attention was to be paid to Greece and Turkey, as the Balkan capitalists were to

[172] TsDA f. 259 op. 36 a.e. 107 l. 337

be shown the best of Bulgarian practice and produce, underlining socialist achievement, but also how trade was to serve the purposes of peace.[173]

Finally, the developing market advertising must be aimed at showing a Bulgarian willingness to help raise their productivity and standards, from agriculture to high technology. Trade with Bulgaria was to show the road to socialist development and give the tools and backing to break the shackles of dependence on the West. Advertising here was to borrow the most from Western marketing, especially in visual terms, in order to deal with "the weak literacy rates of these countries' populations" which meant Bulgaria must use prints, films, screens and cinema to create interesting and captivating ads.[174] These concerns were incorporated into the 1974 creation of a unified Bulgarian advertising agency for abroad, taking over the myriad of smaller ones under the auspices of the Bulgarian Trade and Commercial Chamber. Coordination of advertising activities was especially targeted at the electronics and chemical industries; at the suggestion of the Ministry of Electronics, which was heavily invested in international exhibits as a way to advertise its production, fairs would also fall under the auspices of this organisation.[175] Overall, thus, Bulgarian advertising finally got a dedicated umbrella organisation in the early 1970s. It was to serve nuanced ideological aims depending on which part of the world it operated in – from socialist brotherhood to peace to socialist development – but its practice was becoming more unified, more Westernised, and more modern.

While electronics sales were not the only drivers of this reform in foreign trade marketing in the early 70s, by the latter half of the decade they led to further refinement as Bulgarian computer goods began being produced in quantities large enough to satisfy the

[173] Ibid., l. 339

[174] Ibid., l. 340

[175] TsDA f. 259 op. 44 a.e. 116

Eastern Bloc market and thus "spill over" into the Third World. The Ministry of Electronics, faced with the realities of electronic marketing, informed the foreign trade ministry that its paltry budget for advertising was not enough when facing the stiff Western competition in new markets – "US firms Hewlett Packard, Zinger, Bekman Instruments spend over 10% of their sales on marketing". Regime plans did not factor such an utilisation of sales, and the Ministry demanded that a special fund on "Market Development" be created for its own needs by increasing prices by 2%. This would allow better advertising, investment in joint firms and the timely creation of prototypes to be sent to users for testing.[176] "The market of electronics demands short delivery times and a fast reaction to the client…currently that is impossible as we depend too much on deliveries of some components from non-socialist countries", it argued, and hence the Bulgarian National Bank must allow 10% of all capitalist currency sales and 2% of all socialist currency sales to be earmarked for this purse; while the Ministry should be allowed to move from "forward planning and inflexibility" to short-term plans that allow corrections, when faced with user demands and "just in time deliveries".[177] In order to better serve clients in such a fast-moving market, at least twelve new service bureaus were needed as soon as possible, otherwise the Bulgarian computer industry would not be able to satisfy local users. Only in such a way could the sale of more than just component – actual systems – be assured in interested countries such as Greece, Turkey, Spain and India.[178] The regime must also allow the Ministry to partner with local firms in order to have local representation in markets it knew nothing about, and to send representatives to learn the conditions of these countries.[179] This radical departure by the

[176] TsDA f. 259 op. 44 a.e. 128

[177] Ibid., l. 22-23

[178] Ibid., l. 25

[179] Ibid., l. 26-7

electronics industry resulted in it being the first sector of the economy that was allowed to utilise its own hard currency income for its own needs, rather than to feed it into the state coffers, as Atanas Shopov (director of the Stara Zagora factory for disc drives, the biggest electronic factory in Bulgaria and the Eastern Bloc) states.[180] The language of these demands is also revealing, utilising parlance like "just in time deliveries" and manufacture which were hallmarks of the new technological and economic revolution in the late 70s. At the cutting edge of technology, the industry was also at the cutting edge of business and economic practices, and it had to copy Western models in order to compete. It thus pushed reform in marketing and financing beyond what the Ministry of Foreign Trade had already planned. In India, as we have already seen, the embassy trade representatives, facing the best Western firms, were among the loudest voices calling for American and Japanese-style marketing approaches.

These battlefields, where Bulgarian companies cut their teeth in international competition, fed back into general marketing policies in the 1980s. New forms of advertising appeared that would be used in the socialist bloc, targeting socialist users in a new way. Izotimpex paid special attention to visual and large-scale adverts by 1982. Alongside the traditional participation in multiple fairs around the world, totalling nearly 2.5 million levs in costs,[181] it also started producing more nuanced and picture-heavy brochures and catalogues. Russian was not the only language utilised either, with English, German, French, and Spanish catalogues also being published in large numbers – for example, the Stara Zagora factory printed five thousand English copies of its catalogues: as many as its Russian-language ones.[182] Special, picture-heavy spreads were taken out in the Austrian journal "Made in

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[180] Interview with Atanas Shopov "Bez Emotsii za Starozagorskata Elektronika" in *Septemvri* newspaper, issue 52, 1989

[181] TsDA f. 830 op. 2 a.e. 99 l. 4

[182] Ibid., l. 7

Europe", with 21 colour photos.[183] German magazines that were targeting the Arab world were also used, as were US ones targeting China.[184] Izotimpex also produced its own specialist magazines with adverts in the local languages for China, Japan, India, and the Arab world, with much success – 76 such marketing publications resulted in 1756 and 1527 (1981[185] and 1982[186] respectively) return enquiries by interested enterprises through the forms attached with each.

Pic. 8: Bulgarian computers became a common part of advertising the country's success, as seen in the India-targeted "News from Bulgaria" – a magazine that itself in the 1980s paid increasing attention to economic articles over cultural ones. (Source: AMVnR)

The main change, however, was the utilisation of billboards of IZOT produce in the socialist countries – a novel thing in the 1980s, and one not explicitly needed as deliveries were, as we have seen, contracted through the government plans as part of COMECON. Yet,

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[183] Ibid., l. 9

[184] Ibid., l. 9-11

[185] TsDA f. 830 op. 2 a.e. 100 l. 7

[186] TsDA f. 830 op. 2 a.e. 56 l. 29

these billboards could target users and enterprise directors directly, as well as being a Western-style technique that demonstrated Bulgarian prowess. Advertising displays popped up in places where those socialist technocrats – but also their Western colleagues – were most likely to see them: Budapest airport, the Czech borders with Austria and West Germany, and twenty-six in Leipzig (where the famous fair was held) alone. Neon billboards were installed in Moscow, Berlin, and Prague.[187] Airports, hubs of the transnational business class of the rising information economies, featured prominently – Schonefeld in East Berlin and Domodedovo in Moscow got one billboard each, Sheremetyevo – two.[188] Izotimpex understood the connection between mobility and business, and billboards were also placed on the Moscow-Riga highway (linking two cities with important computer factories and institutes) and on all the highways leading into Berlin.[189]

The visual design of Bulgarian marketing material, including at fairs, was improving a lot by the 1980s and this was noted satisfactorily by Izotimpex.[190] This was a noted improvement over earlier fairs, where the firm's representatives sometimes scattered electronic elements haphazardly on their stands, rather than arranging them in an aesthetically pleasing and ordered manner.[191] Until the mid-1970s the firm was still delivering internally working but externally deficient machines, such as the earliest ES-1020 deliveries to India, described as unacceptable:

> The control panel delivered with the system was in a very poor condition. There were banal and unacceptable for a first delivery mistakes. Many technical deficiencies were apparent. The instruction panels and some control lamps had paint on them. Scratched

[187] Ibid.,

[188] TsDA f. 830 op. 2 a.e. 99 l. 12

[189] Ibid.

[190] TsDA f. 830 op. 2 a.e. 100 l. 3

[191] TsDA f. 259 op. 39 a.e. 392 l. 287

> and loose details gave a bad impression of the capabilities of the Bulgarian producer.[192]

Such visual problems had been overcome by the 1980s, as were the majority of the technical service questions – delivering the right sort of cables, English-language manuals, and most importantly: English-speaking technicians. Izotimpex had become aware that COMECON rules were not going to fly in the rest of the world. A deal to deliver a computer centre to Iran in 1986 called for a complete change of control panels from Russian to English language interfaces, and translation of manuals that were only in Russian – which proved impossible, however, due to the large volume.[193] By then, Bulgarians had understood that technical service quality and industrial design were as important as making a quick buck. The Global South's market was a place of fierce competition, where Bulgarian firms had to innovate in ways that they didn't in the socialist world. There were no five-year price guarantees or political alliances to ensure the easy sales that were the norm in the Eastern Bloc. As the regime wanted the hard, Western cash that came with deals abroad, it had to learn new ways of negotiation as well as advertising. The marketing tricks that Izotimpex had copied from their Western competitors in places like India were often driven by repeated calls by local trade representatives and embassy officials who were adamant the old, crude efforts were just not good enough. By the 1980s, Bulgarian foreign trade, thanks to its entanglement with the developing world, had developed more modern and nuanced ways to capture the attention of a potential buyer.

Domestic ideas were thus being impacted by global contact and competition. However, while computers were a great calling card and profitable commodity on the world market, they were also a way to modernise and automate. They were, in everyone's conception, the way of the future. In India this caused problems, as automation ran counter to

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[192] TsDA f. 259 op. 39 a.e. 343 l. 101

[193] TsDA f. 37A op. 10 a.e. 16 l. 17

the problems of unemployment that were exacerbated with each passing year. In Bulgaria, however, electronics held a promise that was tantalisingly simple for the party – boosting the command economy through better productivity of labour. Zooming out through the lens of computer circulations, we have seen how they intertwined Bulgaria with the socialist and global markets. Now we need to zoom back in, to see how society and politics were to be also interwoven with the wires of the new age, and how computers became the shining star of the scientific-technical revolution that the BCP dreamt of since the 1960s.

Chapter 5. Automatic for the People: the Scientific-Technical Revolution, Automation, and Society

Computers were not just a commodity, but also a tool that took on a special significance for the BCP. While the industry was created to produce a modern, high-technology and high-returns sector of the socialist economy, the inherent value of computers' potential to mechanise and automate labour, as well as supposedly remove the "subjective" factor from production, became a mantra for the party. Terms such as intensification had already been mentioned, and these were seen as the solution to the slowing growth of the economy into the 1960s and 1970s. Bulgaria had created the basic industrial society that socialist modernisation was so good at, but now it had to find ways to get the most bang for their buck out of the existing labour pool and enterprises.

Meanwhile, the party's initial proclamations of socialist mobilisation were giving way to other ways of creating a unifying vision for the future. One was the growth of nationalist rhetoric from the early 1960s onwards, rehabilitating older narratives of Bulgarian nationhood, reversing previous internationalist lines vis-à-vis the Macedonian questions, and creating a real cultural industry centred around a glorious vision of the nation by the 1970s, under the auspices of Lyudmila Zhivkova. But this policy was only one side, and could not offer a vision of future prosperity beyond an emotional appeal to national sentiment. The party also looked to create a vision of socialist modernity based on economic prosperity and a new type of society. The New Socialist Man would indeed by Bulgarian, the shining apotheosis of the country's history. However, he also had to be *New* – different to old ways of doing things; and *Socialist* – a distinct political and intellectual being. It was clear he had to be modern – but what would this socialist modernity be now that the first step it had trumpeted once it took power (urbanisation, industrialisation, employment for all, upward mobility and education for previously ignored classes) had been achieved, was subject to discussion.

The content of this new vision of the future was closely tied to the hopes placed in computing and its methods. "A book about Brezhnevites, however, is another story – that of a senile Cold War", Vladivslav Zubok and Constantine Pleshakov famously quipped.[1] This seems even truer in the Bulgarian case, conventionally seen as the most faithful satellite of Moscow. Nothing new could happen in grey Sofia, either in foreign policy nor domestic. But as we have already seen, Bulgaria's computer industry was one of the ways that this small state already cleaved its own path that was often counter to Soviet foreign policy or economic interests. It engendered a trading policy that went hand in hand with a foreign policy that while cleaving to Soviet lines, allowed Bulgaria to link to the wider world and exchange ideas as well as items. This all was reflected in a domestic, computer-enhanced discourse around building communism. Far from senile, the domestic drive to automate and innovate was a rich experience that uncovered the regime's automatic dreams as well as society's own hopes and strategies of living under the regime. Not taking seriously the attempts to implement computers and automation into the Bulgarian economy only serves to mask the gradual and imperfect but real changes that the society and economy underwent during the 1970s and 1980s, which created a Balkan information society.

The computer industry and its intellectual counterpart – cybernetics – were at the heart of the scientific-technical revolution that became the obsession of the BCP (as well as other socialists, above all Brezhnev's CPSU) from the 1960s onwards. The implementation of the newest trends in technology, the methods of computer modelling and control, and the automation of the workplace were seen as politically safe panaceas for a stagnating economy. However, in the Bulgarian case, partly because of the industry's provenance and partly because of Lyudmila Zhivkova's particular cultural vision for the country, the social dimension of computing helped the scientific-technical revolution to become overwhelmingly

[1] Vladislav Zubok & Constantine Pleshakov, *Inside the Kremlin's Cold War: From Stalin to Khrushchev* (Cambridge, Mass: Harvard University Press 1996), p. 8

the ideological content of the BCP program. Computers' march into society would intellectualise labour, free man from drudgery and create a creative personality. The intellectual ideas will be explored more fully in the following chapter, but the political clout they had gained by the 1970s were indicative of a state program that did, contrary to scholars' dismissal of these proclamations as mere obfuscation of the economic reality, aim at revitalizing the socio-economic climate and create a new way of governance with the aim of achieving the dual Marxist goals of a classless society and of a truly free man. Computers were not just a source of cash, but also an inspiration to build the future, and a solution to specific problems in industry. Automaton – the application of computers and electronics to the productive realm, replacing manual labour – posed many discussions and problems that occupied thinkers and regimes throughout the world, and indeed to this day. What the scientific technical revolution was, and how computers would implement it into Bulgaria, is thus the first port of call in such a discussion.

The Scientific Technical Revolution: The New Ideological Dogma

By the 1960s, the party had come to the conclusion that the opportunities for large-scale extensive economic growth had ended. The 8th Congress set out a long-term development plan for 1961-1980, which was elaborated on by the 9th Congress of the BCP in 1966, which

> …approved the [8th congress] line for the movement from extensive to intensive development of the national economy, on the basis of the widest possible implementation of the achievements of scientific-technical progress and the increased efficiency of social productivity.[2]

What shape this intensification would take was up for debate. Throughout the Eastern Bloc, there was a move towards implementing some market principles and economic rationales such as the use of profit as labour motivation and tying wages to the realisation of

[2] TsDA f. 517 op. 2 a.e. 277 l. 2

production. Since 1964, some enterprises had gone over to full self-financing, where profits and sales determined wages. The discussions in 1965 and 1966, including at the 9th congress, pointed out that such reforms went against both the fundamentals of state property and the principles of central planning. Directors were not really held accountable for poor results, and losses were still covered by the state budget, negating the effect of the material stimuli. Enterprises looked to produce the most profitable and sought after goods, leading to shortages in key areas, while the search for quick sales often resulted in poorer quality, as the goods were rushed to the market. Slowly, this experiment of self-financing was quietly left aside, as differentiated approaches were taken to setting norms for enterprises.[3] The culmination was of these attempts at the reformation of the economy was the July Plenum of 1968, with a New Economic Mechanism that put an onus on prices and scaled back central control of the planning and quotas for the economy. Factories and workplaces would now be allowed to offer the State Planning Committee their own plans on how to fulfil broad, macroeconomic plans on the economic structure and goals of the country.[4] This, however, was not fulfilled fully either, as by 1971 it was not enterprises, but the vaster sectoral conglomeration – the DSO (such as IZOT) – that became the main economic subjects; the enterprise-based initiative had proven a failure.

The BCP, like other parties in the Bloc, was looking for a non-market surrogate to make its economy competitive, taking the leap from its industrial extension to competitive intensification. The early 1960s reforms of the USSR, and the even more ambitious ones in the GDR under the *Neues Ökonomisches System* inaugurated in 1963, put such faith in the newly rehabilitated science of cybernetics, to improve industrial efficiency, de-bureaucratize

[3] For more on these policies, see Iliyana Marcheva, "Problemi na Modernizatsiyata pri Sotsializma: Industrializatsiyata v Bulgariya" in Kandilarov, E & Turlakova, T (eds) *Izsledvaniya po Istoriya na Socializma v Bulgariya 1944-1989* (Sofia: Grafimaks 2010), pp. 207-8

[4] Martin Ivanov, "Ikonomikata na Komunisticheska Bulgaria (1963-1989)" in Znepolski (ed), *Istoriya na Narodna Republika Bulgariya: Rezhimut I Obshtestvoto* (Sofia: Ciela 2009), p. 306

the economy, and devolve the responsibilities from central planners to lower-level authorities. Price reform was also key in such plans, but they also had another aspect that is more pertinent to the Bulgarian case of looking for a panacea to intensification: the application of new technology to socialist economics, such as computerised data processing, operations research, regulation and perfection of the production process and information flows within both the factory floor and the economy. This was much more palatable, as it left the party *in* the process, an employer of economic modelling and overseer of technological implementation rather than a redundant body in the face of a rising class of technocrats – something that scuppered cybernetic reforms in the GDR, for example, as Kevin Baker shows.[5]

Variously called the scientific-technical revolution or progress, the phrase became the core of the BCP’s belief in intensification of the economy, a panacea to all economic and social ills. It was the aim of reform, with the mid-60s price restructuring having as an end-goal “the re-direction of the economy in an intensive way on the basis of scientific-technological progress and the principles of the new system of governance of the national economy”.[6] At its core, the scientific-technical revolution was seen as a qualitatively new stage in human development, where the latest scientific achievements could raise productivity by orders of magnitude, and necessitated the turning of science into a productive force. If the latest technologies could be implemented into production, the quality of goods would rise alongside that of the productivity of workers, industries would be put on a “rational” basis, the “subjective” factor – a catch-all for directors’ and workers’ failings – would be minimised, and the economy would intensify and progress without the need for quasi-market

[5] This paragraph draws heavily on his innovative work on the GDR and cybernetics, “Red Helmsman: Cybernetics, Economics, and Philosophy in the German Democratic Republic” (MA Thesis, Georgia State University 2011), especially chapter 3 ‘Control: Cybernetics, Market Stimulation and State Planning’

[6] TsDA f. 1B op. 35 a.e. 154 l. 10

reforms. This is not to minimise the varieties of new economic mechanisms that the BCP toyed with, alongside its socialist allies. Cybernetic economics – a peculiarly Soviet science – was strongly linked to the attempts to introduce feedback mechanisms such as price and profit reform into the economy; however cybernetic thinking also had a closely related but more technologically-based side in the face of creating improved information links and networks between different levels of production,[7] as well as a vested belief in actual cybernetic machines – both computers and automata – as solutions to problems of productivity. It is this technological vision, predicated on the implementation of science, which has been less studied and is the subject of this chapter. In the conditions of a growing electronic sector in Bulgaria, the implementation of a particular kind of science – computer, information, and robotic – that became increasingly the core of the BCP's scientific-technological revolution.

As such, alongside the 1968 economic mechanism, two special commissions were formed to turn the slogan of "science as productive force" into reality. Unsurprisingly, Ivan Popov played a key role in both. The first commission, headed by the director of the State Planning Commission Zhivko Zhivkov (no relation to Todor), was tasked with overseen capital investments and their distribution as to achieve a maximum effect – which technologies were to be concentrated on, so as to achieve production capacities in 1969-1970 (such as the new electronic factories).[8] Zhivko Zhivkov had been a noted opponent of the economic reforms of 1963-1968, and was thus more amenable to the conservative idea of increasing production into more profitable sectors rather than reforming the economy – a perfect vehicle for Popov's strategy. The second commission, for the "Introduction of New Achievements of Science and Technology Into Production", was headed by Popov himself,

[7] Most masterfully studied in the Soviet case by Benjamin Peters in *How Not To Network a Nation: The Uneasy History of the Soviet Internet* (Cambridge, Mass: MIT Press 2016)

[8] TsDA f. 1B op. 35 a.e. 453 l. 8-9

and was to take care of the details of financing and re-structuring of production so as to take into account the newest technologies – the actual implementation of the first commission's decisions. Popov was also to be part of the "summary commission", which would take all these factors into account when finalising the state budget for 1969.[9] From the late 1960s, thus, the scientific-technical revolution's implementation was tied to the interests of the champion of Bulgarian electronics, paving the way for cybernetics and computers to dominate the party's conception of what productive science looked like.

In October 1969, the Central Committee published its decision 412, taken at a plenum in September. The topic – solving the problems of concentrations of production, of scientific-technical progress, and the new system for economic governance. It noted that the country had experienced a qualitative shift with the rise of industrialisation and the changed structure of its economy, which had left agriculture behind. The country could now turn to the solution of "social problems, such as the reduction of the length of the working day, easing the labour of the worker and others".[10] The new economy would take into account the newest trends of technology, and a cybernetic conception of the economy as an inter-linked organism governed by certain processes was in full view:

> The strengthening of the concentration of production, of scientific and development activity, the speeding up of the process of modernisation and automatisation, the deepening of the specialisation and cooperation, the widening of the industrial and economic links between economic cells, lead to a need to perfect from now on the forms and methods of control and their implementation in full accordance with these processes.[11]

This would be achieved through the leading role that would be played by the unified plan for social-economic development through the usage of prognosis, modelling and

[9] Ibid., l. 12-15

[10] TsDA f. 1B op. 35 a.e. 888 l. 8-6

[11] Ibid.

programming of economic and social events and processes. These would become the main economic “cells” of the new structure, a “full-bloodied economic organism”. All this would be predicated on the timely and accurate implementation of the achievements of contemporary science and technology.[12] A key point of this plan was the implementation of “complex automation” and computer technology.[13] Automated workshops will unite the scattered and divided production processes into a more manageable united complex. Machines would have computer-numerical control (CNC). These new processes would be continuous, independent of the “subjective” factor – worker tiredness, need for rest, mistakes. All this meant that by 1975 the country should be using up to 35% of its capital investment for restructuring existing production facilities,[14] introducing automation on the basis of microelectronic technology.[15]

This automation on the factory floor would be accompanied by the restructuring of the national economy on the basis of automated systems of governance (ASU – from the Bulgarian abbreviation for *avtomatichna sistema za upravlenie*) of “pan-national importance” – these would be the capillaries of information that would ensure optimal governance and control of production and accounting both at enterprise and sectoral level.[16] By 1975 Bulgaria would need 300 computers in order to achieve the first level of this governance automation, which would allow for the optimisation of planning and operative control, which was expected to increase productivity in areas reformed on the basis of computer-centred automated control by a factor of at least two.[17] The terms automation, cybernetisation, and

[12] Ibid., l. 8-7

[13] Ibid., l. 8-17

[14] Ibid., l. 8-19

[15] Ibid., l. 8-18

[16] Ibid., l. 8-20

[17] Ibid., l. 8-21

computerisation became the defining pillars of this new policy. Electronics was the way to accurately measure output and control production; it would allow industrial machines to be controlled accurately and "objectively"; they would also be the means through which the universities and BAS, under CSTP leadership, would work out ways to model economic and industrial processes.[18] In a separate point, these three pillars were also expected to help in tackling the basic problem of Bulgarian industry – quality of production – through a creating "the conditions for objective evaluation of quality, starting with the input control of quality of resources, materials and primary equipment and ends with the control of the finished product".[19]

This was not just an industrial policy, or even purely economic. Creating the means for accurate control – whether of the machine or the enterprise – meant improved communication channels that ensured more accurate information about the state of society. Socialist governance in accordance with cybernetics was the ultimate and final goal of optimisation through the scientific-technical revolution:

> To ensure fully the normal functioning of all cells as systems and subsystems of a unified organism of socialist governance. In this activity they are to widely use the newest and modern methods of cybernetics, as a systematic method, mathematical modelling, the optimisation of processes, the investigation of operations, network charts, computer technology and others.[20]

This meant the gathering of "enough and objective information" in order to create accurate "conceptions for the future developments of the country". The unified plans of socio-economic development depended on this new mechanism of governance, which would use prognosis to identify the most pressing areas in social development, uncover hidden

[18] Ibid., l. 8-22

[19] Ibid., l. 8-25

[20] Ibid., l. 8-26

structural problems and allocate the right resources for them.[21] The first concnrete step was to be taken in the area of logistics where

> The organisation and governance of the work of material-technical logistics [is] to be subordinated to a unified scheme of movement of material resources on a national scale, built on a cybernetics basis through the use of contemporary electronic-computational technology.[22]

Ultimately, thus, the scientific-technical revolution was aimed aim at improving *flows* of information: between automated machines and the product they were making (where CNC would ensure accurate information flows about the process); between the product and quality control; between the different parts of an enterprise and enterprises within a sector; between the economic sectors themselves (allowing for accurate logistics and getting goods and material to the right place on time); and between the sectors and the central planning authority, which would analyse this data and be able to feedback this into the new plans. This was a cybernetic conception of society and the economy as a giant organism, where the science of control and communication was the key way to optimise governance. The party had to create accurate channels for information flows, and ensure these flows were objective, and then its economic goals of intensification would be solved!

This lengthy meditation on the 1969 document is necessary due to it being the clearest first conception of how the BCP viewed its problems and possible solutions. It also introduced the defining topics of Bulgarian modernisation until the end of the regime: automation, computerisation (sometimes called electronisation), cybernitisation. It identified the problems as being the irrational use of resources (which could be streamlined through better information flows and automation); poor quality of production; not enough modernisation of production; lack of objective information about economic processes. It also put the role of the worker at its centre – he was both a subjective factor, who often led to

[21] Ibid., l. 8-27

[22] Ibid., l. 8-35

problems in production; but he was also someone who had to be saved from the hardest conditions of his unsavoury work. Automating the workplace had a Marxist goal of minimising manual labour, freeing Man to be a creative worker – an issue that will be also at the core of the next chapter. These conceptions also reveal another BCP belief – the technologies and methods to solve economic problems existed, they just hadn't been applied correctly. This is unsurprising given Popov's key role in the commissions and institutions that defined scientific policy in Bulgaria in the late 1960s – if the industrial tools of the automated factory and the computer-controlled ASU were put front and centre as the solution, there would be no need for the ineffective, divisive and politically-suspect economic tinkering of the 1960s. The 1969 program set the tone and defined the terms that would capture Zhivkov's imagination of a socialist and ultra-modern solution to the need to intensify production and raise labour productivity. The scientific-technical revolution provided the tools to do this – it just had to be harnessed and implemented. The computer was the paramount present tool that was to tackle past problems and build the socialist future.

This language persisted throughout the late socialist regime, driving Politburo debates on economic growth and scientific policy. The increased onus that the party put on world trade from the early 1970s onwards was closely connected to the needs of the intensifying economy. The aims of raising living standards, labour productivity and applying technical progress to all areas of production was inextricably linked to raising the technical levels of goods to standards that were acceptable on the world market.[23] The methods of cybernetic feedback in the economy would also streamline the process of deciding what kind of resources and how much of each had to be purchased from abroad, and the new system of controlling production would also allow the domestic industry to tailor its output levels to the

[23] TsDA f. 1B op. 35 a.e. 3079 l. 16

demand for Bulgarian goods abroad.[24] Simply put, Bulgaria's trade was also predicated on implementing the scientific-technical revolution and intensifying the economy – and vice versa, with both socialist integration and the transfer of know-how being key to that progress.[25]

Scientific-technical progress was also expected to solve the problems of slowing growth. As industry absorbed the labour surpluses in the 1950s and 1960s, by 1974 the BCP was expecting the intensification of labour production to account for 86.3% of industrial growth in the following year, with over 95% of national income growth over the 1970-5 Five Year Plan expected to have come from increased productivity,[26] facilitated by rational management and improved technology. However, the Politburo would continue seeking the "watershed" moment in intensification until the end of the regime. In 1978 the Central Committee expressed "anxiety" at the unsatisfactory introduction of computers and ASUs in the economy, slowing both the rise in quality of production and in creating better socio-economic governance.[27] Computers were being used to solve elementary tasks such as accounts and data processing, rather than being harnessed to automated production and governance tasks, "where in fact the fate of efficacy and quality is solved and where new principle problems arise, the solution of which determines the optimal functioning of whole factories, ministries and economic sectors".[28] Reconstruction of factories often didn't take computerisation into account, while ministries still weren't making the usage of computers and their capabilities an "irreplaceable" part of their tasks. The party tasked the CSTP, Ministry of Electronics and KESSI (Committee for a Unified System of Social Information in

[24] Ibid., l. 21

[25] Ibid., l. 42

[26] TsDA f. 1B op. 35 a.e. 4940 l. 28-33

[27] TsDA f. 1B op. 66 a.e. 1287 l. 67-1

[28] Ibid., l. 67-2

its Bulgarian abbreviation – a system that will be discussed more fully below) with overseeing how enterprises complied with party norms and directives in this key area. The ultimate aim was "to reach the watershed in using computer technology for the further transformation of governance in accordance with cybernetic principles".[29] A National Council of Automation of Production and Governance was established at the CSTP to direct the proc,ss, setting the tasks that ministerial computer centres were to solve, facilitating an "uninterrupted process on all levels of governance and economic organisation".[30] Nikola Stefanov, the head of the Central Committee's Science and Education department, admonished the economy's organisational weaknesses, "some of which had been repeated for years", continuously hobbling the process of creating "a scientifically-based technology of governance".[31]

The unchanging nature of this debate into the 1980s demonstrates both the regime's obsession and its failure of vision. Struggling to achieve good rates of growth was a COMECON-wide problem. Andrei Lukanov, the key figure in foreign trade and deputy-prime minister by the early 1980s, reported that Bulgarian-led discussions at the 98th meeting of the Executive Committee in January 1981 had highlighted the importance of scientific-technical co-operation among European socialist states struggling with intensification. Implementation had to be concentrated on key and priority areas that were proven engines of growth, with a special place given over to "intellectual factors" to acceleration – this meant concentration in rational management of resources, new synthetic oils, automation and an end to as much manual labour as possible on the basis of microelectronics.[32] This thinking was at

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[29] Ibid., l. 67-5

[30] Ibid., l. 67-6/7

[31] Ibid., l. 68-9

[32] TsDA f. 1B op. 67 a.e. 142 l. 48-9

the basis of the preparations for the economic plan to be unveiled at the 12th Congress of the BCP, where Prime Minister Grisha Filipov stated that "if we allow modernisation and reconstruction to spill over into many places, we can just forget about solving our main tasks".[33] The most promising areas for scientific-technical progress, especially electronics, were thus monopolizing development as the party scrambled to turn Bulgaria into the mini-Japan of Zhivkov's vision – a high technology economy within COMECON.

The development plan for the eight Five-Year Plan (1980-5) thus aimed for a 25% rise in productivity and a 3.8% annual growth in national income, on the basis of complex automation.[34] To achieve this, the Automation-8 program was to be generously funded – in 1982 alone there were capital investments of 140 million levs earmarked for semi-conductor development, 265 million for IZOT, 242 million for the metal works sector (with a huge expectation that a lot of it will be spent on automated lathes and other machines).[35] This was expected to lead to the rise of mechanised labour in metallurgy from 63.5% in 1980 to 75% in 1985; in light industry from 56% to 65.5%; in the Ministry of Machine-Building and Electronics itself from just under 45% to 48%. Special POKs (*Problemno Orientiran Kompleks* – Problem Oriented Complexes, complete packages of hardware and software for specific economic tasks) were to be created for warehouses, the oil industry, information processing, the state savings bank, agriculture. Electronic robots and manipulators were to rise from 16% of all automated machines in 1980 to a staggering 54.3% in 1985; CNC-controlled lathes were to rise from 3.4% to 11% of all industrial lathes; CNC-metal grinders –

[33] Ibid., l. 13

[34] TsDA f. 1B op. 67 a.e. 668 l. 26

[35] Ibid., l. 32

from 3.1% to 19.2% of all.[36] Wholesale automation was the panacea, with macroeconomic reforms pushed aside.

In the following years, other intensive, high-technology sectors joined electronics as a supposed golden goose. This was, above all biotechnology, which was expected to have widespread application in key sectors such as agriculture and pharmaceuticals. This was again, however, predicated on automation and electronic achievement[37] – such a sector depended on the latest technology on the factory floor such as clean rooms, air-conditioned units, qualified workers. This new intensive and automated sector was to be an integral part of the 1984 and 1985 socio-economic development plans. In the last years of COMECON, biotechnology would join the older debates of the need to intensify the economy, but the talks themselves reveal the continued failure of the scientific-technical revolution to solve socialist planning problems. In 1986 the 38th COMECON meeting on scientific-technical cooperation discussed the Bloc-wide plans up to 2000. Accelerated development was predicated on intensifying the economy, and the most important factor in that was scientific-technical progress and the radical modernisation of the material-technical base of production.[38] Joint work had to overcome internal problems, and allow socialist goods to enter the world market. This also depended on developing a modern technical services, advertising and user-support network.[39] If the socialist world wanted to enter the new millennium prepared, it would have to solve the problems of mechanised manual labour, robotic automation and higher quality.[40] Until the late 1980s, then, the Bulgarian belief in automation was part of a wider socialist technological thinking that was a replacement for substantial economic reform. It was

[36] Ibid., l. 32-3

[37] TsDA f. 1B op. 67 a.e. 2198 l. 158-160

[38] RGAE f. 9480 op. 13 a.e. 2487 l. 10

[39] Ibid., l. 23

[40] Ibid., l. 26-7

perestroika and its Bulgarian variant – preustroistvo – that would bring the question of structural change back into the discussion. As we will see in subsequent chapters, this was closely connected precisely to the failure of this technological utopianism to solve the core problems of growth in the socialist economy.

However, the substantial changes in the nature of production and labour in the hey-day of the automation dream – the late 1960s to the late 1980s – created real changes to Bulgarian economy and society. Automation, imperfect as it was, changed the nature of work and education. The scientific-technical revolution's ideological importance lay not just in its replacement of problematic economic or financial reform, but also in its claim to be changing society and man himself into a new kind of worker and citizen for the information age. The BCP's ideology has to be seen as a flawed but real attempt at bringing about a Marxist vision of the future as much as a driver of intensive growth. Not taking these changes seriously would miss out the giant effect that the growing computer industry had on the domestic landscape.

The March of the Machines

The first introduction of a computer for the automated control in a Bulgarian enterprise happened in 1969, in the "Zlatna Panega" cement factory – the biggest in the country, and one of the biggest such plants in Europe.[41] The site was chosen as it was noted that the cement industry was one of the most automated in the world, and Bulgaria needed to follow suit. More so, due to worker error and fuel consumptions, there were losses of over 1 million levs per year over the five automated conveyors in the factory. These could be minimised as the constantly changing process of dosing and stabilisation of the chemical reactions required the fast and precise calculations of over 81 equations with five unknown

[41] TsDA f. 517 op. 2 a.e. 172 l. 15

variables in the span of three minutes – something that was ripe for computerisation.[42] The central control of the technical production process would thus require a computer. That is not to say that Bulgarian industry had no automation until then – "Zlatna Panega" itself had automated mixers and furnaces. Yet for the first time a Bulgarian ASU would have a computer heart.

This was just the beginning. The sixth five-year plan (1970-5) was the first in which automated systems became a key part of capital investment and party plans, building onto the growing confidence in domestic technical abilities and the birth of the factories within the IZOT systems. The "cybernitisation" of the economy was at the core of the doling out of capital investments for the plan, with automation to be prioritised especially in the structure-defining sectors of the economy, with 430 million levs to be invested over the whole period in automating in machine-building.[43] This would enable the production of 1700 computers, 7000 magnetic discs, 13000 magnetic tapes, 270 thousand changeable disc packages and 17 million integrated circuits by 1975, which was the year by which the party expected computers, radio electronics and communication equipment as well as organisational technology to make up 30% of all machine-building volume. This was to material backbone of the automation of the metallurgical, chemical, food industry and textile sectors.[44]

Metal works were some of the first that the party turned their attention too, as a quintessential sector of socialist modernity, the staple of all breakneck autarkic-aimed modernisations in the Stalinist mould.[45] Computer-controlled machines and automated lines had already proven their worth worldwide, allowing not only for better qualities and

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[42] Ibid., l. 14

[43] TsDA f.1B op. 35 a.e. 1246 l. 87

[44] Ibid., l. 88

[45] There is no need to repeat Stephen Kotkin's arguments in *Magnetic Mountain,* which puts steel front and centre in Stalinist industrialisation. The Bulgarian regime, too, built an outsized steelworks and metal work sector, centred around the huge Kremkovtzi plant outside Sofia.

quantities in production, but also a much quicker switch between different production types and parameters when needed. Bulgarian industrial methods were seen as obsolete by the start of the sixth five-year plan. By 1974-5 the first experimental highly-automated systems in metal enterprises were to be introduced, aiming at large-scale automation in the sector by 1980.[46] Popov was a champion of the idea that it was the metalwork sector that needed to be automated first as it would take care of modernising the most widespread methods of machine-building in the country. It would lower the cost of production in this key area, and would lead to positive changes in 70% of all machine-building (which was heavily tied to various metallurgical processes – both as users of their produce and creators of machines to work in the sector).[47] Popov held that this would contribute to "the ending of their dependence on the different of qualification in the workers that service the machines, or the lack of working hands*",* which would in turn

> …create the basis for the realisation of the highest form of complex automatisation of one closed cycle in a certain sphere of machine-building production – prognosis and planning, construction, technology, the production process, accounting, wages and placement.[48]

Popov succinctly synthesized the party thoughts from the late 1960s onwards, applying it to the important sector in order to create the first working example of a complete cybernetic industrial process in the Bulgarian economy – with computer and ASU input and governance at every step: from the planning to the delivery of goods to the market. He felt that the country was prepared to carry out such modernisation as IZOT was building up the capacities to provide the tools of digital control; the Balkankar DSO could provide the hydraulic and pneumatic systems; his old haunt, Elprom, was experienced in providing power

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[46] TsDA f. 1B op. 35 a.e. 1990 l. 15-17

[47] Ibid., l. 21

[48] Ibid., l. 22

engineering solutions; and the metal works factories themselves already built machine tools.[49] All the pieces were in place in Bulgarian industry, they just needed to be collated into one closed cybernetic system, and applied to a task. Of course, while the material pieces were already around, Popov highlighted the need for the *language* of automation: the machine languages that would control the machines and the planning software that would allow for the automation of design and prognosis. This task was given to BAS, and its key institutes – the mathematical and cybernetic ones.[50] Co-operation would also be key, especially with the USSR and GDR, which had already started rendering technical assistance in automation since the mid-60s –Soviet specialists had been advising Bulgaria on machine-building automation since 1966, noting the rarity of such systems in the country.[51]

Apart from the application to industrial metal works, special attention was also paid to the logistics sector and the internal trade network, where the need to automate was very pressing as there were over 10 million accounting operations daily by 1971 – until then the majority of those were done in the most "primitive" way, without any computer technology.[52] Likewise, work in the servicing and provisioning sectors "requires huge physical and psychological tension", the same report noted, with little mechanisation of such basic tasks as loading and unloading in warehouses, moving goods around, alongside the poor mechanisation of accounting and trade operations. All this led to workers in the service sector often being rude, and even cheating customers.[53] If automation reduced the stress on the put-upon socialist worker, he would not take it out on the customers, and thus improve greatly the often-maligned socialist service network.

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[49] Ibid., l. 24

[50] Ibid.

[51] RGAE f. 9480 op. 9 a.e. 261 l. 51-68

[52] TsDA f. 1B op. 35 a.e. 1501 l. 121

[53] Ibid., l. 130-1

The new head of the CSTP, Nacho Papazov, reported that over 1 billion levs were spent on the automation program by 1972, of which 132 million levs on computing, with over 3500 tasks carried out throughout industry. Some DSOs did best, such as the shipbuilding one, which had fulfilled 80% of its automation tasks; while IZOT itself had the highest success rate in terms of successful and profitable implementation (given a score of 0.74 on a 0 to 1 scale).[54] Twenty one enterprises were to have complete ASUs, capturing the whole process that Popov had envisioned earlier, but all were showing lags to a certain extent. The ZIT factory in Sofia, the Kremkovtzi steelworks, and the Neftohim oil refinery in Burgas were among the best performers, but the chemical combine in Stara Zagora and power plants in Sofia and Bobov Dol were much further behind.[55] Apart from the 21 complete ASUs (designated as "of national importance"), over 200 enterprises were introducing partial ASUs to automate certain aspects of production, often on the basis of calculations done in regional computer centres (more on those below). Twenty five had already been implemented fully, and another 85 were currently in the process of design and implementation, but the rest were still at the "idea" stage by 1972.[56] ASUs were also being introduced in agriculture, such as in the APK (agraro-industrial complexes, the new stage in Bulgarian agricultural policy) "Druzhba" in Ruse. Three DSOs had already completed ASUs for the automation of administrative activities in the union itself – IZOT, Shipbuilding, and Elprom. Seven more were still being built, with the worst results in the DSOs of Balkankar, Metalhim, and Chemical Production.[57] As can be seen, the best performing sectors were the ones who were already at the cutting edge of technology in Bulgaria and were priorities for the party –

[54] TsDA f. 517 op. 2 a.e. 115 l. 5

[55] Ibid., l. 9

[56] Ibid., l. 10

[57] Ibid.

computing, power engineering, and shipping (which was growing in this period). Unsurprisingly, IZOT itself prioritised automation in its own factories both in order to up the productivity of the very factories that the rest of automation was predicated on, but also to fulfil its plans first and present itself as a star performer.

Apart from the specific enterprises ASUs, there were fourteen further ones "of national importance" planned, which were methodological rather than industrial-based. These were aimed at producing automated governing systems for both service sectors and tasks common across different economic areas, such as a financial-credit system or financing. Others included an ASU for Tourism, for Labour & Social Work, Data Processing, Transport Control, and Construction; as well as the two that lagged the most due to their enormous complexity – a system for Optimal Planning of Socio-Economic Development and a System for the Control of Research & Development Work.[58]

Pic. 1: The processing centre in Neftohim-Burgas – the heart of the enterprise ASU. (Source: soc.bg)

[58] Ibid., l. 11

The largest, by far was ESSI – the Unified System of Social Information – which was tied to the growing network of territorial computer centres, discussed below. The common characteristics of these ASUs was that they were to automate both common operations *within* enterprises, as well as *between* them. If the enterprise-based ASUs were the cybernetic mechanisms of the body's organs, in Weiner's analogy, these national ones were to facilitate the feedback needed for control and communication within the whole body.

To create such complex systems, the CSTP had already itemised what was needed and what was available "in-house". For the development of an ASU for research work, 900 workdays of specialisations were paid for during 1972, to study the experience of other countries – 570 of them in the USSR, but also 25 in Japan and 30 in Denmark, for example.[59] Bulgaria was keen on learning how non-socialist countries organised their own automation programs, too. This went hand in hand with the material need for certain ASU elements, as the CSTP oversaw the creation (in 1971) of ESPA – a Unified System of Information and Means of Automation. This list included 454 instruments needed to carry out automation, of which 266 were being produced in Bulgaria, with the rest produced in other socialist states. As a whole, the CSTP noted, the plan was being fulfilled with good speed, and by 1973 all the key elements such as ES-1020 processors were to be in place – in 1972 alone 28 computers were to be produced to facilitate ASUs. However, by 1973 only 83.9% of the computerisation plan was to be fulfilled, as there was a need for 87 computer centres, yet only 73 would be delivered.[60] This meant that socialist production was not enough – capitalist imports would have to continue, in order to facilitate socialist automation.

[59] Ibid., l. 12

[60] Ibid., l. 13-15

The program kept growing, with partial ASUs being at some stage of implementation in 541 enterprises by 1974, and further ones at DSO or ministerial level being built too.[61] However, there were continuous problems and they weren't exhausted just by the late implementation or not enough computers. Computer centres themselves were not used to full capacity, with only 73% of effective machine time being used, meaning they were slower to pay back their costs.[62] However, the slowness and problems meant that at the current level of growth Bulgaria would, by 1980, reach the levels of automation in industry that West Germany, France and Switzerland had achieved by 1971.[63] The solution to such slow progress, elucidated in the 1975 Politburo theses on scientific progress up to 1990, was "*more"* – more ASUs, more computers, more speed, more cybernetic theories and models for the functioning of the economy. The language is permeated with the same definitions as 1969, with more emphasis now on social governance than the actual computerisation, which had been started and was progressing, albeit slowly:

> An especially large attention should be paid to the problems of social governance [their emphasis]. More specifically the problems of the cybernitisation of governance and the perfection of organisational structures, economic mechanisms, the introductions of new methods in planning, control of scientific-technical progress.[64]

The material base was being built, despite the lagging speed. Automation and electronisation were reorganising the economy, and were now to be joined by new work in the social and natural sciences, including law where new legal forms were to perfect social democracy by new means of judicial relations within this more inter-connected society. Hand-in-hand with automation would now come "typification, unification and standardisation [their emphasis] in all spheres, the perfection of the system for the control of quality with the

[61] TsDA f. 517 op. 4 a.e. 35 l. 64

[62] Ibid., l. 53

[63] Ibid., l. 52

[64] TsDA f. 1B op. 35 a.e. 5368 l. 30

aim of achieving a maximum efficacy of material and human resources".[65] Automation was now recognised as an embedded fact of the new society, and there would be new social effects from this, discussed in the second half of the chapter. The base of such cybernetic transformations would continue to be the workplace, where automation had to become more wholesale. By 1990 up to 70 enterprises were expected to have total ASU and another 200 more limited but capable subsystems. Everything from the plan accounting to material provisions would be controlled by sector-wide ASUs. This meant that by 1980 up to 180 extra universal computers, 700 mini-computers and 3000 terminals would be implemented into enterprises, together with their peripherals and other communication systems.[66] The scientific theses' very drafting also showed the ambitious horizon that the BCP was chasing – comparisons were not just with the USSR but with the wider world, especially the capitalist ones. It was not enough to become more automated than the Czechs, but to reach the levels of Western Europe. To achieve this, over 800 scientists participated in drafting the theses, including people who had studied scientific and automation policy in the socialist bloc but also the USA, Japan, Austria and the Netherlands.[67]

In the later 1970s, as Popov fell from favour to be replaced by Doynov at the helm of Bulgarian industry, automation was the thread that united the two. Doynov was a continued proponent of the modernisation of the industry, and there were notable effects by the end of the decade. Automation would be a hallmark of 1980s industrialisation in Bulgaria too. By 1978 the plan for the 1980-5 period called for a further 243 ASUs of technical processes, 322 for enterprise governance, 16 sector level ones, and 162 for the automation of design and scientific work. The expected effect was nearly 2 billion levs by 1990, all down to growing

[65] Ibid., l. 35

[66] Ibid., l. 68-71

[67] Ibid., l. 94

productivity of labour, better product quality, and less resource waste.[68] The procurement of the technology to do so was at the core of the STI plans that Doynov oversaw from this period onwards, as discussed in Chapter 3.

The National Program of Automation after 1980 (Avtomatika-8) built on these ambitions. Over 1.8 billion levs were assigned for capital investment in the sector over the next five years, although it is indicative that many of the key ASUs were ones created in the 1970s – such as in ZIT and Kremikovtzi: already upgrading key areas of the economy took priority over building the first ASUs in other, under-mechanised, sectors.[69]

Pic. 2: Automation marches on – the new control centre of the Devnya cement works near Varna. (Source: Museum of Mosaics, Devnya)

Over 3000 industrial robots were to enter the machine-building sector, 2100 metal works machine with CNC were to enter the shop floor.[70] 480 new enterprises were to get ASUs of some sort (but the large-scale programs were saved for the sector-defining, already

[68] TsDA f. 517 op. 5 a.e. 14 l. 63

[69] TsDA f. 517 op. 6 a.e. 29 l. 7

[70] Ibid., l. 10

automated, enterprises as mentioned above).[71] Altogether, Doynov assigned three and a half time more capital investment to automation in the eighth five year plan than the previous one.[72] Popov's plans had found a worthy successor in terms of a man who saw the importance of the sector, but the solution continued to be based on throwing money at the problem rather than a discussion of the reasons for lagging behind plans. Automation exhibited, under Doynov, the sort of "gigantism" that defined his industrial policy – here expressed in the quantity of systems and capital.[73]

A couple of ASU projects from the large-scale 1980s campaign to automate serve as good examples of both the promises and problems of Bulgarian automation. Botevgrad, the semi-conductor producing town about an hour's drive from Sofia, was the setting for a couple of pilot programs. It was the perfect place to try them out, as it was a town integral to the production of electronics, with a correspondingly high (for Bulgarian standards) level of automation, computerisation, and technically-literate workforce. In 1980 it produced 156 million levs of industrial production, of just under 17% of total production for the Sofia district.[74] It housed not just the semi-conductor factory, but the "Chavdar" bus factory, and the major "Georgi Dimitrov" chemical works, while its mountainous geography made its AKPs major producers of milk. It had already made strides in automation, especially in the semi-conductor plant, which had automated its planning, operative production governance (shop-floor), material provisioning and logistics, and accounting operations; at its heart was an ES-1020 equipped computer centre. The chemical factory was implementing ASUs in

[71] Ibid., l. 27

[72] Ibid., l. 28

[73] This gigantism is best expressed in the most (in)famous of Doynov's pet project – the creation of the giant Radomir machine-building plant (the "factory for factories"), which was to be based on the latest Japanese technologies. Clashes with the pro-Soviet party faction in the face of Lukanov, however, led to the factory being equipped to Soviet standards, losing its Japanese contracts (which its profits were predicated on), and Radomir became a black hole for over 1 billion levs of investments, with no real returns throughout the 1980s.

[74] TsDA f. 517 op. 6 a.e. 38 l. 11

governance and administrative work, thanks to a new Robotron computer, acquired in 1981. Even the AKP had a computer centre, also equipped with a GDR machine (Celatron). The district people's council was well equipped with electronic calculators for its own accounting work, while the Chavdar factory was also beginning to automate; there were also plans for automation in the regional hospital.[75] The CSTP report concluded that the Botevgrad territorial system was successfully using computers to solve its governing and production tasks, automating routine operations. However, it still exhibited a "local character", with no attempt yet to link or co-ordinate the local actors in their own automation tasks. The local government, too, did not yet use computers in a capacity that would allow it to oversee the various ASUs operating in the town.[76] Future automation in the region had to concentrate on an overarching computerisation of government work, administration, social provisioning and the creation of a central reference base on local labour and financial resources, to be used by all the currently not-linked enterprises.[77] The bus factory and hospital were to quickly finish electronisation, and then be linked to a common Information Computer Centre for Collective Use, allowing Botevgrad's governance to be put on a completely rational basis, and connect to the Sofia district automation networks.[78] The CSTP's report did raise questions of how exactly this was to be done – one commentator rightly noted that the creation of common reference bases for all automated systems was all well and good, but "the problem of who will collect information, who will move it, and who will be responsible for it, is not solved".[79] Another noted that this was an improvement on earlier concepts, which saw the industrial and agricultural systems in the region as separate, but which indeed had to be united under a

[75] Ibid., l. 12-13

[76] Ibid., l. 14

[77] Ibid., l. 15

[78] Ibid., l. 16

[79] Ibid., l. 37

common, regional ASU as the “complex social-economic development of territorial systems requires unity in planning of all processes, bearing in mind the environmental-geographic conditions, labour resource and harmonic development of the territory”.[80] However, the exact methods of how this was to be achieved was still not clear.

The healthcare ASU, called “Electronic Medical Establishment”, was to be implemented in the 1983-5 period, after the Botevgrad hospital got its own computer centre in 1982.[81] It was to be the pilot program for further introductions of automation in healthcare in Sofia, Plovdiv, Varna, Stara Zagora, Pleven, and Ruse,[82] the biggest cities in the country. This program was conceived as both the introduction of advanced electronic diagnostic equipment into medical practice, and as “the creation of a system for automated governance of processes and activities in the medical establishment”.[83] It involved the creation of a unified hospital information system on the basis of SM-4 mini-computers, and local terminals and microprocessor systems to carry out the specific set out in four sub-systems – “hospital activities and economics” (accounting and administration), “para-clinic”, “poly-clinic”, “statzionar” (three systems connected to the gathering of general and medical information of patients in emergency rooms, there for doctor visits, or in the wards).[84] The stated aim was thus to both improve the quality of diagnostics and medical services, but also the “rationalisation of medical labour”, freeing doctors and nurses from superfluous “labour-consuming” activities. The mundane tasks of reception and appointment-making would be automated through the gathering of patient information at entry and inputting it into the electronic system. This would allow, overall, also for the “governance of patient streams in

[80] Ibid., l. 45

[81] TsDA f. 517 op. 6 a.e. 52 l. 24

[82] Ibid., l. 23

[83] Ibid., l. 20

[84] Ibid., l. 23

the polyclinic and carrying out of mass prophylactic examinations of the population".[85] Automation was the way forward for the rational labour of all workers, whether medical or industrial. The Botevgrad pilot system and its stated aims are perfect illustrations of the hopes the party put into ASUs as a tool to transform relations in all spheres of Bulgarian labour.

It wasn't just the improved health of the population, however, that was the aim – as always, the rise of productivity was the defining logic behind such measures. The pilot program also automated clinical laboratory analysis, automatically sorting information and returning results electronically, cutting down labour time in the sector by up to 30%. The introduction of new programs to analyse blood sugar, urine samples, cholesterol and creatinine tests were to increase labour productivity in Botevgrad labs by up to twice their previous levels.[86] Intensive therapy was also to be automated, through the use of six bed monitors and a central processing station, allowing for the automatic discovery of up to ten different types of cardiac problems, as well as taking patients' pulse, visualising and registering ECG patterns and other such measures, connected to a visual and sound alarm to inform medical personnel if anything went wrong.[87] The methods and equipment was Bulgarian created, and the overarching aim of these innovative (for the time and place) methods was, again, the rationalisation of labour by combining such disparate measures into one system, one screen, and one print-out[88] - a perfect illustration of the dream to simplify the increasingly overwhelming information flows of a modern economy and society. The introduction of such "computer technology as a means of intensification and intellectualisation of labour of the highly qualified medical personnel" would also have a

[85] Ibid., l. 22

[86] Ibid., l. 26

[87] Ibid., l. 27

[88] Ibid., l. 29

direct economic effect by spurring the production of more specialised equipment and programs.[89]

To visualise the full extent of what ASUs were expected to do, we can turn to the implementation of the Soviet-made ASU "Sigma" in the early 1980s. The system was part of the 1981 joint Soviet-Bulgarian technical co-operation plan, which would use the "Balkan" car plant in the town of Lovech as the pilot scheme for implementing the system in various Bulgarian machine building plants.[90] Despite the system being created by Soviet teams, the implementation called for joint work between the Novosibirsk branch of the Soviet Academy and the Lyubomir Iliev-led BAS Computer Centre.[91] "Sigma" was an adaptive system for the governance of industrial enterprises, allowing for both horizontal and vertical integration in the enterprise – that is encompassing all activities of the plant and facilitating integrated technical and administrative governance congruent with regional and state planning.[92] The "Balkan" plant was chosen as it had a key role in the production of "Moskvich" cars, was made up of seven fairly independent factories that depended on inter-factory co-operation, and already had a computer centre equipped with ES 1020 and ES 1022 machines[93] – thus it had the importance, need for organised governance, and qualified cadre and processing power to implement a complex ASU system. The Soviet had initially wanted to automate just some workshops as well as the annual production plan processing, but Bulgarian requests widened the scope to many more functions. Industrial use thus started in March 1983[94] (still done in a

[89] Ibid., l. 31

[90] RGAE f. 9480 op. 13 a.e. 481 l. 22

[91] Ibid., l. 32

[92] TsDA f. 517 op. 6 a.e. 52 l. 6

[93] Ibid., l. 7

[94] Ibid., l. 8

record ten months), and was announced in the "Pravda" newspaper, a potent symbol for Soviet-Bulgarian scientific co-operation.[95]

The system itself had seven main "complexes", depending on which sector of enterprise production or activity they governed. The "production" system analysed past performances and produced reports for low level managers, showing the achievement against tasks and annual plans; it was connected both to the logistics and provisioning-governeing "material resource" system (accounting for movements of goods in and out of warehouses, limiting waste and keeping statistics) and to the "optimisation of production plan" computerised system, which helped in the planning stages by taking into account resources and optimal deadlines – the three functioned in a direct feedback loop. These were to be controlled by one computer centre. Another would take into account the "preparation of new production" complex, which would automate the design, quality control, overview of production, analysis of flows and correction of production schedules of new car parts in the plant. This was closely connected to the "labour resource" system, which kept track of the in-house cadres and their qualifications, key to assigning tasks for any new production. The last two complexes were the "wages" system and the "technical preparation" one, a database of production norms, resource needs, and functions overview of the factories' different workshops. All were united by the central computing centre, which would ensure the coordination between the separate clusters within the ASU.[96]

The effects were tangible. Worker productivity was better accounted for, planning and accounting were much simplified through an automated system that continuously and daily fed information into the central computer. Labour was better organised and production was noticeable more "rhythmic" – the Bulgarian industrial parlance for predictable and steady,

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[95] Yuri Polyakov, *Optimizatsiya Planov Proizvodstoa Predpriyateiy Mashinostroeniya (Na Primere ASU Sigma)* (PhD Dissertation, SAN-Novosibirsk, 1984), p. 3

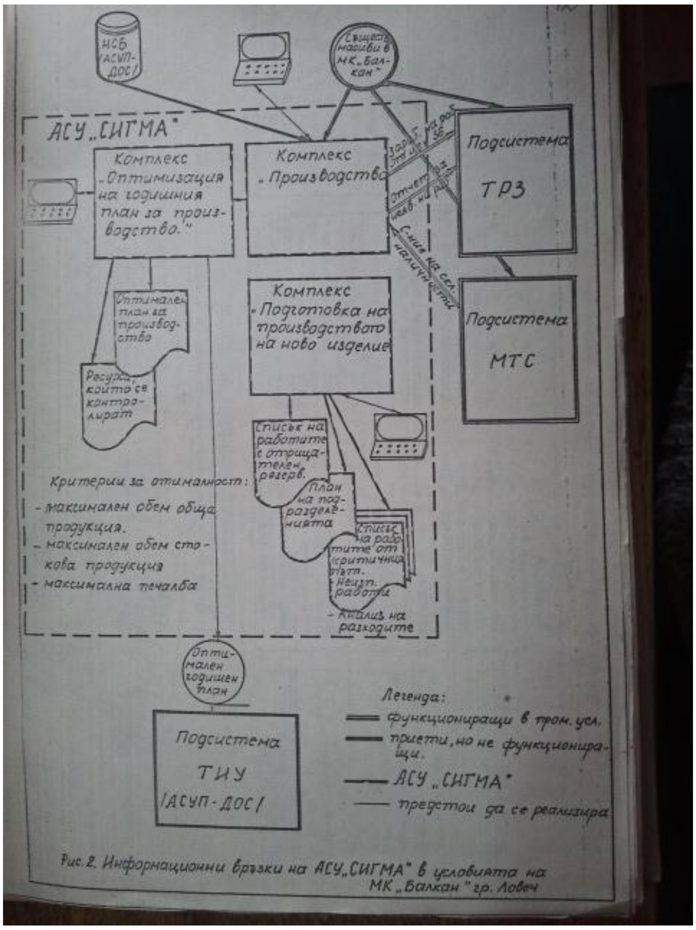
[96] TsDA f. 517 op. 6 a.e. 52 l. 14-15

rather than the previous bursts of production activity at the end of the month or year in order to fulfil the annual plan. This had knock-on effects as no workshop or factory within the plant slowed down the rest, and neither did "Balkan" slow down its socialist co-operators in "Moskvich" production. The system had also been applied to many different areas that would be of use to other enterprises, and had shown new methods and programs for analysing input data, cutting down the processing time for reports. The economic effect was over 10% higher than expected – a full 220 thousand levs in saved governing and accounting costs, with more expected from the increased production. The system would thus pay for itself in just over two years, while it had created the needed experience to implement it in other enterprises much quicker.[97]

The automation itself was predicated on the entering of information into the system through a standardised document template, which had enough recorded variables to allow for the easy identification of deviations to be fixed. It could generate daily overviews of the workshops' activity, wages, production quality, unfinished production, temporary transfers between workshops, stockpiles. Every month it could produce a report on usage of resources, costs calculations, workers' norm fulfilment, and wastage. It had in-built sub-programs that would also warn the user of "critical zones" – tasks that were nearing deadline, and whose lateness would have a cascade effect down the production process.[98]

[97] Ibid., l. 9

[98] Ibid., l. 15-17



Pic. 3: ASU Sigma's interlinked clusters of databases and information flows. (Source: TsDA)

All in all, it was the perfect management tool that the BCP desired – utilising a holistic view of the production process, while giving management a master view of its resources and tasks. It was, as can be seen by the various outputs it could create, also a disciplining tool, keeping a check on workers' own norms and quota fulfilments. What information was input was thus an important choice in what kind of effect the system was supposed to effect – in this case, the elimination of as much of the "subjective" factor of workers' shortcomings as much as parameters that would optimise management decisions on new products. The focus of many of the variables was *loss* – wastage, unfinished production, transfers (and thus temporary lack in certain workshops). Overcoming the regime's production problems was to be done through streamlining the process on the work floor by disciplining workers as well as allowing for a daily overview of the situation and a fast response by the managers. They were as much the subjects of this discipline as the guy on the conveyor belt. The choice of what information to record was a politically charged decision in industry but even more so in the area of social governance, and thus we now turn to ESSI – the vast social information system – and the series of territorial computer centres it depended on, to see what automated socialist governance's aims were more widely.

A National Network

Industry was not the only place where computers were expected to intensify the economy. The crux of socialist governance of a new type depended on the ability of the centre to have accurate information of social and economic factors at a district level, where computing power had to be provided to local councils and regional administrations in order to facilitate such work. This was a key part of the economic and social development plan discussed by the Central Committee and approved by the Council of Ministers after the 9th Congress's focus on intensification. The 1967 CSTP report which was to put such decisions into practice dedicated its fourth point to precisely this:

> For the perfection of governing work, planning and scientific-development and project-construction work, fast and precise computations are key, as well as accounting and statistical records. The fast and precise completion of calculations, accounting and statistical operations at minimum expense can be solved through the building of a unified system of computational centres [their emphasis].[99]

This system would unite the centres at places like BAS, the ministries, the Central Committee, enterprises, with a regional network of territorial computer centres. The first such regional computer centre (RITz – *Regionalen Izchislitelen Tzentur*) had started construction in 1965 in Ruse, with the aim to create a base from which to study mathematical programming means and methods domestically and abroad. It became a core for the design of software that would address the kind of tasks such a centre would have to fulfil, and carry out calculations related to accounting and planning production. It sent people to specialise in such

[99] TsDA f. 517 op. 2 a.e. 102 l. 42

planning to the USSR, GDR and Czechoslovakia in 1966, where they studied linear programming in both industry and agriculture.[100]

However, the centre would not get its machines until 1967, the first provincial computer centre to be equipped with a computer – a British-made ICL 1904.[101] By that point the RITz had 57 staff, some of which trained in the UK in preparation of getting the machine. Working with the COBOL language, by 1970, RITz-Ruse would design and implement automated systems for information processing, accounting, labour and wage databases for numerous factories in Ruse and the region, including the locomotive factory and tractor stations in local APKs. In the following years it would also work on “optimisation” programs that were implemented in agriculture and industry – from the optimal usage of certain chemicals in metallurgy to the optimal feeding of animals in collective farms. Its primacy among regional centres made it the hose of the first conference on computer and ASU implementation into enterprises in Bulgaria, in May 1970.[102] The Ruse centre was hailed by CSTP as cutting edge, producing good results, such as in the development of programs for all aspects of economic planning.[103] In 1971 it was re-organised, with an element being split to be part of “Orgproekt”, carrying out tasks of implementing ASUs; while the computer centre itself was renamed into a Territorial Computer Centre as part of the nation-wide move to consolidate such computer centres (TITz – *Teritorialen Izchislitelen Tzentur*). Its task was the servicing of territorial computing needs, such as by local administration, rather than designing and implementing programs.[104] It would gradually, during the 1970s, incorporate

[100] TsDA f. 517 op. 2 a.e. 95 l. 13-15

[101] Alexander Petkov, “Razvitie na Informatsionnite Sistemi I Tehnologii v Ruse” in *Izvestiya na Suyuza na Uchenite-Ruse,* 2 (2001), p. 1

[102] Ibid., pp. 1-2

[103] TsDA f. 517 op. 2 a.e. 106 l. 15

[104] Petkov, “Razvitie…”, p. 3

specialists from the Regional Statistical Authority, and create (in 1975) a Scientific Centre for Territorial Planning – a part of its new task of facilitating party and state plans at the regional levels, as well as being a collector of information of its fulfilment. To do so, its machines were gradually updated – first an ES 1022, then an ES 1030 supplemented with SM-4 minicomputers.[105]

Ruse was, of course, not the only TITz. Other regional centres were also being equipped from 1968 onwards, the first being that in Gabrovo, the first provincial centre to get an IBM machine[106] – the choice of the "Bulgarian Manchester", a stalwart of the old type of pre-socialist industry, makes more sense once we consider that during these years the town also got a technical university and specialised factories within the IZOT system (Mechatronika). By mid-1972 there were 91 computer centres in the country, including in all territorial centres (28, in each okrug), but only 55 had computers yet.[107] In the first nine months of 1972 they had seen 60641 hours of machine usage, which was 76.2% of the actual possible total – this was considered a good achievement. 62.5% of that time was used for data processing, 30.6% for program testing and 6.7% for other tasks, such as training.[108] There was huge variety between the centres, however – 97.4% of the hours used in one computer centre as opposed to just 26.9% of machine hours being used at the Ministry of Education.[109] There were general improvements, however, as priority tasks such as economic planning and operative control had risen as part of the overall usage, while routine statistical analysis had fallen.[110] The TITz system was growing and its tasks were pushed towards helping local

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[105] Ibid., p. 4

[106] Vela Lazarova, *Istoriya na Gabrovo* (Sofia: Otechestven Front 1980), p. 398

[107] TsDA f. 517 op. 2 a.e. 115 l. 17

[108] Ibid., l. 18

[109] Ibid.

[110] Ibid., l. 19

authorities plan and fulfil their socio-economic development priorities. Yet, there remained a huge variation in capability and usage between the different centres, as the country was struggling to equip all of them with actual computers, while some such as Ruse – who had priority and a history already – were much better utilised than those in poorer, more overlooked regions and ministries.

Pic. 4: The Pleven TITz in the 1970s. (Source: Lostbulgaria.com)

Despite problems, the computerisation of the economy and administration grew. By March 1975 there were 114 dedicated computer centres in the country, of which 54 in enterprises and the 28 territorial ones servicing local administrations (by this point, some were also in schools). Of these 60% had one computer, 17.5% had two, 4.5% had three or more – meaning a full 18% were still operating without any computers.[111] Nearly half – 45% - were in Sofia, and 30% of the rest were concentrated in seven large district centres. As the

[111] TsDA f. 517 op. 4 a.e. 25 l. 11

doubling up of computer power was seen as key to ensuring redundancy, the CSTP sought to limit further growth in order to ensure that all centres had sufficient machines.[112] The rapid growth of centres in the first five years of the break-neck automation did not produce even results, it was noted – computer centres demanded the right kind of buildings, with sufficient climate control and regular cooling, which sometimes meant that it took over four years for a centre to be built (as was the case with the Vratsa TITz, between May 1971 and October 1975). By the end of 1974 the country had produced 183 large computers, of which ES types were 35%, 22.5% were of the ZIT-151 (the Bulgarian copy of the Fujitsu computer) and the rest were others. Even with the 88 machines planned to be built in 1975, the plan was not to be fulfilled, leaving gaps in the computer centres. Only 7% of machines delivered in 1972, for example, had memory capacities over 64KB and not much had improved – so peripherals were to be prioritised, as sufficient memory was key to the operations of these centres. More than 40% of machines were not used well or enough, such as the second machine in Kremikovtzi or the one in Devnya. Most damningly, 53% of machines used were still imported[113] – a glaring example of the emerging tension between the computerisation plans of the party and its export-oriented policy in the industry.

The report's overview of what had been achieved did not successes too. For example, over 9400 specialists were now working in the computer centres by the end of 1974. Plenty had been done to create the specialisations in university faculties and post-graduate schools, and just more had to be done in practical training.[114] By the end of that year there were 76 dedicated computers working in enterprises, with increasing machine time dedicated to

[112] Ibid.,

[113] Ibid., l. 12

[114] Ibid., l. 13

engineering tasks rather than administration there.[115] Thirty higher education places had been selected to implement computer centres too by 1975, increasing machine hour time by 200% - from 179 thousand in 1972 to 345 thousand in 1975, leading to 230% increase in data processing during this time (as these computer centres carried out tasks outside the education sector too), all helping raise hourly productivity. This was done through an average use of each machine for 14.1 hours a day – higher by over 90 minutes than Soviet counterparts – although some machines did much better than others: Gabrovo's TITz achieved 94% working hours during the day thanks to a three-shift system, and similar work practices made the one in BNB reach 90%, but the Vidin TITz achieved a paltry 39%.[116] Real economic effect was being felt, despite this unevenness – twenty major engineer projects saw their duration cut by four to six times; 100 thousand levs were saved in bridge planning; the Ministry of Transport alone saw 5 million levs in savings in 1974 thanks to computerised control and planning. The effect was calculated at between 12 and 14 million levs per year.[117] This was expected to grow with the perfection of work within the centres, by re-organising shift work, increasing training, and organising a central technical service bureau.

The territorial centre system, as well as the spread of computer centres in various ministries and enterprises, created a fledgling but not connected matrix of computing power. The delivery of more machines and more ASUs would proceed apace throughout the late 1970s and 1980s, as we saw in the previous section, yet the mid-1970s saw another key discussion in the Politburo: the precise direction of development of the technical means that Bulgaria lacked in order to help the automation of governance. In December 1974, Doynov reported on the main directions of economic development in the future, and accentuated the

[115] Ibid., l. 14

[116] Ibid.

[117] Ibid., l. 15

need for mini-computers as opposed to larger computer centres in order to allow for the cheaper and deeper penetration of computers into more locales and enterprises, which would create hierarchical automation and help spread the cybernetisation of the national economy:

> Small and medium enterprises and organisations, thanks to minicomputers, linked with powerful computational centres for collective use, achieve the ability to automate the governance of production without possessing large machines.[118]

Bulgaria had to start producing smaller machines if it was truly to automate governance and production. It had to make up its lag in "mathematical provisioning" – software – which not only allowed the computer to carry out its tasks, but also "which makes the computer needed, marketable, effective and sought after on the international market."[119] It was also to expand its communication network and modernise it, with radio-electronic production to reach 600 million levs by 1980, including creating electronic Crosspoint systems[120] with over 1260 relays.[121] The turn to small machines would continue in the 1980s, leaving behind the larger computer centres which were key to large-scale processing and moving towards more personal computing; however the improvement in communications *between* these centres is what is key. Georgi Atanasov also reported, at the same meeting, of the world being on the cusp of a communications revolution with new cable and laser-fibre developments. Bulgaria needed to capture it and increase its connectivity – only 22 direct channels existed between Sofia and Moscow! These talks also hinted at turning Bulgaria into a communications hub between Europe, Asia and Africa due to its geographic position,

[118] TsDA f. 1B op. 35 a.e. 5106 l. 194

[119] Ibid., l. 192

[120] The cross-point or cross-bar switch is a collection of switches arranged in a matrix; the electronic cross-point allowed for the large scale telephone exchanges and telephony systems after the mid-1960s.

[121] Ibid., l. 196

piquing the interest of Zhivkov.[122] Yet it was the domestic element that Atanasov emphasised, where new communications would lead to better information flow

> I feel that we can solve all this [bad integration of information and communication networks] on the basis of completely new means of communication and information activity…and if this material gives more space and importance to this question, I think that it will help in the fuller solution not just of the question of automated systems but the whole realisation of governing activity of our leadership.[123]

The improvement in communications and the creation of effective electronic telephone exchanges, together with the creation of the ESTEL tele-processing system that utilised it, birthed the means of connecting the computer centres of the state to one another, a real network that would enable the transfer of information and the automated governance dream that was at the heart of BCP thinking. A national network was to be overlaid on top of these myriad computer centres – ESSI.

ESSI was in the party's thinking since the late 1960s, when it was becoming clear that computing power would allow the processing of large quantities of economic and social data. By 1970 a DSO – MOSI (Machine Processing of Statistical Information) was created to organise work in this area. It would be transformed into the NPO "Avtomatizatsiya" by 1974, while the work on creating a national network for the collection and processing of social information would be transferred to a committee – KESSI – working under the Council of Ministers, in 1977.[124] While not having the rank of a ministry, KESSI had an important role to the party as it sought to automate its social information gathering and modelling. What ESSI was to collect and process was to be a myriad of things: enterprise production and accounts were to feed into it, as well as local government socio-economic planning. It would

[122] Ibid., l. 72-78

[123] Ibid., l. 79

[124] Taken from the brief historical overview on the website of the private company "Information Services" AD, a successor of the state-owned ESSI systems under their various guises after 1970: https://www.is-bg.net/bg/about (Last accessed: 4th January 2017)

also have a major subsystem for citizen registry, the Unified System for Civilian Registration and Administrative Services for the Population (ESGRAON), a project started in June 1974: “the created system has as its aim to noticeably improve the technology and culture of administrative services for the population and to perfect some parts of the informational processes in the local and central organs of government”.[125] It would create registration cards for all citizens, which would contain education and work status, their EGN (citizen registration number), any convictions or other legal proceedings, financial obligations, property and car ownership. It would also create standardized forms to be used by all local governments in order to ease the collection of information and allow it to be machine processed. As the CSTP admitted, this was to be a hugely complex system.[126] The introduction of various national data banks and territorial information systems, a better communication network, a wider computer centre network with built-in redundancy, was projected to require over 82 million levs in extra research and 223 million for the actual implementation (including 149 million for the further equipment of territorial centres and nearly 58 million for improved communication networks) – while the economic effect was expected to be great but not quantifiable yet.[127] ESSI was a gamble for a party that preferred projects’ results to be predictable and direct.

The creation of ESSI was predicated on the creation of a “rational computer network”, as the Politburo noted.[128] Thus its practical development accelerated after 1975, as the basic bones of the national computer centre network was in place. The 1975 scientific theses of the BCP, discussed above, used ESSI as a main reason for the increased production of smaller

[125] TsDA f. 517 op. 4 a.e. 33 l. 44

[126] Ibid., l. 44-5

[127] TsDA f. 517 op. 4 a.e. 35 l. 66

[128] TsDA f. 1B op. 35 a.e. 5106 l. 265

machines and the aim to create 3000 terminals was connected to the need to encompass as many enterprises and government offices as possible into “multi-machine networks”, a Bulgarian synonym for networked computers.[129] The practical application and creation required multiple organisations to co-operate, with the BAS’s own Cybernetic Institute taking a lead. In 1976 it released a report on the methodologies of teleprocessing of information in large multi-machine networks, a topic of co-operation with the USSR. It studied existing systems such as APRANET and TYMNET, seeing many advantages in such networks: collective usage of common databases through terminals, as well as the exchange of data and programs across great distances.[130] It aimed to create the structure of such a network using means available in the socialist world, as the creation of such systems had become inescapable at the present level of development. Its conception of ESSI is worth quoting fully, as the most complete definition, showing its techno-utopian scope:

> [A] pan-national, automated information system for the gathering, processing and storage of data for governing, planning and accounting of the social-economic development of the country, which has as an aim the complex informational servicing and mutual interaction of all organs of social governance. Its aims are the ensuring of the needed prerequisites for the solution of given tasks in achieving the maximal economic and social results with the optimal usage of natural, material, human and other resources of the country. ESSI is an integrated system, which uses the informational base of automated systems of governance (ASU) and all automated information systems (ASI), created in the country, including the systems designed for the servicing of citizens.[131]

Its structure was to be based on the various TITz and ASUs in enterprises, and depended on the mutual linking of such systems in order to use common funds of information. For example, each TITz was to house a territorial database which contains information on the natural, material, and human resources in the okrug, which could be of use to both the local party and enterprise managements. All of these must be linked to a national

[129] TsDA f. 1b op. 35 a.e. 5368 l. 70

[130] BAN-NA f. 20 op. 5 a.e. 113 l. 2

[131] Ibid., l. 24

database and national computer centres, whose databases must also be accessible to all organs of governance. A communication subsystem using mini-machines and separate channels for data transfer was to ensure the independence of user machines and the autonomy of computer centres in the event of breakdowns in the network.[132] By 1980 an experimental network communication system was to be built, and special communication processors were to be installed in major cities (Sofia, Plovdiv, Varna, Stara Zagora, Veliko Turnovo, Burgas, Vratsa), connecting those TITz into the first echelon of the network, together with their territorial enterprises and ASUs. The national ASUs – such as databases on banking or pensions – were to be connected next.[133] Terminals were to ensure each enterprise was connected to its TITz, and the TITz to the national networked system.[134]

The system would require computers of at least 3rd generation vintage, such as the ES 1020 to ES 1030 series, capable of at least 250 thousand operations per second. Modems of at least 4800 bits per second were also required, as well as specialist programs to allow the connections of all the machines. This was to be in-built into all future TITz modernisation.[135] Improvements were also being made to the ESTEL system, with its fourth version based on IBM System Network Architecture and using the internationally accepted Synchronous Data Link Control algorithm, making the Bulgarian network compatible with international standards. New ES series terminals such as the 8501 type were also based on IBM stations, further improving user access. Databases being developed and implemented included "Horizont", a system with predictions on the development of the economies of advanced countries (allowing enterprises and the foreign trade ministry to tailor its policies) and

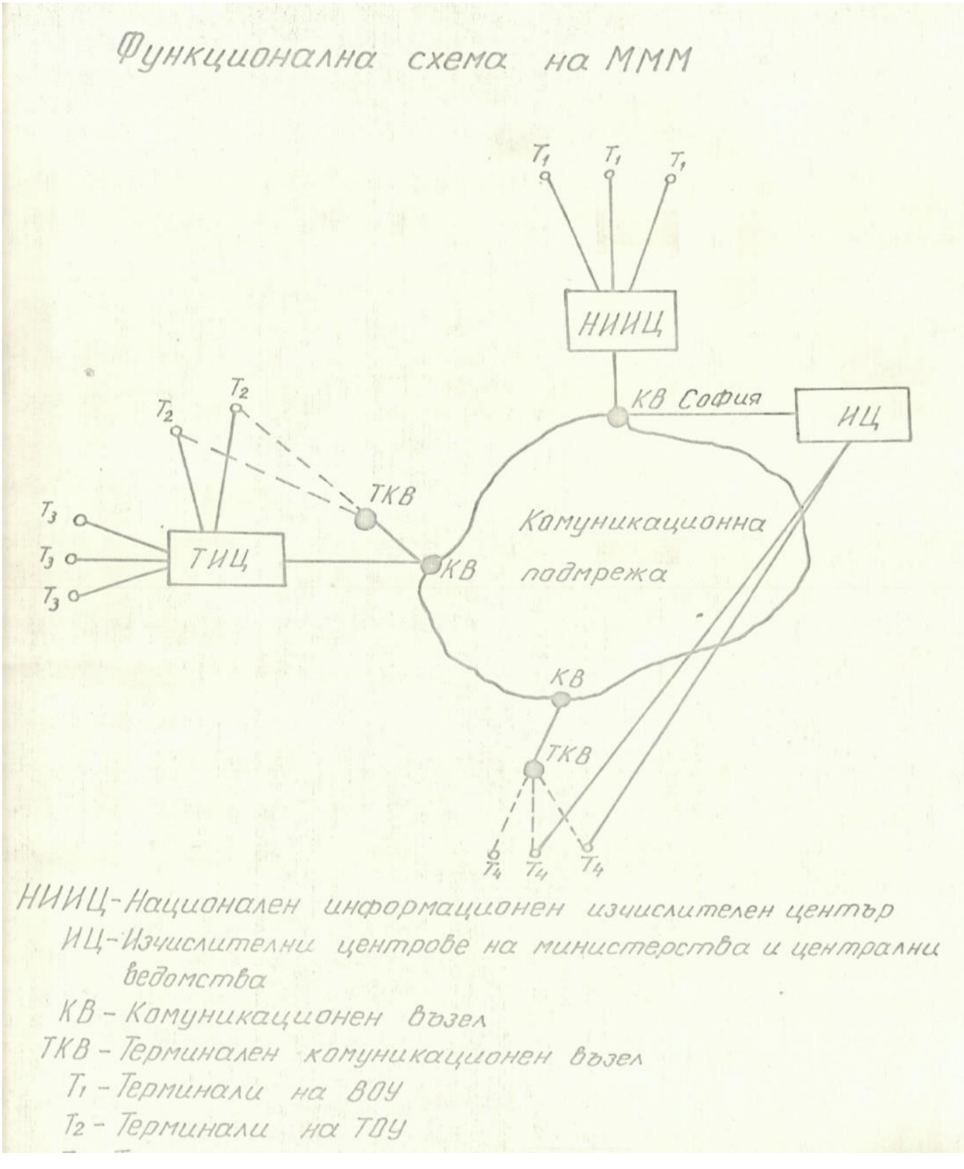
[132] Ibid., l. 25

[133] Ibid., l. 27

[134] Ibid., l. 28

[135] Ibid., l. 30-35

“Sirena” (a database of implemented scientific achievements and completed dissertations in the country, easing research work). The network itself would also be connected to international databases such as the one in the Moscow VINITI (the Soviet Institute for Scientific and Technical Information), expanding the databases available to users.[136]



Pic. 5: Map of the network. T1 through T4 are the terminals of local party and state organs as well as enterprises. They are connected to the central TITz, while the territorial administration was to have a secondary, back-up connection to the national network through a dedicated terminal. T4 – enterprise terminals – were also to connect to the central computer centre for the sector (usually housed in the corresponding ministry). Through the

[136] Ibid., l. 49-53

Sofia interchange, the network was to be connected to the national databases. There was thus a lot of back-up and overlap built into the system, to ensure safety – while not voiced, the spectre of nuclear war must also be factored into this network redundancy. (Source: BAN-NA)

The Soviets themselves took interest in the system, and noted its scope as facilitating the "timely and accurate statistical and other information and analysis for the development of economic, social and cultural life in the country for the needs of social governance at different levels" as well as the standardisation of programs and documents to be used nationally.[137] One of these standardisation methods was the creation of the unique citizen number – EGN (*Edinen Grazhdanski Nomer*) – which allowed every citizen to be entered into the national database, with the very number encoding the date and place of birth as well as gender. It was just one among many variables that the system was to encode, putting massive strains on the limited capabilities of Bulgarian computing in the late 1970s. In his report on the National Information Calculating Centre (the heart of the system) Dano Balevski, the head of KESSI, stated that the system of operative tracking of plan fulfilment had been tested by March 1979 and was entering active work during the latter part of the year. It tracked, daily, over 500 indicators of development, keeping track of the economic and social effects of the party's plans.[138] This centre could not cope with the tasks it was given – it required a computer with over 1.5 million operations per second and 1200 MB of storage. Currently it had to export over 3000 hours of processing to local TITz systems, as it was equipped with an ES 1022, insufficient to the task.

> The lack of machine time destroys work rhythms and destroys the agreed schedules for distribution machine time to users. Work is nervy and under huge pressure. This reflects on the quality of the work, worsening it and raising the number of mistakes, and mistakes in information that is given to higher organs of governance can lead to serious consequences.[139]

[137] RGAE f. 9480 op. 12 a.e. 583 l. 1

[138] TsDA f. 517 op. 7 a.e. 58 l. 6

[139] Ibid., l. 8

To ensure socialist governance's smooth operation, the national centre required capitalist machines as there were none that met the criteria within COMECON. $4.5 million were assigned to the task, showing the importance of KESSI to a party which was careful to give out handouts of precious convertible currency. The equipping of the system also brought in interest from the USA. In 1981, CDC (Computer Data Corporation) offered its new "Cyber 170" systems to Bulgaria, stating that KESSI's needs couldn't be satisfied through purely socialist machines. The company could offer a system that was configured to work in networked modes on large databases, and was compatible with the ES system (which was, of course, part of the rationale of the Ryad system). The company could produce machines with specifications that would be easy to approve for export, as COCOM did allow export of certain machines below a certain threshold of performance.[140] IZOT's co-operation with CDC will be discussed in more detail in chapter 7, but the US company's interest in this socialist governance project demonstrates both KESSI's scope and international provenance. It was an object of interest to both superpowers, if for different reasons.

The Soviets were particularly impressed with the ESGRAON database, which allowed the production of various lists and graphs of citizens aged up to 3, 6, 16 and 18 years old, which was useful for many reasons:

> These lists will allow in the work of servicing Bulgarian citizens who are not yet of age, such as in areas of immunisation, determining the number of school-age children etc. The information of these lists is used for planning and making decisions in building kindergartens, schools, preparing specialists for education. The lists of people that are reaching the ages of 16 and 18 is useful in work on passport issuance and the distribution of labour resources.[141]

These databases could be used to also determine army conscription lists (16 year olds), while the system also eased pension work (as it could create lists of people coming up

[140] TsDA f. 1003 op. 1 a.e. 130 l. 57-8

[141] RGAE f. 9480 op. 12 a.e. 1777 l. 36

to retirement age). The system, with its ability to present information in clear graphs according to so many factors – from gender to age to people of working age with no employment or those with higher education – eased the work of social governance, and was something the USSR could learn from and implement too.[142] The ESGRAON system, together with the associated EDSD (Unified State System for Clerk Services), had already been in use in Bulgaria from 1978, when it was tried out in the Ruse and Burgas regions first. Over 150,000 households in Bulgaria were paying their taxes and different household bills without the usual clerks and tills but through the automatic databases,[143] all of this helping to achieve the aim of "maximally freeing citizens from their direct participation in services, saving them time and raising the social productivity of labour".[144] By the end of the year people could pay bills and taxes in such a way in Plovdiv, Ruse, Varna, Burgas and Stara Zagora, reaching many of the largest cities. The pension system had been computerised too, while the labour history of four million workers was nearly digitized too. City administrations had introduced the ability for citizens to request certain documents and carry out administrative tasks over the telephone, saving them the trouble of queuing, bureaucracy, and wasted labour hours. Bureaus for such "complex administration" had been set up in Sofia, Pleven, Ruse, Gabrovo, Vidin, Blagoevgrad, Veliko Turnovo and others.[145]

KESSI had made the servicing of society and governance decisions easier, creating the databases and networks needed to record and process the huge amounts of information produced by and about an increasingly complex society. Its abilities and roll-out, though, could never satisfy the party which was seeking more and more complete information. The

[142] Ibid., l. 37

[143] TsDA f. 517 op. 5 a.e. 20 l. 4

[144] Ibid., l. 2

[145] Ibid., l. 6

Politburo complained in 1983 that KESSI was still not servicing government adequately with information, or was doing enough for the citizens themselves.[146] This was a difficult task – the Bulgarian economy had seen a massive growth in administrative workers and actions, while the computer industry continued to be export-oriented, leaving KESSI always underequipped for the task. By 1980 there were 1.4 million workers in administration and services, up from 630 thousand in 1960.[147] At the same time, their productivity had risen only 4% as opposed to a ten-fold growth in industrial productivity – over 80% of their time was spent in meetings and travel.[148] KESSI and automated governance was taking steps to increase their productivity, and there were notable improvements, but going was slow. What could really change workplace productivity was the entry of computers to the individual offices and desks, rather than just enterprises and ministerial departments. KESSI's solution to automatic governance was large-scale networks and large computers with terminal connections, in the service of large-scale processing. The early 1980s, however, were seeing another revolution in computing which the party now latched on to as the next step in automation – a personal automatic revolution through the personal computer.

Microcomputers and Robots: The Future of Automation

The Altair 8800 sparked the PC revolution in 1974, becoming the first commercially successful machine of this type. By 1977, the Apple II had come out, making the previously unknown company a household name and catapulting Steve Jobs and Steve Wozniak to public prominence. Established companies such as IBM were slower to pick up on this new trend of small, desktop computers aimed at individual users, but by 1981 they too entered the fray with the 16-bit, powerful IBM PC. Paired with the MS DOS operating system, created

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[146] TsDA f. 1B op. 67 a.e. 2695 l. 104

[147] TsDA f. 37A op. 9 a.e. 37 l. 7

[148] Ibid., l. 8

by Microsoft, it was clear that the world of computing had changed. By 1982, *Time* magazine had made "the Computer" its machine of the year.[149] The true, mass information age had arrived.

The BCP was well aware of these trends, and the development of a domestic PC was part of the 8th five-year plan. It was discussed as part of the 1980 plan of the CSTP, which tasked a team of the ITCR at BAS to create a Bulgarian personal computer on the basis of an Intel 8080 processor. The first 50 were created at the experimental base of the institute and distributed for free to 35 organisations – this was the IMKO-1, short for *Individualen MikroKOmpyutur*[150] (although the joke was that it stood for the Bulgarian abbreviation of "Ivan Marangazaov – the leader of the development team – Copies the Original"). This was a promising start, as it produced a workable machine, complete with processor, monitor and a tape machine to load programs through. The CSTP thus developed a program for the development of these machines between 1982 and 1985. Vladimir Lazarov reported on the microcomputer revolution in the world, noting that these new systems allowed for the automation and intellectualisation of immediate workplace tasks as well as usage at home. In 1981, 500 thousand units were sold worldwide, and by 1984 it was expected that figure would top 5 million.[151] The CSTP's program noted this and stated that much like the ES series, the Bulgarian PCs must be based on the latest foreign developments, with at least 64 KB ROM and a dedicated video-monitor, and software based on BASIC. This was the immediate task, but 16 and 32-bit machines were being developed and must also be part of the plan – the newest 32-bit machines would have as much processing power as a medium-sized IBM 370 (which the later ES series, such as the ES 1035, were based on). A lot of

[149] For more, see Paul E. Ceruzzi *A History of Modern Computing* (Cambridge, Mass: MIT Press 1998), chapters 7 and 8

[150] TsDA f. 517 op. 6 a.e. 38 l. 66

[151] Ibid., l. 56

functions of complex systems, hitherto carried out on large computers, were becoming part of the capabilities of PCs. Computers such as ATARI systems also attracted the younger generation to computing through both education and entertainment software, such as games.[152] Currently, only the USSR and Hungary were making some sort of PCs within the socialist world, but neither was commercially available. There was a nice for a socialist PC. The machine would also have a political aim, an extension of the 1970s automation discourse:

> In the socialist conditions of life the role of personal computers is seen in a new light: the possession of a personal computer doesn't have the characteristics of a purely commercial usage; here the personal computer serves for the easing, intellectualisation and efficacy of labour at the workplace, for scientific activity, education, prognosis, planning and many others.[153]

The IMKO had already demonstrated that Bulgaria was roughly at the current world level, and was definitely leading its socialist allies in technology, so "this, as a rule, creates the pre-conditions for an eventual acquisition of profitable specialisations to Bulgaria's benefit."[154] The country had already taken a leading part in many COMECON technical initiatives such as "Unified System of Program-Compatible Microcomputers for Mass Usage" and "Local Networks for Education", which would develop a Bloc-wide standard. Again, much like in the late 1960s, the party had its eyes on the massive market to the north and east – "as illustration of the reach of these markets we can mention, that in terms only of regional agricultural centres in the USSR there will be a need for tens of thousands of personal computers in this five-year plan alone."[155] A series of 8-bit computers that could be connected to a family's TV set were envisioned as a cheap, home computer; paralleled with

[152] Ibid., l. 62-3

[153] Ibid., l. 66

[154] Ibid., l. 67

[155] Ibid., l. 69

better, 16-bit machines for offices. This would come with upgraded peripherals such as colour displays, Winchester disk drives, and printers (there was already a license with EPSON for this).[156]

The program however also envisioned domestic usage, especially in education (which will be discussed more in the following chapters). Class rooms were to be equipped with computers, special classes were to be held and introduced, the teaching of BASIC programming was to extend to all school children. Blagovest Sendov was developing his own method of computer-based education. A wide network of computer clubs was to encompass the country, ran by the youth organisation DKMS. A co-ordination centre for the exchange of programs was to be set up. All was aimed to turn the PC into the final stage of automation of Bulgarian work and now even homes. The expected effect is worth quoting at length:

> The realisation of the aims of the programs will ensure the mass entry of personal computers into the spheres of education, professional circles, scientific circles, schools and universities, trade and construction organisations, in the many hobby clubs, in open spaces for games and work through PCs, and many other places. The effect of the entry of personal computers into our country will reflect en-masse in all spheres of social life. The wide distribution of personal computers will constitute the real manifestation of the all-encompassing intellectualisation of our life, and in the end will lead to a massive and geometrically multiplied economic and social effect in all areas of the national economy and social life. In many cases, with the help of personal computers it will become possible to solve economic and technical tasks through cheap technology at the workplace of specialists, the engineer, the economist, the doctor, the economic director or supervising worker.[157]

Bulgarian workers would finally become the Marxist Renaissance man. The PC was a real revolution in the capitalist world, but it had a distinct socialist flavour, stemming from the earlier hopes invested in ASUs and computers as a whole. The desktop computer would be a personal ASU – easy to use, and through programs it would be able to solve any sort of task: from accounting and processing to gaming and education to creating graphs or easing technical work through CAD software. As more and more administration and service work

[156] Ibid., l. 70-71

[157] Ibid., l. 79

displaced industrial work, the later would be taken over by robots – the other facet of the 1980s automation dream. Man would be free of menial labour, and would become the controller of processes.

Pic. 6: A Pravets-82, displaying the "Karateka" computer game. (Source: soc.bg)

The year 1982 saw the transformations and first steps towards this, as CICT created a PC section (based on the old "electronic calculator" one), and ITCR also developed its own laboratory. In only a few short months that year, the Marangozov-led team created the IMKO-2, a completely Apple II-compatible PC that entered the market as the "Pravetz-82". From 1983 it would enter serial production in the Instrument-building Factory in the town of Pravetz – the birthplace of Zhivkov, which under his patronage would become both a town and the home of this high-technology sector. Printers, floppy drives and video CRTs also entered production, in order to create the full range of peripherals needed.[158] In the following years, the range would increase – the 16-bit professional PCs of the Pravetz-16 series (analogous to IBM PC) in its various upgraded variants entered production from 1986 in the Pravetz factory, which became a Scientific Production Combine of Microprocessor Technology. IZOT also produced its own series – the IZOT 1036 and IZOT 1037 computers – but the talent had been moved to Pravetz, a new organisation that was at the cutting edge of technology. The old production organisation was slow to adapt to the change, a parallel to IBM's lag too – it was too invested in the ES series, which aimed at the creation of large systems for different uses. It was already experiencing problems in implementing the production of SM computers, let alone the microprocessors key for PCs.[159] The Pravetz combine drew the best young cadres of the ITCR at BAS as well as certain specialists from CICT (given tasks such as CPUs, controllers, operative memory; while the institute was to work more on networks and applications of PCs),[160] who helped it serially produce over 5000 units by 1984;[161] and at the end of the regime, it was managing to reach its capacity of 100,000 units per year.[162] It also produced, from 1986, the "Pravets-8" series of 8-bit machines for home usage – pluggable into the TV, they were the first step towards home automation that the BCP hoped for.

Parallel to this, robots were also being produced, to further automate the workplace and industrial floor. Doynov had made robotics item two in his wide-ranging speech on scientific-technical implementation to the Central Committee in July 1978, right after microelectronic applications to the economy. He talked about the age-long dream of man to

[158] TsDA f. 517 op. 6 a.e. 48 l. 34-6

[159] TsDA f. 517 op. 6 a.e. 98 l. 12

[160] TsDA f. 37A op. 10 a.e. 16 l. 66-8

[161] TsDA f. 1B op. 67 a.e. 3090 l. 167

[162] Milena Dimitrova, *Zlatnite Desiteletiya na Bulgarskata Elektronika* (Sofia: IK Trud 2008), p. 221

create machines that could copy the functions of man himself, and we were finally on that threshold thanks to the advancements in microelectronics, hydraulics, pneumatics, and precision machine-building. With the right programs, this machine would be able to carry out so many functions, freeing man from manual labour more completely than any previous ASU. The monopoly of

Pic. 7: Production in the Pravetz factory. (Source: Sandacite project)

man had been broken and robots were a fundamental change in the tools of labour and organisation of production. If the 60s and 70s marched under the flag of computers, then the 1980s were to be the robotic decade. Whole factories would be robotised around the world, and Bulgaria was to not fall behind.[163] It would also go a long way towards solving the vexing subjective problems in quality: "robotisation will introduce changes in the role of the subjective factor in production quality. It will no longer be determined by the psycho-

[163] TsDA f. 1B op. 65 a.e. 24 l. 39-41

physical and physiological abilities of man, but by the stored programs and capabilities of the machines".[164]

As we saw in chapter 3, he made robotics a key aim of STI work in the 1980s, and this was paralleled in domestic developments. The Stara Zagora factory started operating the "Beroe" combine, dedicated to creating robots, while the Institute of Technical Cybernetics added Robotics to its title in 1978 too, and was headed by Angel Angelov. VMEI Lenin introduced a robotic technology centre the following year, in order to prepare students for the 1980s push.[165] The Central Committee itself was familiarised with the latest trends in robotics through a 150-page collection of articles from journals and newspapers around the world, driving point the importance of these machines to the future of industry and society.[166]

Licenses were quickly bought from US, UK and West German firms, starting in 1978, to start creating the RB 110, 211, 231, 232A machines – used in welding, lathing, painting and other industrial tasks.[167] These were quickly put into production, and 3000 were expected to be implemented into machine-building by 1985;[168] 422 million levs of metal works machines and robots were to be manufactured by 1983.[169] There were twice as many robots in the country in 1982 as opposed to 1980,[170] producing four million levs of direct economic effect,[171] with the aim being that over half of all "mechanical manipulators" would be

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[164] Ibid., l. 46

[165] Evgeniy Kandilarov, "Elektronikata v Ikonomicheskata Politika na Bulgariya prez 60te-80te Godini na XX Vek" in *GSU-IF*, vol. 96/7 (2003/4), p. 461

[166] TsDA f. 1B op. 65 a.e. 25 l. 79

[167] TsDA f. 517 op. 5 a.e. 20 l. 81-3

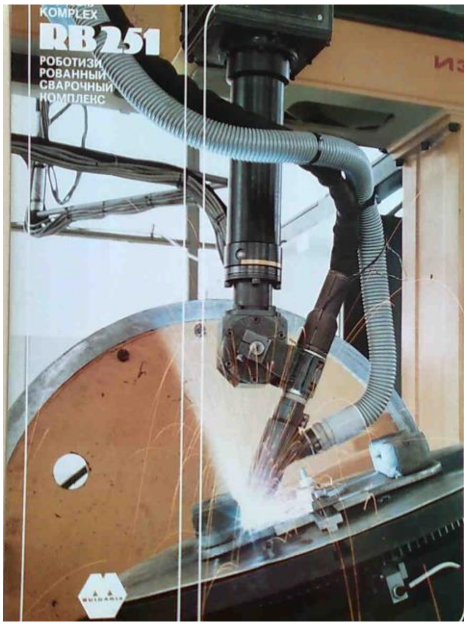
[168] TsDA f. 517 op. 6 a.e. 29 l. 10

[169] TsDA f. 1B op. 67 a.e. 1604 l. 61

[170] TsDA f. 517 op. 7 a.e. 55 l. 88B

[171] Ibid., l. 89

digitally controlled robots by 1985.[172] Robotics became a part of the COMECON division of labour too, and once again, the Bulgarians managed to defend their positions – in 1982 the Soviets noted that while the Beroe combine was still not fulfilling all its orders, it had implemented many different types of robots, and the shortages were much more severe in the USSR.[173] Robots became a sales item to places like India and Zimbabwe, as we saw in the previous chapter. They were an integrative part of the automation dream that the party forged, an extension of and part of the new ASUs, and the next stage of automating the industrial floor while the microcomputer automated the office. Since the late 70s, when the first robots were introduced, the party was already identifying workplaces that could be robotised – 180 places in the Shumen "Madara" factory alone, or 40 in a Plovdiv plant. There were many applications expected in the car and ICE-producing plants of the "Balkancar" combine too.[174]



Pic. 8: Advertising brochure for an RB 251 welder robot. (Source: Scrapbook presented to Angel Angelov on his birthday, kindly shared with me by Peter Petrov)

[172] TsDA f. 1B op. 67 a.e. 668 l. 33

[173] RGAE f. 9480 op. 13 a.e. 875 l. 13

[174] TsDA f. 1B op. 65 a.e. 24 l. 97-8

Microprocessors were presented to the party as another element of automation, and a real catalyst for the fated revolution that the BCP had been aiming for since the 1960s. A Lazarov report to the CSTP in 1983 talked of a microprocessor revolution, with universal applications and being the basis of new sorts of automation. He ensured the leaders that "as a result of their 'intelligence' there is now the possibility for the decentralisation of governance functions, and automation can enter areas which were until now technically impossible or economically unviable".[175] Human labour would be changed, other reports helped, making Man an intellectual worker, removed from the harmful areas of production: "a person will be removed from the harmful productions and through digital displays will have access to the technological process."[176] The language of the scientific-technical revolution persisted as the panacea to production and economic problems. In 1985, before the start of Gorbachevite preustroistvo, the Central Committee plenums still considered the application of the latest technology to be the threshold to success:

> This is the stage of the powerful development of minicomputers and microcomputers, of their widespread introduction into production, governance, education and everyday life. This is the stage of the new generations of computer machines and robots, of biotechnologies, of the miracles of informatics and others.[177]

This was also the cusp of the mobilisation of cybernetic "self-regulation" as a tool to attack bureaucratic deformations and push towards a certain type of reform, as will be seen in the last chapters. But the application of electronics, robotics, and automation to the economy proceeded apace until the end of the regime. Rationalising labour and raising productivity remained the aims – computers and ASUs remained the means.

Rational Control Meets the Masses

[175] TsDA f. 517 op. 6 a.e. 56 l. 122

[176] TsDA f. 535 op. 3 a.e. 58 l. 69

[177] TsDA f. 1B op. 66 a.e. 66 l. 7

There was one little problem – the actions of the socialist worker when his labour was to be rationalised and controlled through the means of automation. Destroying the "subjective" factor had been a party obsession throughout the programs to automate the economy and introduce a streamlined, recordable and thus observable workspace. The reaction of workers who were to be automated away or become parts of these complex man-machine systems was not always that of the model socialist who strived to introduce the latest work methods into his everyday life. The responses reveal an unease with this type of encroaching modernisation, which could impact established workplace practices as well as the very strategies of survival within the shortage economy, such as the "grey" or "black" economy.

This was very clear in two particular examples that will be discussed in more detail. The first was that of the ASU "Astra", a project started by Peter Petrov and Vasil Sgurev at ITCR in the late 1960s. This was an automated system for operative governance of industrial transport in open-air mines with the help of computers. It was a project driven by self-initiative by the two young scientists in ITCR, who created it as a side-project. It utilised a single large computer at a command post in the mine, linked through cables to various radio receivers and magnetic sensors within a quarry or mine. These receivers themselves would gather information about the location, movement, speed and status of various large trucks that carried out the loading and unloading of ores within the site, and they themselves would be fitted with radio transmitters to communicate their co-ordinates to the intermediary points. The system thus allowed for the gathering, transmittal and processing of information regarding the logistics and transport within the mine, which was then processed by the command post, and allowed constant and accurate control over the whole complex system. Its complexity, innovation and performance was praised by members of the Soviet Academy in 1972.[178]

Once completed, it was introduced into the "Medet" copper mine, which agreed to trial it in 1973. By then, the pet project had received ITCR backing and a development team which eased the work, and it was key to promotions for both Sgurev[179] and Petrov.[180] The system itself received a gold prize and diploma for "significant contribution to the development of science and technology" at the 1973 Plovdiv Fair, and raised so much interest at a Moscow exhibit the following year that it led to purchase inquiries from ten Soviet organisations and further interest from another thirty eight.[181] It was the subject of a documentary film which also won a prize.[182] Its application was estimated to bring in 400 thousand levs of economic effect per year by 1976, as it was upgraded with newer computers, and was capable of being sold for up to 1.2 million levs per system.[183] In short, it was a perfect poster child of Bulgarian ASUs – created by its young scientists as a side project, then brought to fruition by its institutes, of high standard, and of interest to foreign clients.

[178] Archive of the Russian Academy of Sciences (henceforth ARAN) f. 579 op. 6 a.e. 380 l. 84-7

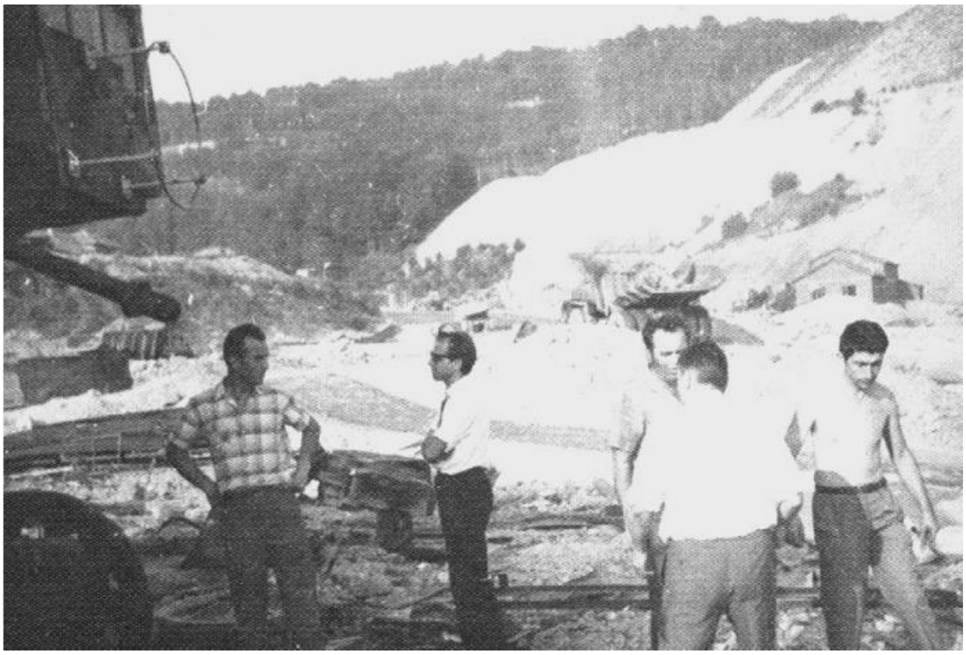
[179] BAN-NA f. 20 op. 5 a.e. 40 l. 21

[180] BAN-NA f. 20 op. 5 a.e. 65 l. 6

[181] BAN-NA f. 20 op. 5 a.e. 55 l. 7

[182] Peter Petrov, *55 Godini Avtomatika, Kibernetika I Robotika v BAN* (Unpublished; shared with me by author), p. 10

[183] BAN-NA f. 20 op. 5 a.e. 93 l. 17-21



Pic. 9: Science in the field – installing "Astra" in the "Medet" mine. (Source: Peter Petrov personal archive)

Its application in the "Medet" mine, however, was not so smooth. Petrov recalls the struggles of installing its various components throughout the huge site in the winter months, knee deep in snow, before finishing up in the spring and summer.[184] However, more so, he remembers the initial problems. Before the installation of this automatic system with all its sensors, control and dispatch of the trucks had been done through UHF radio links between each driver and a command post staffed by female workers. They were the ones responsible for directing the trucks to particular points to load and unload, and keep track of the work done by each. As Petrov puts it, due to friendships or sometimes workplace romances, each dispatcher played favourites. A favoured driver would be dispatched to loading areas where the loads were consistently heavier (and thus allowed for quicker fulfilment of quotas), or would have his tally bumped by one or two ticks next to his name – "phantom" loads. Less lucky drivers would, of course, be harmed by such a personal system. As the system was installed, and the computer became an arbiter of truth, the system would inexplicably start to

[184] Interview with Peter Petrov, 11th December 2015

break. Petrov recalls that there were no faults in the computer itself, or the cables, or even the radios transmitters in the trucks. What his team found when they went back to "Medet" in late 1973, were smashed sensors – the intermediary points in the mine, which collected data from the trucks' radios. It became clear that the drivers would "accidentally" hit the sensors during their workday, rendering the whole system useless as the automatic, impersonal link between truck and command post was severed. During this time, the mine operated according to the old routine. Petrov recalls how a member of their development team travelled to military factories that made tank armours in order to create custom-made boxes to house the sensors. Once that was achieved, the accidents mysteriously ceased, and the mine was successfully automated.[185]

Similar "sabotage" happened in the case of the first computerised supermarket in Bulgaria. It opened in 1977 in Sofia, with a central computer connected to electronic tills. Conceived as a showpiece of how new technology would help the consumer, it also had the aim to keep accurate track of the cash flows as well as the stock that the shop held, being able to alert management when things were running low and had to be re-stocked. It ran into problems at home when it threatened the petty theft and misappropriation that was the hallmark of the shortage economy of the Bulgarian state – on the very first night after its installation, someone had tried to pour water on it (as the electronic tills made it impossible to 'misplace' small change, while the computer kept stringent records of all stock); when this failed due to it being designed as waterproof (it seems someone might have guessed what would happen), it was set on fire.[186] As Shkodrova notes, the socialist shop assistant was not a popular figure, often seen by all as corrupt, always trying to put aside money or goods for

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[185] Ibid.,; corroborated by Vasil Sgurev in an interview on 7th July 2016

[186] Albena Shkodrova, *Sots-Gurme: Kurioznata Istoriya na Kuhnyata v NRB* (Sofia: Zhanet'45 2014), pp. 101-105

friends[187] – it was thus no wonder that the "rationalisation" of their labour, too, would be opposed. Another problem was that the computer's rationality itself would run counter to the myriad of supply and shortage problems inherent in the Bulgarian service industry, with its poor assortment, periodic shortages and non-rhythmic supply.[188] Even if sugar was running out in the computerised supermarket, there was not much the managers could do when it was simply not available in the warehouses at that moment.

In 1984, the sociologist and then secretary of the Central Committee Stoyan Mihailov, stated that there was a lot of lying in the country. Untrue, subjective information was circulating through social governance networks such as KESSI. Planning documents were often liars, and fictive achievements were often entered into the databases. Socialism had remained conservative far too often in the post-war period, he held, and fallen behind often – and such conservative positions had to be abandoned now, in favour of revolutionary ways; these lies were a reflection, too, of this attitude towards the unchangeable quotas and plans.[189] KESSI, too, was thus a network through which people continued to exercise their subjectivity. It was never envisioned as a system that would allow true horizontal connection between multiple users, but it didn't address the user-centre relation either. In fact, it was codifying it and covering it with a veneer of rational, scientific method. The subjective, fictitious numbers of economic achievements became part of the information flows.

As early as 1983, Lazarov's report noted the social and psychological barriers to innovation and automation.[190] Bulgarian sociologists grappled with this in the following years – which will be picked up in detail in the next chapter – noting that the volume of

[187] Ibid., p. 110

[188] Ibid., p. 113

[189] TsDA f. 1B op. 67 a.e. 3792 l. 104-6

[190] TsDA f. 517 op. 6 a.e. 56 l. 129

implementation and the march of technology did not guarantee success. A 1985 article in the "Political Agitation" journal delved into the reasons of work resistance to the introduction of new technology as a whole. They included fears of cutbacks and loss of employment, or of bonus remuneration linked to the old work habits. There was a reluctance to re-train, a fear of risk and a lack of self-confidence. Workers felt that only the showcase value of new technology was being sought by the party, and that they would in fact face increased demands. There was scepticism over the very quality of the introduced innovations, and a feeling that the money could have been spent better. The article noted this was a "real reflection" in the life and activities of the collectives.[191] Goodman cites this as an extension of the New Soviet Man's reality – a man who has no rights but a tiny piece of power: to mock, to steal, to bribe, to work poorly. That ignores the real ability of ASUs and computers to become wardens of the workplace, to automate work and be methods to decrease worker's tactics of everyday resistance – the very act of destroying systems indicates that they knew well what the effect was. But the automatic dreams of the BCP do show that just the introduction of new technology was not enough, and without addressing the fundamental nature of massaging statistics in the economy, it just reified a false picture into a reality by the very fact of computerising it – the final arbiter of rationality and scientific progress for the party. The nature of change in society and to man's role in it after the advent of the computer was supposed to be harnessed to socialism by the Politburo. However, it also spawned a veritable intellectual and educational revolution, which had a wider, varied, and complex life of its own.

[191] Quoted in Seymour Goodman, "Information Technologies and the Citizen: Towards a 'Soviet-Style Information Society'?" in Loren R Graham (ed) *Science and the Soviet Social Order* (Cambridge, Mass: Harvard University Press 1990), p.60

Chapter 6. The Socialist Cyborg: Education, Intellectuals, and Popular Discourse in the Information Age

The state had its own aims and dreams, understanding computers as means to dual ends – those of financial profit and of economic growth without substantial reforms. At the same time, it was heavily dependent on the new specialists it was creating and fostering to both explain and create these means of computers and cybernetics. The grand strategists of Bulgarian industry, Ivan Popov and Ognyan Doynov, were indeed trained in engineering sciences and kept abreast of the latest developments in world science and electronics. However, they were not computer specialists. The true electronic intellectuals of Bulgaria laboured in the BAS institutes, the huge CICT, the university departments, the ministerial, DSO and enterprise research and design departments. This growing stratum was a professional class, with its own interests and own ideas. For them, computers and cybernetics posed a huge number of questions about not only the technical path of their own work, but its political and social implications. To be a man in the age of thinking machine was to be a fundamentally different type of human, one who related to manual and intellectual labour in a different way. The horizons that computing could offer these scientists were both utopian and troubling. As their clout grew, the language and questions they posed burst out of the walls of their laboratories onto pages in philosophy journals, books, and popular magazines and newspapers. The language of cybernetics and the questions of what computers meant for Bulgarian society increasingly permeated other intellectuals too, including sociologists, psychologists, philosophers and pedagogues.

At the same time, another state project was creating the space for these men and women to try out new ideas. While the first specialists were trained abroad, the BCP invested in first the universities and then comprehensive schools, creating the conditions and courses to train the future engineers and computer specialists. The expansion of computer-centred education became a field upon innovative ideas about how to train children and young people in this new information age could be tried out, a practical application to some of these new discourses that were taking over social disputes in print. The computer and robot was not just a mean to change the present nature of the Bulgarian economy, but became a dominating core of thinking about its future – the next generations.

This chapter's discussion of both computerised education and the intellectual debates that blossomed in the country as the industry grew are not just an exercise in the history of ideas. Their importance lays in three main areas. Firstly, it shows how the cybernetic discourse of Bulgarian intellectuals was both informed by and differed to issues that engaged thinkers throughout the world during the information revolution. Once again, this demonstrates the close connections that this stratum had with global issues and networks, due to their privileged position. Secondly, these intellectual clashes were a rich and fertile ground for articulating a future vision for the country. In the socialist state, every discussion was political, especially one so closely connected to a main state policy. The discourse of the intellectuals was not self-contained domestically either, but became a powerful channel once we consider their key reports to the CSTP, Central Committee and Politburo, explaining the direction of computing and its applications. The computer created so many possible futures of how man would progress – or digress – that these debates became an avenue for reformist thinking, holding up the achievements of the party against their own promises as well as the possibilities of the information age. Last but not least, the spread of practical computer education but also new ideas about schooling among the next generation was how some of these intellectual ideas had a lasting impact on society. Connected to this, these debates were not contained just in the institutes and journals, or even the classrooms – cybernetics, computers, and robots became a dominating theme in areas of Bulgarian popular discourse too. The intellectualisation of labour went hand in hand with that of entertainment.

Taking each issue in isolation obscures the close interconnectedness of this overlooked technical intelligentsia with the real policies of the country. We have caught sight of their impact in previous chapters, looking at reports and suggestions they made to the Politburo or CSTP. However, how they got to these conclusions, and what drove their discourse, is supremely important. What is also key is to see how these technical intellectuals concretely impacted society and not just politics, through their power and prestige as the torchbearers of the future. Their impact on education and culture had a lasting effect on Bulgarian society, often overlooked. These engineers, technicians, professors, and scientists introduced concepts that would be discussed by social scientists and humanities specialists; studied by children; and written about by writers. Thus the practical systems of how to integrate man and machine, which they were working on in their institutes, became a part of the life of increasing numbers of people. The cyborg – the amalgam of organic and machine elements into one complete system – was real. How and what would make it socialist was a key and vexing intellectual question. If the future was socialist, how would its practical side be too? Before we come to that, we must look to the past – how did the class that debated this fiercely arise, and how did Bulgarian education change in the world of computers.

Training the Technical Intelligentsia

Nikolai Naplatanov, the director of the ITCR, complained in 1965 that the Bulgarian universities were not yet training graduates ready for electronic and cybernetic work. The institute itself had to train them up once they came to them, putting extra pressure on the scientists who had to spend valuable time on classes rather than getting right down to business.[1] This was unsurprising, as the "Computer Technology" faculty in VMEI had just opened in 1964,[2] and the 1964-5 school year was the first in which VMEI introduced a semi-

[1] BAN-NA f. 20 op. 3 a.e. 77 l. 27

[2] Vasil Nedev, *Hronika na Bulgarskata Kompyuturna Tehnika* (unpublished)

conductor specialisation for undergraduates, as well as the first computer class was started in a Bulgarian school (the Sofia Technical School "A. Popov").[3] This was a first step to rectify the general poor technical education of many specialists that the Industrial Department of the Central Committee complained noted. In 1966 it noted that scientific-technical progress and implementation was being held back due to not enough specialists in the newest industries, and this was something that the Ministry of Education had to rectify.[4] At the start of Bulgarian computerisation, the demand for cadres far outstripped the supply. Talented students from courses in electrical engineering or mathematics were re-trained through quick courses in order to staff the new computer centres, as stop-gap measures before the first graduates of the new courses could finish their education. This hunger for specialists is best demonstrated by the biography of Georgi Konstantinov, an anarchist who had spent years in prisons and even the Belene labour camp after he participated in blowing up a statue of Stalin in 1953. Released in 1962 after the closing of the camps by Zhivkov, his amnesty allowed him to study mathematics in Sofia University. He graduated in 1969, and despite being the subject of constant surveillance and one of the largest DS files in Bulgaria, he was hired at the Computer Centre of the Ministry of Internal Trade! In 1970 he underwent crash courses in the ZIT factory, was even tasked with helping in write parts of the manual for the ZIT-151 machine, and even became the head of a section of the centre. Even an anarchist terrorist and ex-political prisoner could thus find himself in such a sensitive position, due to skills that were in demand by a state that desired quick progress.[5]

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[3] Evgeniy Kandilarov, "Elektronikata v Ikonomicheskata Politika na Bulgariya prez 60te-80te Godini na XX Vek" in *GSU-IF*, vol. 96/7 (2003/4), p. 444

[4] TsDA f. 517 op. 2 a.e. 97 l. 42-46

[5] For more on this, see Georgi Konstantinov, *Tom III, Chast 1 – Napred I Ako Putyat Vodi Kum Golgota* (Sofia: Shrapnel 2009), pp, 15-20 and *Tom III. Chast 2 – Svobodata, Sancho, E Veliko Neshto!* (Sofia: Shrapnel 2009), pp. 6-7

The education push widened and by the 1969-70 school year there were also university courses in operations research, complex automation, and automated systems of control within various universities and establishments, enrolling 1220 students in automation-related degrees alone.[6] During the 1970-5 five year plan, higher education received 193 million levs of investment, twice as much as the previous period. Computers and automation devices were provided to classrooms in order to allow practical training, while doctoral dissertations in the sciences were to be tied to the national development plans, with topics chosen from lists approved by CSTP and the institutes.[7] Admissions to the course of "Computational Mechanics" in Sofia University was increased, five new specialisations and degrees in automation were opened throughout the country, and four types in specialist secondary schools. Between 1969 and 1971 over 6300 people went through such degrees, higher than the 4300 planned.[8] The five year plan up to 1975 saw the tailoring of admissions to specific economic needs during the period,[9] and as the computer institutes were being expanded, and factories being built, students flowed into these specialisations in increased numbers.

These students were not only drawn among the best high school graduates in the country, but had other certain privileges. In 1972 the rector of VMEI Lenin, Professor Diviziev, complained to the CSTP head, Papazov, that too many students were being requested for the seasonal agricultural brigades that were key to the ailing sector throughout the regime's history. Papazov tried to counter this, but the Rector was steadfast, and stated

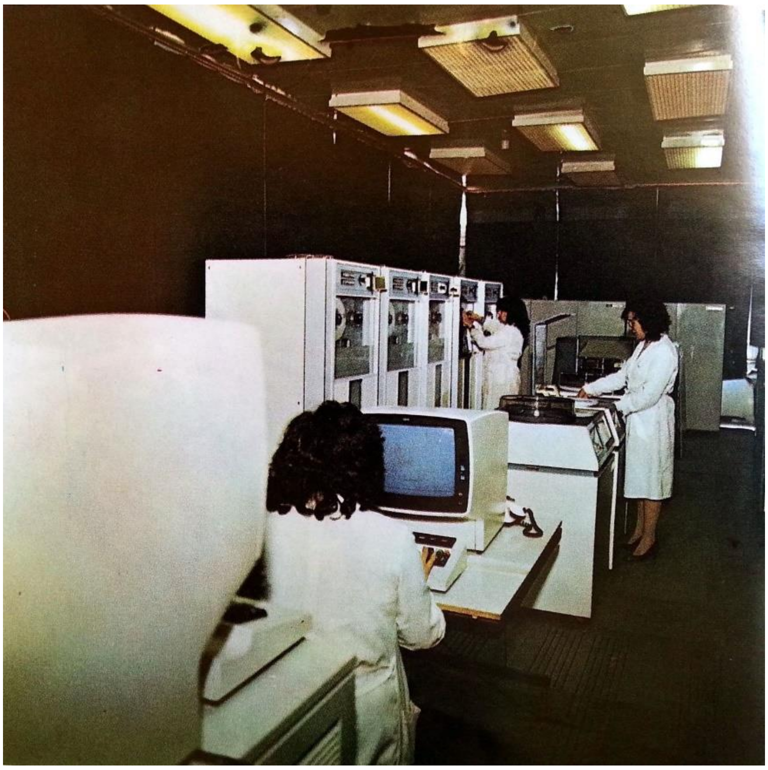
[6] TsDA f. 517 op. 2 a.e. 105 l. 19

[7] TsDA f. 517 op. 2 a.e. 89 l. 44-45

[8] TsDA f. 517 op. 2 a.e. 113 l. 100

[9] TsDA f. 517 op. 2 a.e. 74 l. 5

that at the very least, certain specialisations should be exempt from this disrupting work.[10] Military service was also reduced or lighter, with graduates destined for the electronic courses kept in units based in or around the cities, so they could in fact do courses there; or were based in relevant units, such as signals or electronic warfare.[11] By 1984, those accepted into electronic, automation or biotechnology courses in university were exempt from military service, the culmination of this policy.[12]



Pic. 1: A computer training centre in VMEI-Varna, c. 1980. (Source: soc.bg)

By 1979 the expansion of computer education in universities was part of a wider expansion of Bulgarian higher education, which made the country one of the world's leaders in students relative to size. Over 720,000 workers in the economy had higher or specialist education, and over 80,000 per year were going through special courses of further

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[10] TsDA f. 517 op. 2 a.e. 111 l. 21-22

[11] Interview with Peter Petrov, 19th March 2015; the author's father himself had his service in the Navy reduced due to being accepted to study automation. His time in the Navy was also spent in radio decryption.

[12] TsDA f. 1B op. 67 a.e. 3517 l. 24

qualification.[13] There was increased onus on connecting students to material production, giving them practical training so they would see “labour as the main field of achievement”, as part of a multi-faceted development.[14] The latest contemporary technology would help them in tat, helping them intellectualise their labour, and satisfy their growing “information needs”.[15] The universities had turned into a veritable producer of specialists for the cutting edge industry, but they would also have to become better at preparing these young people for the practical side of work.

By this point, the party was turning also towards the application of computers to education in schools too. They held immense promise for a changed approach to the classroom, and if the future of the Bulgarian economy was one based on computers and automation, then every future worker would have to be familiar with them, not just those who chose to study them further in university. Introducing computers to Bulgarian schools was the ultimate aim of plans that had been discussed since the late 1970s, with suggestions to do so through SM-4 mini machines and terminals. However, it was the microcomputer revolution that allowed the implementation of parts of this plan, much as it did in the rest of the world. The first Bulgarian classroom to be equipped with PCs was in 1983, at the Sofia Electronic Technical School “Lenine”, which got 18 Pravets’82 machines. They came equipped with educational programs, software applicable to chemistry and mathematical classes, and BASIC[16] – the computer language that all children in Bulgarian computer classes would have to learn over the 1980s. By 1984 there were 300 PCs in various Bulgarian schools, t*ogether with languages such as Pascal and Logo. The eleventh grade was restructured so as to

[13] TsDA f. 1B op. 66 a.e. 1731 l. 7

[14] Ibid., l. 22

[15] Ibid., l. 37, l. 57

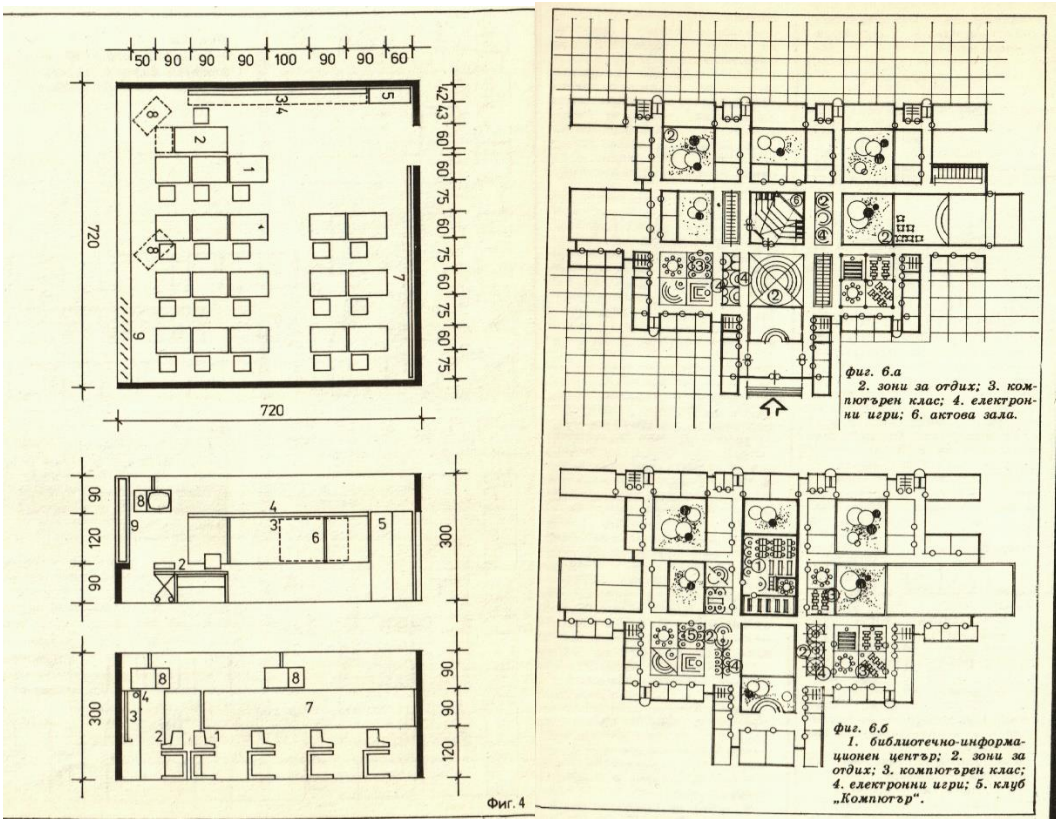
[16] *Kompyutur za Vas,* 1984 (1), p. 36

introduce classes on “introduction to cybernetics” and “automation of production and computers”. Classes using computers would start from the fifth grade. The plan was to have over 3000 PCs in schools by the end of 1985.[17] No numbers are available for the fulfilment of that plan, but it was unlikely given that the Pravetz factory was producing small runs at the start of its existence.

This didn’t stop the planners. Each Sofia school was to have a classroom equipped with 20 PCs in a networked regime, while smaller schools were to have at least 5 computers each, by 1987. The total was expected to be 105 large computer classes and 98 smaller rooms altogether. They would be equipped with large numbers of educational programs and would allow for the “automation” of education, as well as train the next cadre of specialists.[18] Architects and pedagogues were already designing the ways classrooms would be put together in a high-technology way, so that pedagogy would “open up towards the environment and integrate with it and use the school building as a centre for out-of-class education, as an education-cultural centre with universal functions”. Integrating PCs into the education process required precise and scientifically designed spaces, the desks to be placed a particular distance apart, chairs to be of particular height. Computer education turned students into part of the

[17] *Kompyutur za Vas,* 1985 (2), p. 9

[18] TsDA f. 517 op. 6 a.e. 89 l. 5-15



Pic. 2: The scientific conception of an ergonomic computer classroom (left) and a modern school, with the computer lab a part of a large, integrated system with information centres and a public computer club. (Source: Computer for You magazine, 1985)

cyborg organism – "Its integration into the school environment is effective only if it ensures the optimal functioning of the system 'Man-Machine-Environment' and in accordance with ergonomic viewpoints."[19] It would make them part of a cybernetic system in preparation for their role in the economy, where they would always be part of a man-machine system in this technological future.

Progress was slow but real, as computers marched into the Bulgarian classroom. Soviet specialists were impressed with the design and usage of Pravetz PCs in schools, and the depth of discussion that their effect on education was stirring in the country.[20] In 1986, the Educational Qualification Technological Centre opened in Pravetz, a specialised and

[19] *Kompyutyr za Vas*, 1985 (3), p. 6

[20] ARAN f. 2061 op. 1 a.e. 18 l. 7

probably the best equipped school for computing in the country, directly linked to the town's microprocessor combine (the school still exists today, and it is likewise part of a larger organisation – the Sofia Technical University). It was a sign of the growth spurt that computerised education was expected to create.[21] Electronic education was only the first step into a general program for all knowledge to be achieved and learnt through the computer. This was the new age, where a worker would have to work with these machines at his workplace or use them at home, and thus it was only a precursor to the constant engagement with the machine throughout life.[22] This was the cutting edge science, and it would permeate culture and education, making them an integrative part of production – all three united by the new tools of the age.[23] Computerisation of education was an integral part of the question that Zhivkov had posed back in 1984 – "this question is about the most valuable thing that our society has – the person as a creator of all material and spiritual goods in Bulgaria".[24] Intellectualisation, that core aspect of automation and electronisation of the economy, depended on education. But the ideas of what exactly was to be taught, and what skills a child must acquire in their work with the computer rested very much on what the debates were between the intellectuals themselves: what was the computer for? What were its possibilities but also pitfalls? The cybernetic language that was inherent in treating children and their classroom as part of an integrated machine with optimal feedback was a powerful tool to talk not just about technology but society, economics, politics, culture. Education policy was not in a vacuum, but part of a state push to create workers, as well as a reflection of what its

[21] TsDA f. 1B op. 59 a.e. 153 l. 57

[22] TsDA f. 1B op. 68 a.e. 3416 l. 38

[23] TsDA f. 1B op. 68 a.e. 3425 l. 68

[24] TsDA f. 1B op. 67 a.e. 3595 l. 15

technical intelligentsia – who designed courses and classrooms – thought the point of Man in this machine age was.

Pic. 3: Model citizens in the making – a computer classroom in the mid-1980s. (Source: soc.bg)

The Cybernetic Tower

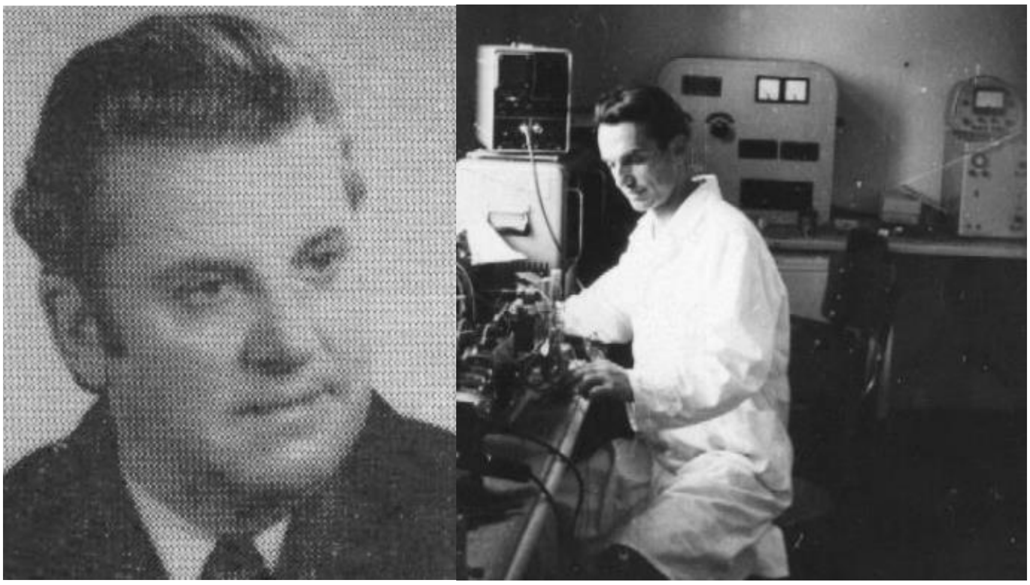
There were two key research institutes for the development of computing and cybernetic thought in Bulgaria – IZOT's huge CICT, and BAS's growing ITCR. The first was heavily concerned with the creation of the lucrative magnetic tapes and processors, at the cutting edge of research and with huge funding. The latter was also concerned with the creation of certain computing items – it was, after all, the birthplace of the Bulgarian microcomputer as well as the RB series of robots – but its specialists also dealt more heavily in the application of electronics to the economy by creating automation systems such as "Astra", as well as concerning themselves with theory and methodology in mathematical modelling, game theory, economic planning, ergonomy and bionics. It was thus the ITCR that was the cauldron in which the ideas of cybernetic thought bubbled most fiercely, and a more in-depth look at its development and concerns is key to understanding how this Man-Machine discourse developed within Bulgaria.

The history of the institute dates to a November 1959 Council of Ministers decision to create a BAS section (not a full institute) on Automation and Tele-mechanics to fill this gap in Bulgarian science.[25] BAS ratified this the following month and in 1960 the section started work on the theoretical and application problems of automation under the directorship of Denyo Belchev. It worked initially on automation in the energy sector, industry, theory of governance and the elements that made up automatic machines. It was housed first in the Agricultural Academy, and then in a few rooms at the BAS "scientific city" outside the Sofia city centre, starting with just three workers to start. In 1961 the first scientific plan was formed, right down to 1980, but there was a difficulty in procuring the right personnel. The slow start saw transformations into a United Section of Automation in 1962 and then a Central Laboratory of Automation in 1963, when the director became the energetic and ambitious Nikolai Naplatanov.

As Petrov recalls, he was the perfect combination of a committed communist with impeccable credentials. He had been a partisan during the Second World War, while his father, who had emigrated to the USSR, was inserted back into the country by submarine after the start of German-Soviet hostilities before being caught by Bulgarian police and shot in 1942 (the parallels with Popov's background are worth noting). In the early 1950s he graduated the Leningrad Electric Technology Institute with a degree in electrical automation, before specialisations in Dresden and Berlin by 1960. He was an associate professor at VMEI by 1961 (he would become a full professor in 1966, and the Rector for a short period in 1968-70), a young and promising scientist whose skills were in demand in BAS, which was trying to find specialists in this niche and new area. It was under his leadership that the Laboratory would become an Institute, which happened in 1964. Petrov talks of him as someone who could also sell his ideas to both BAS and the CSTP, thanks to good managerial skills and the

[25] The chronology draws on the historical note at the start of the BAN-NA fond 20, which is the archive of the institute; as well as Peter Petrov's unpublished *55 Godini Avtomatika, Kibernetika I Robotika v BAN*

aforementioned background. In 1963, when he was put in charge of the fledgling lab, he immediately invited Prof. Boris Sotskov, a member of the Soviet Academy who had been a leading figure in Soviet automation and tele-mechanics since the 1940s (and deputy director of the Institute of Automation) in order to help him plan the formation of such an organisation in Bulgaria. Thus, by 1964, Bulgaria had its own promising cybernetic institute, with Naplatanov as director and Peter Petrov as scientific secretary.[26]



Pic. 4: Naplatanov (left) and Petrov (right). (Source: Peter Petrov personal archive)

The institute started with seventeen scientific workers,[27] which was immediately deemed to not be enough if it was to function at the level envisioned by Naplatanov or to fulfil its COMECON co-operation plans. There was an acute need for assistants but also an English specialist in order to boost the information bureau. There was an "absolute need for information on a world level" in order for the institute to develop, and the translation of

[26] Interview with Peter Petrov, 19th March 2015

[27] BAN-NA f. 20 op. 3 a.e. 69 l. 1

Western scientific literature was a priority in the early years.[28] It took for its model the large Institute of Cybernetics in Kiev ran by Victor Glushkov, the towering figure of Soviet informatics and cybernetics, which at that time had over 3200 staff. Naplatanov thus demanded 135 extra staff over the next three years in order to cover the key research areas, and develop new ones such as bionics,[29] which was a personal interest of his.

Despite the usual administrative games of push and pull, BAS did give the energetic director a lot of what he desired, and by 1972 the institute had 168 workers of which fifty six were scientific workers (a term that denoted specialists with doctorates who were at various stages of their post-doctoral careers), forty four other specialists with university degrees or doctoral students, forty seven specialists with specialist secondary education (obtained through the technical schools in Bulgaria) engaged in scientific and laboratory assistance, and twenty one administrators.[30] In 1978, the last year of Naplatanov's dictatorship and before the addition of robotics to its purview, there were 173 workers (with a greater proportion of scientific workers) and twenty five in the production workshop – added to help build the prototypes and small runs of the institute's specialist production.[31] During that decade, it had also acquired its own computer centre, freeing it from its dependence on buying machine time in the BAS centre, which was crippling to the productivity in the sphere it was supposed to specialise in.[32]

Angel Angelov was put in charge as the institute was reorganised into ITCR, after Doynov was asked by Zhivkov to create the scientific basis for this next stage of automation. Nikolai Iliev, at that time the scientific secretary of ITC (still without the "R") and Doynov's

[28] Ibid., l. 35

[29] BAN-NA f. 20 op. 3 a.e. 71 l. 3-4

[30] BAN-NA f. 20 op. 5 a.e. 3 l. 8-9

[31] BAN-NA f. 20 op. 5 a.e. 143 l. 8

[32] BAN-NA f. 20 op. 5 a.e. 69 l. 9

link to the institute, helped in the restructuring of the institute after talking to Angelov about what exactly to concentrate on[33] – when BAS gave the go-ahead to add robotics, it was thus him and his expertise that pushed him to the directorship. Angelov, as we have already seen in chapter 2, was a key figure in Bulgarian electronics. He had been educated as an electrical engineer in Sofia, and then specialised in semi-conductors in Moscow in the late 1950s. He worked in industrial electronics throughout the 60s, before becoming the director of CICT in 1968 and the longest serving representative at the SGK that determined the Bloc's electronic policy. He had been a deputy director of the whole of IZOT in the early 1970s, and deputy director of CSTP itself just before taking up this post.[34] As someone who had held key roles in the Bulgarian technical and scientific hierarchy, his appointment to the head of the ITCR demonstrated the growth of its importance and reach. It came with the creation of a true production wing, "The Trial Base", with 350 workers – it would be here where the first PCs were manufactured. By 1989 the institute was employing over 1300 scientists, specialists and assistants – a huge element of the Bulgarian electronic landscape.[35]

Both the devices and whole projects that were being designed in the institute were not self-contained technological projects. They started raising more and more philosophical and social questions, uniting the two strands of thinking, previously separated, amongst the institute's specialists. Even such seemingly mundane projects such as the ITCR's mathematical modelling of the water resource system of the Iskar river (near Sofia) started raising concrete questions about governance.

[33] Interview with Angel Angelov conducted by e-mail through his daughter Sonia Angelova Hirt, 29th June 2016

[34] Peter Petrov's draft of an article on Angel Angelov's life, for the BAS bulletin

[35] Peter Petrov's unpublished *55 Godini Avtomatika, Kibernetika I Robotika v BAN*

Pic. 5: Angel Angelov (far right) with representatives of IBM and Ivan Popov (second from left) (Source: Peter Petrov personal archive)

The cyberneticists here ran into the problems of the planned economy, noting that the "rational usage of resources…is now regulated by administrative and not economic means. For example, the production of one ton of steel takes two times more water than what technological norms require."[36] They noted that cybernetic models and systems require *precise* information at every level, rather than the fudging of numbers and resources needed by enterprise managers. In order to automate the Iskar river's water usage, the computers that would allocate resources would need accurate information about usage and shortages in consumers, factories, towns, irrigation systems. The managers of enterprises, always seeking to ensure their fulfilment of quotas and thus requiring more water than was actually needed, were thus hindering the proliferation of precise information needed for the placement of governance on an objective basis, as was envisioned in the party programs. Accuracy of information was an over-arching concern for any cybernetic thinker, whether he was building a simple mechanical tool or modelling a system. In the Iskar system, information could not be accurate at its current state due to a particular, non-objective system – criteria of what the system was to do were "parachuted" in from higher organs, as a general solution to a general

[36] BAN-NA, f. 20 op. 5 a.e. 28 l. 41

problem, and they could thus not really be used as a template for the real, existing situation on the ground.[37]

The very nature of a water system such as Iskar raised concerns in technicians that had practical and political consequences. A water system had many variables, it was dependent on environmental factors, produced statistical "noise", was influenced by human mistakes and choices – it was unstable and constantly changing. Centrally decided parameters of usage or savings were thus not as easily applicable to a chaotic system, with the informational structure being related to the functional structure – the system of gathering, processing, and acting on the information in the Iskar system would not function properly without changes to the governance system of the waterworks sector.[38] The ITCR's intellectuals quickly saw that technological solutions were not neutral, but had an impact on political decisions. This conflict between technicians who recognised the need for adaptation in plans and the ability of local systems and decision-makers to react to local problems that could not be predicted by a centralised plan was not, of course, inherently Bulgarian. It was a feature of socialist planning and technology all the way back to the late 1920s, best seen in the figure of Peter Palchinsky, an engineer who advocated the autonomy of regional planning and individual decision-making within the central plan, taking into account local infrastructure, labour and natural resources in solving particular tasks – and who was executed after the 1930 Industrial Party Trials.[39] He recognised the social role of the engineer, and the social analysis inherent in those carrying out industrialisation – something which ITCR's specialists were running into in the 1970s as they sought accurate information in a socialist system that often bent numbers.

[37] Ibid., l. 89

[38] BAN-NA f. 20 op. 5 a.e. 33 l. 7

[39] For more on this figure, see Loren R. Graham, *The Ghost of the Executed Engineer: Technology and the Fall of the Soviet Union* (Cambridge, Mass: Harvard University Press 1993)

This search for precise information was at the basis of the theory of cybernetics. All systems require information loops, a constant stream of feedback about how the system's behaviour is playing out when it meets its environment. For a system's structure to be able to respond to a fast changing environment – be it in the factory or society as a whole – it would need information.[40] This was implicit in the Politburo's automation dreams, but was made much more explicit in all the work of the ITCR. Naplatanov personally led the section working on bionics and the optimisation of the role of the human operator in technological systems, and noted this throughout its exhaustive research during the 1970s. A 1972 prognosis on cybernetic developments until 1990 put the onus on the creation of global information systems that will subsume national information systems such as ESSI, as well as bionic modelling of smaller systems and a better understanding of the aspects of Man and Machine when they interact, placing robotics and automatics on a bionic basis – that is, the application of biological methods of control and information processing in engineering.[41]

Naplatanov's team delved into this headlong throughout the decade, starting with his ergonomic research of 1975. In it he aimed to develop a theory of how to optimise an operator's actions when he acts in a governance system where his contact with the outside world is purely through indirect indicators of the environment such as screens, gauges and computer monitors. In this "Informational Model System" man acts on data and information, rather than the environment itself. In such a system, the operator – Man – becomes just a link in the closed contours of a governing system (again, this can be on a production line or when manipulating administrative, social or economic data too) and the question is how to optimise

[40] The first publicly available book on cybernetics in the Eastern Bloc, Soviet mathematician Igor Poletaev's *Signal* (1958), described cybernetics as follows: "*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.*"

[41] BAN-NA, f. 20 op. 5 a.e. 8 l. 14-17

his interaction with information, and how to ensure that accurate and sufficient but not overwhelming data reaches him, facilitating his decision making.[42] The following year, a wide-ranging report stated that only through neural modelling and studying the mechanisms of biological information processing, such as those used in sight, can we make the next leap in computing power and technical systems that can autonomously carry out the tasks that man can already. The main task was to study how biological systems managed to operate in conditions of so much environmental noise, and isolate the key information they used to survive – something very applicable to the complex social and industrial world in which Man was operating by the 1970s.[43] On such a biological basis, algorithms of recognising certain visual images could be introduced into man-machine systems, further easing the work of the human operator, freeing him from and more mundane tasks.[44]

What was becoming apparent to Naplatanov and his team, however, was that the quantity of information a human operator had to deal with was ever growing, threatening to overwhelm him. Using the example of a pilot in a fast-moving jet, flying over a quick-changing landscape, he stated in 1976 that

> …the quantity of information that a pilot receives from separate instruments is so big that he can't assimilate and decode in such a part of the second as is needed for the control of the supersonic flying machine. This requires a search for ways for optimal congruence between the system of information presentation and governance.[45]

This was becoming true of all human operators. New technology meant that a worker could know every detail about timings, chemical balances, ratios in an industrial process but not be sure which information is useful; and the problem was multiplied infinitely when that worker was in the area of social governance where ESSI would record data on everything

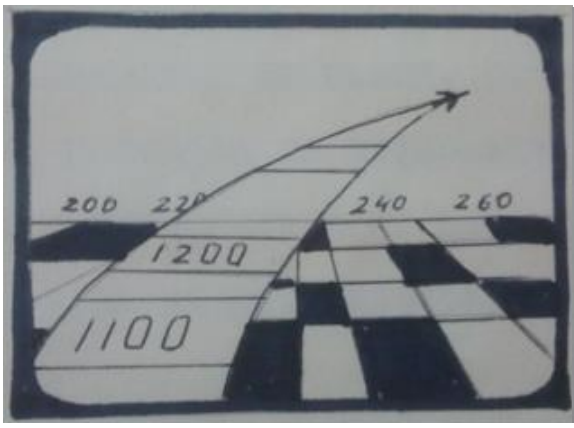
[42] BAN-NA, f. 20 op. 5 a.e. 79 l/ 7

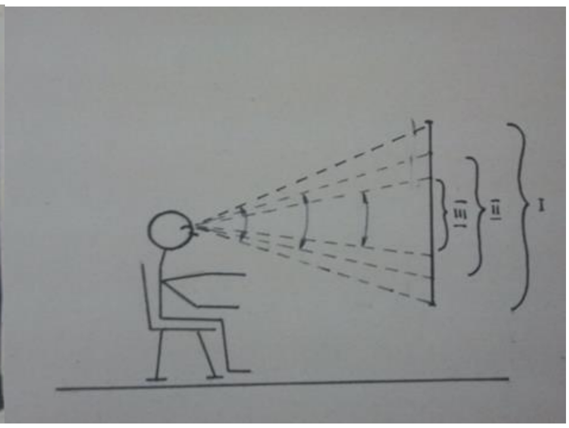
[43] BAN-NA, f. 20 op. 5 a.e. 101 l. 133-136

[44] Ibid., l. 137

[45] BAN-NA,, f. 20 op. 5 a.e. 116 l. 19

from demographics to education to wages to pensions or leisure activities. What was the optimal usage of information, and its optimal quantity? Naplatanov sought a solution in the "conalogue", the Contact Analogue Indicator, a means of transferring information from a quantitative into qualitative state, allowing the operator to quickly orient themselves.[46] The chaotic and complicated environment (be it natural, industrial or even social) would be simplified into an analogue that would be presented to the human operator, easing his orientation within the processes he was supposed to govern – the conalogue would create a full picture of the general situation, a qualitative solution to a quantitative problem. Naplatanov's team considered factors such as how long an operator's eyes lingered on particular instruments, how often they looked at particular parts of control boards, the tracks the eyes made over screens and keyboards (a "road map" of the operator's eyes), all key in how a person created a conceptual model of the events and objects he was keeping track of through the informational machine.[47] This allowed them to mathematically model the operator's behaviour, with certain assumptions made such as that interruptions in the gaze indicating a mind going off track or day-dreaming. Thus the need to design optimal industrial control systems led to engineers having to take on the tasks of workplace psychologist too, thinking about how a man interacted with the machine, and thus what the machine was *for*.





[46] Ibid., l. 21

[47] Ibid., l. 32-4

Pic. 5: Designing a conalogue – sketching how to combine quantitative and symbolic information (left) and the operative visual field of operators (right) (Source: BAN-NA)

Such concerns were pressing as the other huge ITCR project of 1976 was on information teleprocessing, in preparation for the construction of ESSI. It would integrate the information used and gathered on all levels of society, from the automated systems of governance in enterprises to information systems in ministries, a database of all information that was kept in the country. This report was the first that visualised how the integration would work, with maps of linking up and expanding existing territorial computer centres who would act as hubs for the local area's social and economic information – ESSI seemed to be just around the corner.[48] The exponential rise in data that would have to be manipulated by human operators in planning weighed heavily on Naplatanov's mind, as is shown in his subsequent 1977 report on new principles for control of robots. In this seemingly separate area, he pondered the sociological and psychological impact of more perfected robots on the human operator – but these were questions also about the wider "robotisation" of society which automation and information integration was bringing. This new stage for Bulgarian society would bring on not only the need for more complex algorithms but new methods of robot/machine-human interaction, through natural language interfaces and machines based on the physiology of man. Only then would robots and automata be able to help in the intensification of the economy.[49] Robots and automation would thus also bring in the new stage of human development, having a social function as they "free man from the need to carry out unqualified work and so give workers the ability to move towards highly-qualified labour, which expands their knowledge."[50] New labour would be intellectualised rather than menial. The end of distinction between physical and mental labour was near, as robots would

[48] BAN-NA f. 20 op. 5 a.e. 113

[49] BAN-NA, f. 20 op. 5 a.e. 137 l. 21

[50] Ibid., l. 25

allow research to be carried out in areas inaccessible to man, leading to a fuller knowledge of nature.[51] Naplatanov was also clear that robots would have a clear social and economic impact on a full employment state – worker numbers would have to be reduced, and wages would be impacted. A new qualitative stage of technology would mean a new level in social development too.[52] Naplatanov's bionic interests made the institute wield disproportionate influence in the field among COMECON members, with a 1975 pan-Bloc meeting in Varna (under the aegis of ITCR) creating the socialist thinkers' definition of bionics as the organic merging of technical and biological sciences that led to the study of "structures…of systems with task-oriented behaviour".[53]

It should not be surprising that ITCR's workers were closely involved with questions of philosophical and political bearing, for they were the vanguard of creating the ASUs of the regime. Developing tools to help engineers design led to discussions of human creativity "which by its nature is hard to formalise, creates special difficulties in designing the very systems of automating design."[54] An automated workspace involved a set of programs, algorithmic languages, means of interacting with graphic information and creating them, which meant that the ITCR designer had to keep in mind not just technical specifications but the whole process of interaction between all elements, including the worker – but also the information being fed into this system, often from above or horizontally from other enterprises or workspaces: what widely could be termed the "rest of the economy".[55] Such requirements hung over the work of all projects in the institute, from what was to go into ESSI to how to present information in medical questionnaires that would allow the data to be

[51] Ibid.

[52] Ibid., l. 26

[53] ARAN f. 1807 op. 1 a.e. 423 l. 5-7

[54] BAN-NA f. 20 op. 5 a.e. 133 l. 73

[55] Ibid., l. 77

easily transferred into computers and analysed (for hospital systems, such as the one tested in Botevgrad).[56] Information and interaction were key terms for Naplatanov and his teams.

This was not, of course, just the obsession of the director. The theoretical questions of cybernetics were subject to COMECON-wide problems, such as those of the optimal distribution of resources within hierarchical systems – questions that vexed all socialist planners and engineers. The Bulgarian team, led by Ivan Popchev, investigated the various ways to control the variables and parameters within such fluid systems, rejecting both full centralisation and full decentralization (using water resource systems as their main example). In the first case the users' interests were never taken into account, and governance is reduced to the solution of optimised tasks set by the centre; in the second everything is subordinated to the user, and even a purely logical analysis of a local situation would show that this would not lead to optimal results for the system as a whole. It was co-operative government that was the optimal solution, where both central and user interests are taken into account, creating a "game situation" where both sides actively affect the distribution of resources and tasks. The co-operative model meant periodic re-surfacing of the need to distribute (resources, information etc) involving the stages of information exchange, realisation and evaluation – a feedback loop par excellence.[57]

In such cybernetic discourse, the kernel of actual reform of the economy by empowering users, was evident – running counter to the regime's expectations that the tools of information processing would lead to non-reform solutions. Thus the language of increasing "socialist democracy" and co-operative control in workplaces must be seen as correctives, the party's way of integrating the intellectual impact of its tools into an orthodox political program. The Bulgarian scientists seemed particularly preoccupied with the

[56] BAN-NA f. 20 op. 5 a.e. 135 l. 10

[57] BAN-NA f. 20 op. 5 a.e. 139 l. 40-41

modelling of social and economic processes, according to Soviet observers, who noted interesting methods and results in modelling economic, demographic, sociological, musical and other questions;[58] others were doing good work in consumer price reform modelling.[59] These were areas in which cybernetics crossed over into questions with wider implications, and into the pages of journals read not just by engineers.

Information Age Philosophy

The implications of information and cybernetics were not discussed only within the engineering institute set up to design the means of economic automation, however. With the rise of Bulgarian computers and the party's desire for "scientific" social governance, cybernetic debate took over the pages of the country's premier philosophy journal too, *Filosofska Miisul.* The magazine was published monthly between 1945 and 1991, its pages reflecting the state of the field in the country, often publishing translations or commissions by other socialist but also Western philosophers. Its run and stance was often marked by the towering figure of Todor Pavlov, the premier Bulgarian Marxist philosopher who also headed BAS up to 1962, and the Institute of Philosophy up to his death in 1977 (for the last twenty years of his life he was also a member of the Central Committee, and for ten – 1966-76 – the Politburo). He was an early opponent of cybernetics, toeing the early Stalinist line well, by stating that "even the most complex robot does not assimilate, does not sense, does not remember, does not think, does not dream, does not fictionalize, does not seek."[60] His stance, marked as it was by the changing intellectual winds coming from Moscow, softened over the 1960s, allowing cybernetic discussions on the pages of the journal.

[58] ARAN f. 579 op. 9 a.e. 81 l. 22

[59] Ibid., l. 127

[60] Loren R Graham, *Science, Philosophy and Human Behaviour in the Soviet Union* (New York: Columbia University Press 1987), p. 278

Concurrent with the BCP turn towards automation, introductory articles on what cybernetics was were published by Soviet luminaries such as Aksel Berg and Victor Pekelis.[61] Bulgarian authors concentrated less on general introductions, and more on the aspects of automation and computerisation that would impact people. Trifon Trifonov called for the improvement in domestic psychology studies in order to reflect the growing complexity of the new workplace, where the psychological burden on the worker was becoming heavier than the physical. "Repetitive actions lead to the formation of conditions such as apathy, boredom, slacking", and a psychology of labour that studied the worker as a cybernetic organism was needed if the state was to weed this out as it started automating.[62] The new professions would not be rationalised if the state didn't match the right worker to the right job, taking into account psychological characteristics that would impact how he interacted with the machine. The way a worker processed and transferred information, how fast they made decisions and how accurately they did so, were now key in the intellectual workplace. Shift work would have to change to screen out mental fatigue.[63] The psychologist, using cybernetic principles, was key to perfecting labour governance as he would have to consider the worker as a holistic carrier of so many values and positions – gender, age, family situation, interests, education, profession, tastes, needs – in order to create the perfect working collective, where the workers' actions manifested. This psychology of labour was borne out of the technical progress of the country, the author held, and would facilitate its actual implementation – otherwise, it would be held back, as the social aspect of technological changes in the workers' lives would not be taken into account.[64]

[61] A. Berg, A. Kolman, V. Pekelis "Za Kibernetichnata Informatsiya I Choveshkovo Mislene" in *Filosofska Misul* 1969 (8), pp. 79-80

[62] Trifon Trifonov, "Psihologiyata na Truda u Nas" in *Filosofska Misul,* 1969 (9), p. 74

[63] Ibid., p. 76

[64] Ibid., p. 78

Others accented on the growth of information as a whole in the increasingly complex society. The more we know, the more unknowns appear to us, stated Buriev and Boev pithily – what Zeno had known thousands of years ago was becoming more obvious with all the more information we were acquiring about the world.[65] This was closely connected with the intellectual aspect of how to govern society in the information age. Information was used in social governing to maintain homeostasis, and it was present in social consciousness as a tool to use for the durability of the social system – thus only information that reflected objective reality was "good" information: the question was to determine it.[66] Bourgeois social consciousness was full of bad information due to its narrow class interests, not being able to encompass the deep meaning of social objects or not being able to see how to solve its inherent contradictions in the rare moments that it did. "From a social cybernetic viewpoint the more promising system will be that which can most rationally use the streams of social information in its governing processes", and science would judge capitalism harshly on this count. In contrast, socialist social information helps bring the material and spiritual unity of all members of society, "a complex system with internal unity" – best exemplified in ESSI, which allowed for the objective solution of problems. Such developments would allow for the charting of future roads according to these objective laws and information.[67]

ITCR scientists weighed in on these complex problems of social governance, some more so than others. Making the tools of the information society was closely connected to how these tools would be used by that society. The issues of the informatisation and automation of society that Naplatanov was concerned with were not his alone. A colleague from ITCR, Nikolai Stanulov, was a prominent contributor to cybernetic discourse in the

[65] V Buriev & V Boev, "Opit za Teoretiko-Informatzionna Interpretatsiya na Protivorechieto Mezhdu Natrupanite Znaniya I Vuznikvashtite Problemi" in *Filosofska Misul* 1969 (8), p. 61

[66] Petko Ganchev, "Sotsialna Informatsiya I Prognozirane v Obshtestvoto" in *Filosofska Misul* 1969 (10), p. 23

[67] Ibid., pp. 25-7

journal. In 1973 he linked cybernetics and social governance, stating that feedback is key to governance theory as without it there is no "comprehensive information about the governed object and all other outside disturbing effects".[68] Each cybernetic social system required negative and positive feedbacks, the first keeping output within programmed outputs and the latter getting the system to exit its programmed situation, amplifying variation and tending towards destruction. The mass socialist competition among workers, the development and fulfilment of plans, and the rising social productivity of labour were examples of positive feedback in the social mechanisms, fulfilling tasks that negative feedback could not.[69] At the same time, each social system – like a biological one – exhibits change in a temporal sphere, moving from the past to the future. Just as in the technical sphere where a human operator can monitor this change in production and choose the optimal criteria of governance for the new state of the system, the same was possible in social systems. The Governing Mechanism was key, being the regulator and receiver of all information – and as the party now desired to raise the effectiveness of governing the national economy, a General Theory of Social Governance was needed.[70] The most primitive society has no need for governance – the people are both objects and subjects of governance. More complex ones see the subject and object as independent parts, dependent on each other to create systems – unlike technical ones, where someone creates the system, people *formed* these complex ones. Stanulov saw Wiener's ideas on the cybernetic nature of class relations as wrong – the father of the discipline saw capitalist societies practicing regulation, rather than governance as in socialism, and that was superior. The Bulgarian stated that socialist dynamics are just as based on regulation, which was just another name for governance feedback. Socialist society

[68] Nikolai Stanulov, "Kibernetika I Socialno Upravlenie" in *Filosofska Misul*, 1973 (1), p. 43

[69] Ibid., p. 44

[70] Ibid., p. 45

had to use the feedbacks that were the basis of cybernetics, but that required a definition of what the governing and governed parts in socialist society were – the party, the judiciary, the workers and others.[71] There were middle links in this system, allowing relation between the levels, such as legal or political proceedings which could act as inhibitors, or the science of prognosis which allowed for "surges" of fast progress.[72]

Stanulov created a scheme that related the different aspects of social existence to each other. He placed the most importance in social consciousness, the changing amalgamation of temporally changing social activity and views, which can regulate the "social being" (society) through the state and its regulatory mechanisms such as laws or economic planning. These changes in the social being – the day-to-day experience of life – would feedback information into the social consciousness, allowing it to remain dynamic and regulate its orders once it observed the positive or negative effects they had on the social being.

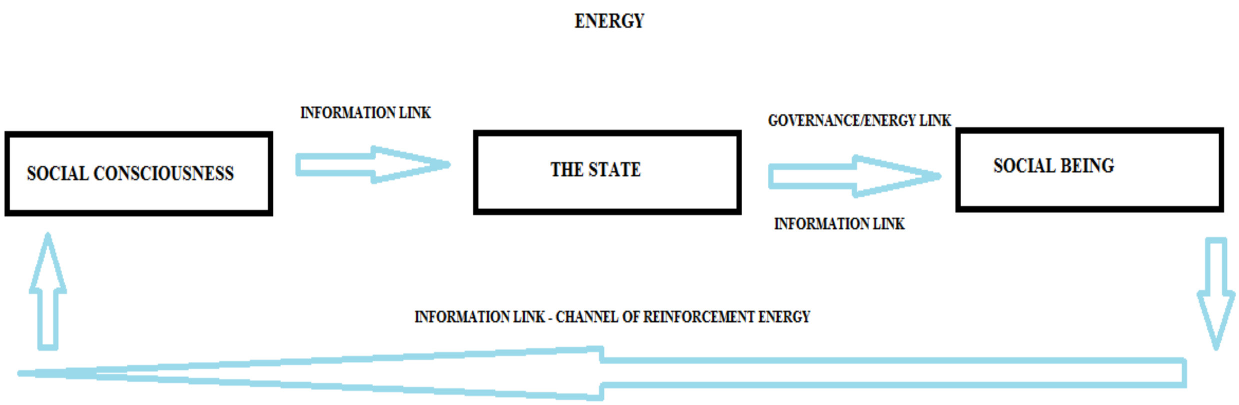


Fig. 1: Stanulov's "social consciousness" model of governance (Source: *Filosofska Misul*)

This mechanism was not the engine of a social system but a way to change consciousness – humanity was the engine, which would use this scheme as a method to act on

[71] Ibid., p. 47

[72] Ibid., p. 48

the world.[73] He concluded that information and governance were inseparably linked in the sense that there was no governance without information. The informational effect was independent of the governing – transfer of energy – action. It could act on the latter overtly or covertly, a dialectic system that depended on the presence or absence of deviation in the object of governance. The primary importance for the receiver in this system was the pragmatic nature of information. It was the only thing that mattered in order to regulate the system, and to allow for social consciousness to be an active governing factor and receiver of the right information from social being. To do so it needed subsidiary, mediating systems which put in practice political and legal realities.[74] Stanulov's theory was coherent and complex, exhibiting a dual nature – both an orthodox understanding of who was governing (humanity, hence the proletariat in a socialist state) and a more radical placing of a consciousness as governor over the existing state. This was, of course, permissible in a state which was consciously presenting itself as walking the road *to* communism, hence the state was serving a historical role, a mediator for the force of progress. Yet, social consciousness was not just an disembodied historical force in this concept, but an actual force made up of people who acted through the state. With developments such as ESSI or the continued insistence on the existence of socialist democracy, the state could still be maintained to be – discursively – an expression of the dictatorship of the proletariat. Yet, a scheme that made the state a mediator created the space for a cybernetic questioning of how *well* this socialist state was reflecting a popular will. Subordinate to a social power, the state was a link in a cybernetic system and could be judged according to cybernetic principles, in how well it facilitated the transfer of information.

[73] Ibid., p. 49

[74] Ibid., p. 50-51

Information was thus vested with power, and it was the manipulation of information that would be the domain of modern man – as without information there is no governance, which requires the former category in order to be able to direct its orders effectively. Man would be thus the regulator and controller of processes, as automation allowed labour to become a "conscious organ", dependant on information processing, rather a menial and repetitive task. Stanulov, in the same year as his social governance model, published an overview of the philosophical questions still hanging over cybernetics, pointing out "information" as one of the key ones. For him, it was the carrier of functional properties of the relations of material bodies, so it was something that could happen in the inorganic world too – different to the "reflection" thesis that was current for some Marxist philosophers, including Pavlov, at the time. They held that information was a function of living bodies only, narrowing cybernetics' purview, a sort of philosophical rear-guard action against a previously "bourgeois" science. Stanulov pointed out most strongly that modelling the human mind mathematically – which computers were allowing us to do - pointed to the truth that eventually a machine would do everything we could just as well, because Man was the most perfect cybernetic machine: views that were held by Soviet luminaries such as Sobolev and Glushkov.[75] For him, all this pointed to the power that cybernetics could vest Marxism with, helping it uncover the positions of materialist dialectics and give them a methodological and logical analytical power through cybernetic principles.[76]

The journal and other publications soon picked up on richness of cybernetics as a discursive tool for a variety of issues. Publications by BAS that talked of technical cybernetics now mixed the theoretical aspects of cybernetics alongside articles on more usual, engineering applications – a 1975 book had sections on automatic controls for

[75] Nikolai Stanulov, "Malyk Kompendium po Filosofskite Vuprosi na Kibernetikata" in *Filosofska Misul,* 1973 (11), pp. 69-71

[76] Ibid., p. 72

passenger lifts alongside articles modelling enterprise feedback or Stanulov's continued revisions of his theories on how to model information systems. In it the ITCR scientists defended the ability of modelling to uncover much about the real world in a controlled setting – despite many variables being present, computing power was allowing for the simulation of reality.[77] The nine-volume "Foundations of Technical Cybernetics" textbook, overseen by Naplatanov and published between 1971 and 1977, solidified those current views in students – cybernetics was not just about electrical motor control, but control and information processing in general.

The cultural, psychological, and social aspects of this were picked up by other thinkers, less involved with the engineering questions of cybernetics. For Dimitar Georgiev, this new power of information meant that the human personality would now flourish into a multi-faceted, complex nature, capable of vast qualitative analysis as it was now aided by the computers and machines in quantitative analysis and menial labour. [78] The nature of the human mind and labour became the focus of later debates in the journal. The philosopher Mityu Yankov held that this was congruent with a view of nature that had all inherent possibilities held within it from the inception of the universe, only requiring the right conditions for them to be unlocked.[79] He had expanded on this in a book about the scientific-technical revolution and the problems of the social and the biological in Man. The deepest core of humanity, that which set it apart from the animal, was formed and determined by social relations, the relations of particular forms of matter which were in certain hierarchical

[77] Ivan Popchev & Co "Kompyuturna Simulatsiya v Nalichieto na Model za Izbirane na Optimalna Alternativa" in Nikolai Naplatanov, Denyu Bechev & Nikolai Stanulov (eds) *Suvremmeni Problemi na Tehnicheskata Kibernetika* (Sofia: Izdatelstvo na BAN 1975), p. 20

[78] Dimtar Georgiev, "Nauchno-Tehnicheskata Revolyutsiya I Vsestrannoto Razvitie na Lichnostta" in *Filosofska Misul* 1973 (10) pp. 63-4

[79] Mityu Yankov, "Informatsiya I Razvitie" in *Filosofska Misul,* 1978 (5), p. 63

relations to each other.[80] Labour was the most important social structure in humans, connecting the biological and social by exercising the former to support the latter and making biology serve social interests. All other structures built upon this.[81] The massive change in labour and economics created by the scientific revolution that started with the Enlightenment but accelerated with the creation of computers and automated production lines came with its own dangers – pollution and "noise" (in terms of informational noise too). Man is now pushed away from immediate concerns of production and into governing, psychological tasks, a qualitative change for him – science was now a true productive force, as was brain matter. As he changes nature, Man is changing his own nature.[82] This was a common trop amongst others writing in the journal too - men's inherent abilities too could now thus flourish as the conditions of automation and informatisation "intellectualised" his labour. But only in socialism would this flourish as in Bulgaria the means of information, which are now means of production (for there can be no governance and progress without information), are owned by the people, constituting a true "freedom of information" unlike that present in bourgeois countries.[83]

The debate on the effects of automation on labour had flared up on the journal's pages in the late 60s, when the optimism of this yet-to-come process was evident, as the articles by Trifonov and Genchev show. In the 1970s the debate ranged over the effect of the scientific-technical revolution on man, and the role of information in governance, as well as its definition. The debates over how computers would help a multi-faceted personality, an intellectual labourer, were borne out of both the ongoing automation of the economy and the

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[80] Mityu Yankov, *Nauchno-Tehnicheskata Revolyutsiya I Problemut na Sotsialnoto I Biologichnoto u Choveka* (Sofia: Meditsina I Fizkultura 1977), p. 7

[81] Ibid., p. 52

[82] Ibid., p. 100-104

[83] Pavel Georgiev, "Kritika na burzhoazni filosofski spekulatsii s naukata na informaciyata" in *Filosofska Misul,* 1978 (8), p. 105

particular cultural policies of Lyudmila Zhivkova, the daughter of the leader and head of cultural and art policy in the late 1970s and up to her death in 1981. Her policies called for the creation of a multi-faceted personality, a new renaissance man who would be a creative force who would be driven by beauty and aesthetics. Her ideas were often esoteric, influenced by Eastern mysticism rather than Marxist classics, and were interwoven with a cultural revival and much sponsoring of national monuments, writings and films. Zhivkova's figure is best remembered for her eccentricities as well as her patronage of a nationalist turn in Bulgarian discourse, yet her focus on aesthetic education as well as children's education and role in society meshed with some of the debates about what computers could bring to this new turn in Bulgarian culture, and were in fact predated by her rise to prominence.[84] The dangers of Man losing his primacy and uniqueness in the machine age was raised by Victor Afanasiev, a Soviet philosopher whose views supported the Zhivkova thesis – for him Man still had the monopoly of creativity and the production of this new key resource, information. Even a self-learning machine would be bent to the will of man, and would never have the emotional comprehension of the world that was an important tool of knowledge.[85] The social aspects of cybernetics itself would, in the words of Dimitar Georgiev, allow the scientific-technical revolution that the country was experiencing to develop in the same direction as socialist morals and the aesthetic culture of the modern personality. The modern creative power unleashed by science – as well as its destructive possibilities – create a new quality of moral responsibility, based on this new higher social consciousness emerging in the information age. There was a need for flexible and free moral norms when a personality is freed from outside regulation and influences – it became more individual. In capitalism this

[84] Zhivkova is a controversial figure, who has not yet been given her due in academic writing. On her policy towards children, and her international initiative, however, there is an in-depth analysis by Yuliyana Gencheva, *The International Children's Assembly 'Banner of Peace': Performing the Child in Socialist Bulgaria* (PhD Dissertation, Indiana University 2010)

[85] V Afanasiev, "Informatsiya, Chovek, Kompyutur" in *Filosofska Misul*, 1974 (7), p. 115

individualism leads to social alienation, but thanks to the harnessing of the scientific revolution to communism, in Bulgaria it would lead to morality and the new aesthetic personality being placed on a rational basis.[86] Information and computers would allow a new kind of socialist man to emerge, a step towards the communist being that would realise the ultimate order.

By the 1980s, however, as the Bulgarian economy struggled to implement its policies of electronisation and robotisation, the terms of the debate shifted. Bulgaria's primacy in electronics did not translate to "scientific" governance or the reduction of wastages. Computers were not delivered as exports were prioritised, or broke down quickly when they were. The gap between possibility and reality grew even more with the creation of the "Pravetz" family of personal computers after 1982, the very formation of which was indicative of the shortcomings of the existing IZOT economic union to innovate.[87] The automation of the office workplace and the fuller intellectualisation of labour were now a distinct possibility, as the PC would revolutionise the workplace and home.

At the same time the Bulgarian technical elite was increasingly opening up to the world, sharing its own ideas. Under the auspices of BAS mathematician Blagovest Sendov, who had the ear of Todor Zhivkov, Bulgaria was experimenting with new approaches to education since the late 70s, unifying some subjects such as the natural sciences into one in order to facilitate a multi-faceted and integrated approach to knowledge, as the new times required. Since 1979, his method was being tried out in twenty seven schools in the country, with computers envisioned not just as a helping tool but as a means to restructure education as a whole. "By entering the information century, the object of education is changing", he held, as the computer becomes the weapon for the student's brain and was a continuation of

[86] Dimitar Georgiev, "Nauchno-Tehnicheskata Revolyutsiya I Vsestrannoto Razvitie na Lichnosta" in *Filosofska Misul*, 1973 (10), p.64

[87] Interview with Plamen Vatchkov, the director of the Pravetz factories, 30th June 2015

thinking.[88] Knowledge had to be structured and integrated as there were commonalities between hitherto discrete subjects. For example, syntax and morphology in language could be taught through mathematical methods; all social studies could be integrated together too, to put the accent on how social changes and ideas were formed, rather than traditional historical focuses on wars and politics.[89] Computers would also help children learn the arts of coding and decoding as methodologies, skills critical to literature and mathematics. All knowledge was changed by the computer who created the "student-armed-with-a-computer" as the new object of education – it allowed integration of areas that unlocks creativity. Only key changes in education could achieve this.

Sendov's ideas were shared with the world, starting with a 1984 international seminar in Plovdiv. In the inaugural speech, Sendov drew attention to the coming second wave of computerisation, where IT would not just help individualise education but enter all social practice. The computer would be much better than us at remembering – a traditional aim of education – so it could be used as a repository of encyclopaedic knowledge where the computer will be the narrow specialist in many areas of knowledge, while "humans, with its help, will have access to information and the ability to integrate it creatively".[90] In 1985 Varna hosted an International Conference on Children in the Computer World, organised with UNESCO and other organisation. As *Filosofksa Misul* summarised, the discussions there showed that Bulgaria didn't have to repeat the mistakes of previous attempts at upgrading the workforce's skills for this new world, as it could learn from them. Sendov himself is quoted as stating that knowledge has to be presented in an imaginative and integrated manner in order to stimulate interest, as "computers can democratise our

[88] *Kompytur za Vas,* 1987 (4), p. 4

[89] Ibid., p. 7

[90] Tz. Kardashev & Co, "Kompyturizatsiyata v Obrazovanieto" in *Filosofska Misul,* 1985 (6), p. 123

imagination".[91] Human creativity was the crux of this new cyber-society, where the worker was manipulating information and had to use knowledge to produce.

But was there something in socialist administration that was holding back the promise of intellectual labour and this multi-faceted personality that was foreseen in the 60s but didn't materialise in the 70s? Ana Krusteva, a BAS philosopher, overviewed bourgeois concepts of cybernetics in the same year as the conference above, and concluded that the informatics society would be built by a new type of man who was not a slave to hierarchy. Informatics machines were not just perfected tools of labour but ones that allow Man to develop his individual abilities, to become a "creator" of meaning as the computer does not create material transformations but "symbolic" ones, with the new type of labour becoming abstract and blurring professions. Man would thus have to find his own creativity in this new interdisciplinary world. While she criticizes bourgeois concepts of informational societies as flawed, ignoring social relations, her main attack was on hierarchy and impediments to this creativity. [92] For another philosopher, Vladimir Stoychev, the new cybernetic Man would be a Salieri rather than a Mozart – someone who could break down big tasks into many small ones, and through labour and perseverance he could master them, achieving the one in a billion genius of the Salzburg musician. It was a matter of finding the best method of aiding his choices and labour.[93] Salieri was the paragon of the cybernetic model of the creative process, as opposed to the "gift" that is bestowed by Nature – "one is marked with God's spark, while the other one creates his talent alone and to some extent manages to equal

[91] Bilyana Papazova, "Decata v kompyuturiziraniyat svyat: utreshnite problem – dnes" in *Filosofska Misul,* 1985 (10), pp. 106-7

[92] Ana Krusteva, "Informaciyata – novo svetovno predizvikatelstvo?" in *Filosofska Misul,* 1985 (3), pp. 46-7

[93] Vladimir Stoychev, "Filosofski analiz na kibernetichniya podhod v izkustvoto" in *Filosofska Misul* 1985 (3) pp. 101-3

himself with the Salzburg magician".[94] Salieri is not a sad figure, but a carrier of the new approach in art, and in the machine age he is the model for the creator that looked for ways to perfect himself through constant labour. The famous Pushkin tragedy that Stoytchev uses to frame the discussion of the two musicians did not have as its point jealousy, but a contemporary projection of the conflict between a cybernetic approach and a faith in the "muse". A contemporary lab that would develop algorithms for creating machine music would have to bear Salieri's name – after all, his students included Beethoven, Liszt and many others. Genius in the modern age is the ability to choose correctly; if Mozart's creations are the desired perfect prototype for innovation, then Salieri's are the "real, achievable variant" of modelling artistic creativity: "the creator who makes us believe that even people with conventional creative abilities can reach, with much labour and perseverance, the heights of perfection".[95] The tools were there to create this new Man – but he wasn't transpiring in Bulgaria. Naplatanov, too, weighed in on the matter in 1986. This new computerisation of governance and information meant new ways for man and machine to interact, and would result in a "hybrid intellect" that can link artificial and natural intelligence. Real creative flourishing depended on the joint usage of "natural and cumulative machine intellect".[96] It was only a question of furnishing socialist man with the needed environment and technology to allow that.

The 1980s had seen this become an explicit part of Politburo plans for the future. "This question is about the most valuable thing that our society has – the person as a creator of all material and spiritual goods in Bulgaria" said Todor Zhivkov in a 1984 Central Committee discussion of an ambitious program that had the aim of raising the intellectual and

[94] Ibid., p. 102

[95] Ibid., p. 103

[96] Nikolai Naplatanov, "Elektroizchislitelnite mashini I nauchno-tehnicheskoto tvorchestvo" in *Filosofska Misul,* 1986 (3), pp. 86-7

creative abilities of Bulgarian citizens.[97] The debate in *Filosofska Misul*, however, was increasingly comparing state promises to realities. Iskra Arsenova, a worker in the Centre for Scientific Knowledge, overviewed bourgeois views of the informatisation of society, pointing out how most Western observers were in consensus that information workers were the new and main social class.[98] The export and import of information itself had become a weapon for capitalism, and socialist and non-aligned states had to fight for an information order that allowed international transfer of information on an equal and democratic basis. Socialism continued to provide the best conditions for the growth of productive powers of Man, but Arseneva pointed out that in rejecting some of the conclusions of bourgeois concepts of the new society we must not ignore the empirical analysis inherent in them.[99] It was true that the information age was a different stage to the cul-de-sac of industrialism, even if it was capitalist folly to belief that it would destroy the vices of that order; information *did* add value to a product, even if we should be wary of replacing the labour theory of value with an information one.[100]

Allowing for Western concepts of the information economy and age to creep into discussion was part of the wider reformism of late 80s Bulgaria, under the aegis of preustroistvo. Here cybernetics could become a tool to expose the shortcomings of the economy. In 1989, in the twilight of state socialism, the journal came out with a specialist issue on informatics and society, featuring eight essays. In it Peter Mitov, a philosopher, stated that any society closed to new and fresh ideas is doomed to death. Free development is incompatible with a monopoly in politics and science – the transition from industrial to

[97] TsDA f. 1B op. 67 a.e. 3595 l. 15

[98] Iskra Arseneva, “Suvremenni Burzhoazni Teorii za Informatizatsiyata na Obshestvoto” in *Filosofska Misul* 1988 (4), p. 70

[99] Ibid., p. 77

[100] Ibid., p. 72

informational societies was incompatible with rigidity in intellects, or dogmas. The microscope and the computer have to take their place alongside the hammer and sickle if socialism was to strive, but a socialism shorn of "conservativism".[101] Information links people with the market by allowing them to use services more easily; it could also be used simultaneously and mutually. Information is and should not be owned, and by being part of commodities – now becoming info-commodities – it undermined capitalism's base, private property.[102] Years ago he felt that this was an attempt to undermine Marxist analysis, but he now feels this is closer to the truth of accelerating and rescuing socialism. But Marxism is an analysis of capitalism 150 years ago, rather than ready recipes for this transitional period. Information can lead to plurality and discussion, in science, the economy and politics. Information will go where political will takes it. Before, it was dogmatic and in service of a traditional political culture – whether capitalist or state socialist. Preustroistvo fights against this old disinformation of Marxism, a system on which an authoritarian government was built while society was bureaucratised. Real socialism is dependent on free information. For the past thirty years of Bulgarian socialism, people wanted huge changes but saw no results, resulting in passivity, confusion, fear. But now information has collapsed time and space, both internationally and domestically, through wide-ranging telecommunications, and was the promise of a new, just society.[103]

This radical blast against dogmatic socialism was supported by other essays, who argued that the old regime did not just mishandle the new age politically, but also economically. Valentin Korkinov, in an in-depth and wide-ranging essay, eviscerated the labour and workplace organisations that created socio-psychological barriers against the

[101] Peter Mitov, "Infomatsiya, Ikonomika, Obshtestvo" in *Filosofska Misul* 1989 (9) p. 4

[102] Ibid., p. 6

[103] Ibid., pp. 11-14

computerisation of society. In the conditions of automation and Man-Machine systems, the psychological burdens are due not to a reaction against the technical system but the social changes connected to it – the new relations between people, rather than technology itself.[104] With the changing nature of work, there is an attachment to the old methods of doing things, an inherent conservativism. Easy and routine work is now done automatically while computers raise extra responsibility. There was a fear of a fall in job creation and the loss of the individual shape of the worker, reduced to his technical functions. The computer also gives rise to a new type of office, an isolating experience that runs counter to the human striving for contact. Instead of fostering creativity, all this leads to a retreat into oneself and a *loss* of creativity.[105] Man feels surrounded by machines and more dependent on them – machines that require specific education for him to understand their "algorithmic language" and systematic way of "thinking". They fear and resent the might of the specialist who has mastered this new technology, as that can be translated into power over the users who have subordinated their work and personal activities to the computer. The darkest fears of bourgeois society are true here too – that computers could be used for surveillance and tracking.[106] This new type of technology could also uncover the imperfections in work that hitherto may have remained hidden, contributing to a loss of some basis, or meaning in the person's life, who sees the computer as a threat. Those who love the computer, instead, fall into imaginary worlds and lose a sense of reality. This is fatal to human emotion and social development, as well as a contribution to illnesses of the mind, resulting in an increasingly anxious society.[107] The regime's drive to computerise, thus, has been piecemeal and lacking a

[104] Valentin Korkinov, "Nyakoi Sotsialno-Psihologicheski Problemi, Porazhdashti 'Psihicheskata Bariera' Spryamo Kompyuturizatsiyata" in *Filosofska Misul* 1989 (9), p. 28

[105] Ibid., pp. 29-31

[106] Ibid., p. 32

[107] Ibid., pp. 33-4

coherent, well thought-out application. Many computers are in fact lacking, or too expensive – computerisation is often present as an idea, without the computer. The holistic development of an informational workspace requires not just the computer specialist, but also the psychologist – the psychological and physiological needs of the worker in this new economy have been largely ignored. The way to communicate with the machine had been overlooked, as software is developed by specialists who communicate with the machine in a business-like manner, a formal and symbolic way that was alien to the average person who required descriptive and natural languages.[108] Lastly, information is fetishized, data is "right" in its own way without any reference to the human component of how it is created. Specialists hide behind the authority of the computer, an absolute guarantee of science and progress. A job is only well done if a computer is used, no matter if it is needed or not. Computerisation could only have good results when it was consistent with human needs, independent of negative side effects, aware of the social context of its usage.[109] This had been absent in Bulgarian computerisation, a piecemeal application of a new prestige technology. The regime had failed in its own promises, hampering creativity rather than fostering it.

The final essay, by Soviet professor of informatics Anatoliy Rakitov, was the final broadside against informatics used as a tool of control. An individual connected to a computer full of knowledge was the opposite of the computerised state control over the individual. In a society without democracy

> …information technology can become not the basis for freedom but the instrument for total coercion and control. In a society that doesn't have real glasnost and freedom of information, where the freely accessible databases and knowledge are few or don't even exist, information technology can only deepen disinformation and conserve…social-structural backwardness.[110]

[108] Ibid., p. 35

[109] Ibid., p. 36

[110] A I Rakitov, "Filosofiyata na Progresa I Informatsionnata Revolyutsiya" in *Filosofska Misul,* 1989 (9), p, 60

The information economy required a particular set of social conditions, and until now socialism had lacked them. Slow informatisation would lead to a socio-historical backwardness that will last for many years. Countries – including the socialist ones – risked becoming the informational colonies of the more developed countries.[111]

The journal's debates had thus reflected the full spectrum of socialist machine dreams – from the utopian belief vested in them to the disappointment of the regime's failures. It had supported the idea of creating a creative socialist personality, an intellectual labourer, who would usher in the final stage of communism faster. It had been linked to Zhivkova's cultural policy, as well as the state's economic modernisation, offering ways to put social governance on a scientific basis or foster cultural and artistic knowledge in the average person. It had eventually become a prism through which to see how these dreams failed, failing to reform the social relations of the workplace, fostering conservativism, rejection and thus a lower productivity. However, the aim of Bulgarian cybernetics remained the creation of the perfect socialist – not capitalist – amalgamation of man and machine into a Marxist cyborg. Even the critiques were to serve a democratic, reformed socialism. Authors remained wary of the informational economy in its Western variant, and saw it as perpetuating the hierarchical and imperialist functions of industrial society.

These intellectual discourses, however, were not self-contained. As we have already discussed, they had a bearing on educational reforms and attempts to foster a new generation of the true, creative personalities. Discourses about socialist Man always looked towards society, and through initiatives such as the Sendov method they bled into it. There was, however, another way that the state and its intellectuals impacted the new generation of socialist citizens, an attempt to create the right conditions for children to overcome the

[111] Ibid.

conservativism of their elders by getting them to know computers first-hand from a young age.

A Computer for You

In 1984, Bulgarian children's lives were invaded by two new institutions – a network of computer clubs around the country, and a magazine printed by the DKMS youth union, "*Computer for You".* The magazine's first editorial, in its single issue in 1984 (it would be re-designed and launched as a monthly magazine from January 1985), stated that nothing in modern Bulgaria was done without a recourse to electronics. Thus the magazine would offer youths knowledge, experience, and creativity from the interesting world of "her majesty – Electronisation" in all its forms: new programs, new developments in the computer clubs, new developments around the world. The editors encouraged children to write back with requests and concerns, so the magazine could more easily turn the "work with computers into a calling and duty of the young generation".[112] Despite the leading article being penned by the head of the DKMS' Central Committee, a dry expose of the party's current policies, the first issue set the tone for the whole run of the magazine with well-illustrated and accessible articles on computers as a second literacy, for example, interviewing children who spent their time at a seaside computer club rather than the beach. The kids – both Bulgarian and East German – are enthusiastic acolytes of the new technology, eschewing summer fun for the future. The journalism is candid, covering how some of the boys who had parents in the Merchant Navy wanted not Western Hi-Fis from them, but computers – or at least parts, so they could make their own. They wanted computers and knew Bulgarian made some – but where were they, the journalist asks: "there are French cosmetics, whisky – present, there are cigarettes, and whatever colourful rags you want, but there are no computers."[113] This kind of

[112] *Kompyutur za Vas*, 1984 (1), p. 1

[113] Ibid., p. 6

coverage became a feature of a magazine which alongside the practical and educational side of computing, also covered the shortages and failures of the regime to provide the promised technology to the everyday citizen.

The magazine introduced a wide range of articles and tropes, such as “Umko” the computer (a play on the IMKO, the first Bulgarian PC, and “Um” – mind, as well as “clever”) who helped the youngest children get to know the basics of what the machine could do. Throughout its run, lectures were printed, as well as – most importantly – code. Whole programs were offered to students and children, from simple ones to allow calculation on a home computer to more engaging ones such as how to program the machine to become a musical keyboard; how to play computer chase; as well as a number of games that children could program themselves and then play, including space battles or fighting games. The magazine was thus well aware of its audience, responsive, and popular.

At the same time, the first Computer club opened in Sofia in late 1984, allowing people of all ages to train on and use the Pravetz’82 machines it was equipped with. From the very start it suffered from a lack of adequate software literature, with people bringing in their own notebooks to copy programs from the manuals, and it was lacking enough peripherals such as floppy drives or printers.[114] Yet, by early 1985 there were twenty eight computer clubs nationwide and 350 more were being built. A new software enterprise – “Avantgarde” – made up of students and teachers from various Sofia and Plovdiv technical schools and universities, was tackling the lack of programs by creating around sixty computer games and twenty educational programs.[115]

[114] *Kompyutur za Vas*, 1985 (1), p. 9

[115] Ibid., p. 11

Pics. 6 & 7: The "Microcomputer Kids" and how computers would help us at home ("Put more soap in the water!") – the magazine's views of the new age. (Source: Kompyutur za Vas)

By 1986, there were 1500 Pravets'82 computers in use throughout the club network, together with IZOT 1031S microcomputers and new peripherals such as the training robots of the Robco series (teaching children how to program and control robots through the PC) or joysticks for games. The youths themselves were producing software in clubs throughout Sofia, Blagoevgrad, Ruse, Haskovo, Stara Zagora, Silistra, Kyustendil, with domestic self-teaching aids for languages such as Basic, Pascal and Assembler springing up out of the youth movement.[116] The clubs were going international too, as we have already seen in chapter 4 – Bulgarian computer clubs, showcasing domestic prowess and teaching foreign children, had opened in Moscow, Leningrad, Kiev, Kharkov, Havana, Pyongyang, Hanoi and Addis Abeba by the end of 1986.[117] By 1987 the primary wave of building was completed, and 530 clubs were operating around the country – at least one each in the twenty eight okrug centres, 163 in smaller obshtina centres, 306 in factories, schools and universities, and others in DKMS centres.[118] Some were of course better equipped than others – clubs in Sofia or Varna routinely had up to 18 PCs or more, while smaller ones had just two or three.[119] Time was limited, especially when many computers or peripherals broke down or when clubs had to balance teaching children alongside adults who also wanted to learn how to use these new machines. However, the network had spread nationwide and was the place where many people had their first taste of these fabled machines.

Pic. 8: Children and adults together in a computer club, late 80s. (Source: spomeni.bg)

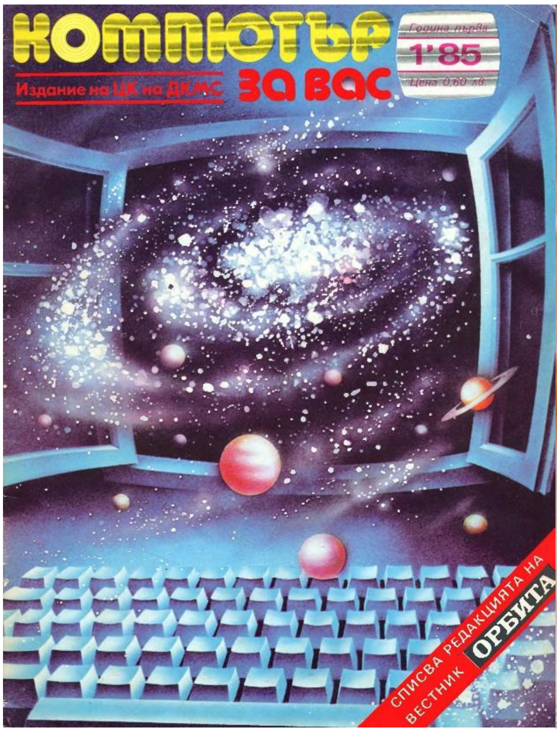
[116] *Kompyutur za Vas*, 1986 (2-3), p. 3

[117] *Kompyutur za Vas*, 1986 (9-10), p. 4

[118] *Kompyutur za Vas*, 1987 (5), p. 2

[119] *Kompyutur za Vas*, 1988 (1-2), p. 3

The magazine covered the clubs extensively, including using them to uncover attitudes amongst children to the new devices. It ran a questionnaire among 200 students who used one of the clubs, uncovering that 66% of children had someone in their family who worked directly with a computer in their workplace. The youngest children wanted to use computers around two hours a day, while teenagers wished for at least four hours a day. Computer games were, unsurprisingly, among the most popular thing to use in the club.[120] Other articles pointed out how fast children were learning to use the machines – an adult was interviewed, recalling how it took him three hours to land a lunar module in a simulation game, while a middle school kid watching him got it right in under a dozen tries.[121] It was both a part of and a testimony of the steady march of computerisation in Bulgarian society, especially among its youngest members. However, its editorial pages served a further purpose – its writers were ready to point out the failings of the state and its economy in a field which they were passionate about.



[120] *Kompyutur za Vas*, 1986 (8), p. 4

[121] *Kompyutur za Vas*, 1984 (1), p. 38

Pic. 9: The universe at your fingertips, as well as the socialist computer dream – the magazine's graphic design helped it capture an audience, while it also ran adverts for the domestic industry. (Source: Kompyutur za Vas)

In mid-1985 its editorial, nestled on the first page of every issue, asked its readers whether they could go out and buy the Pravetz 8D home computer, now supposedly available throughout the country. It acknowledged that schools and clubs had a priority, yet the traders have not been clear about actual availability. They damned the lack of software literature and manuals available, failings that could not be blamed on anyone but domestic enterprises. "We know that the floppy discs for PCs that we produce are shoddy and work (chattering away like a clapper) only in exceptional circumstances. We don't know how long it will be like this" it bemoaned, stating that the editors were uneasy facing the readers in such circumstances – extoling things that were unavailable to most. To make up for it, it offered a 50% discount for subscriptions.[122] In 1988, it was still complaining about similar things, running an investigative piece to find out how easy was it to obtain a home computer. Until recently, it stated, there was only one store in Sofia that stocked them, where kids would bring their sceptical fathers and get them to buy computers to plug into the home TV as well as telling them they can use their home tape player to record programs. "The father is even more in two minds. The tape player thing is good – the house will finally rest from all that disco, brake and heavy metallurgy [a jab at heavy metal]. But what about schools? What about the university entrance exams?" the journalist asks, before defending the kids – this year saw 2000 Pravetz 8D computers had been made available for the home market, at the cost of 420 levs. It extols it as a long-term purchase, which is even a powerful disciplining tool – a father says he locks up the computer when his son has done something wrong, and this is an effective method! However, the computer was difficult to find in other Sofia shops and impossible in the provinces, as stores haven't realised its true potential. Despite promises,

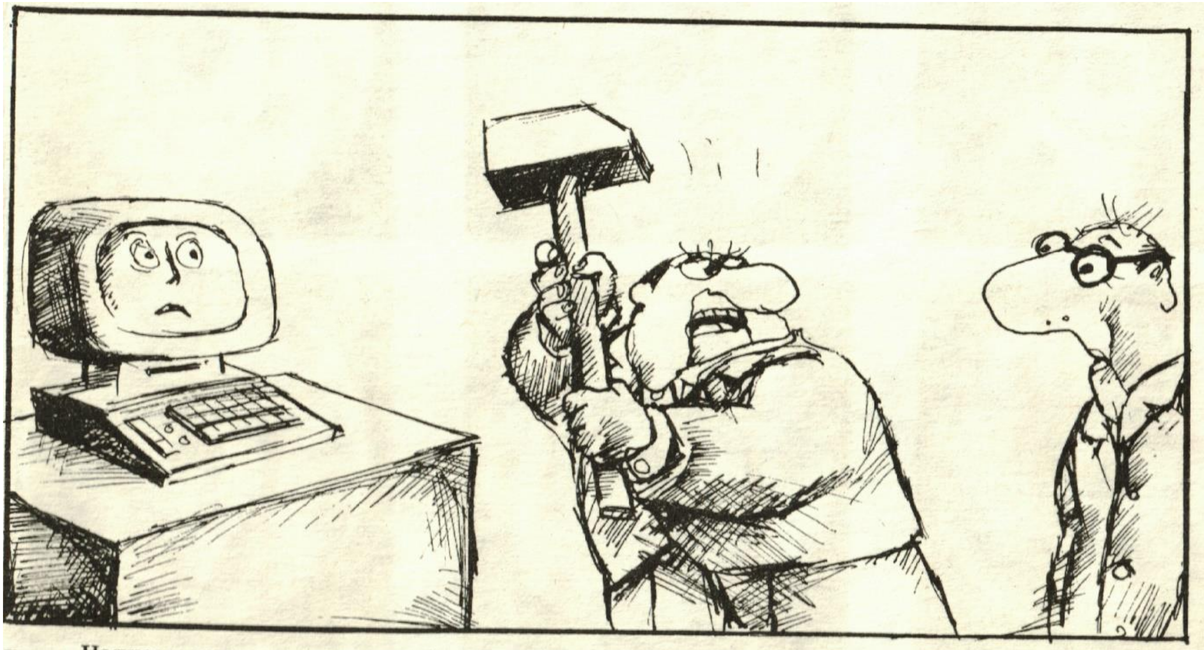
[122] *Kompyutur za Vas*, 1985 (5), p. 1

the internal trading services have not yet fulfilled the obvious demand for such machines by the younger generation.[123]

Its printing of programming codes and algorithms was explicitly part of its attempt to off-set the problems of Bulgarian industry's shortcomings in the sphere. It ran competitions to give away Pravetz 8D computers and even whole desktop Pravetz'82 units, which for some children was the easiest way to acquire them.[124] Its humorous articles and caricatures were not afraid to poke fun at some of the fears about computers, which were wrapped up with pointed barbs at the political climate. In 1985, before preustroistvo had been announced in Bulgaria, and before there was a real loosening of newspaper censorship, it could run a picture that made fun of fears of how the computer could aid DS spying on the citizenry, without any repercussion. The magazine's reflection of the hopes and dreams inherent in the regime's computer dreams co-existed side by side with cutting and truthful reporting on the shortcomings of that same old regime. Its reflections on the problems of Bulgarian software in particular will be an important part of the next chapter, but its importance as a general reflection of both the march of the machines into Bulgarian society and their shortcomings is not to be understated. Its popularity reflected the popularity of the computer in the imagination of young people who were to be the regime's new Men, the socialist cyborgs of the new age. There was another way, too, that the computer and the information age had captured the popular imagination in Bulgaria – science fiction.

[123] *Kompyutur za Vas*, 1988 (3), p. 11

[124] *Kompyutur za Vas*, 1989 (3-4), p. 1



Pic. 10: "He wrote a donos [denunciation] against me!" (Source: Kompyutur za Vas)

The New Laws of Robotics

Bulgarian science fiction saw its heyday under the socialist period, producing a number of works that broke with socialist realist themes, or the more easily dismissed "reds in space" type genres that simply projected Marxist utopias into the future. The biggest boost was received in 1979, when the "Galaktika" library started being published, presenting Bulgarian readers with the best of domestic, socialist and Western science fiction. Classic tomes by writers such as Ray Bradbury, Frank Herbert, Ursula Le Guin or Arthur C Clarke nestled alongside Eastern Bloc classics such as Lem or Strugatzki. One hundred and one tomes were published before the end of 1989, making it a prized possession for many young people.[125]

Some Bulgarian writers, however, had started grappling with the potential effects of computing and robotics from earlier on. Lyuben Dilov, one of the towering figures in Bulgarian science fiction, shot to prominence with his 1974 novel *The Road of Icarus (Putyat*

[125] Info from "Poreditza Biblioteka Galaktika" at the Bulgarian science fiction portal (http://bgf.zavinagi.org/; Last accessed: 23rd January 2017)

na Ikar). Considered one of his main works, a winner of an award by the European Science Fiction Society in 1976,[126] and considered one of the best socialist science fiction novels by Arcady Strugatzki himself, it is a work heavy in philosophy and interpersonal relations. Humanity has taken to the stars through the *Icarus*, a spaceship made up of a hollowed-out asteroid, serving as a home for this generation vessel with only one aim – to explore the universe. The main protagonist – Zenon Belov (named after the Zeno of Elea) – is the first child born on Icarus, a true citizen of the asteroid and the galaxy. He is struggling to find himself in a typical coming-of-age story, and there are love interests too. However, the more interesting part is both the society the book describes, and the philosophical questions it gets into concerning man and machine – the topic of Zenon's scientific dissertation, which he is not very interested in.

A key turning point in the book is a society-wide discussion and trial of a scientist who has created a cyborg child, programming it to play and thus learn, convinced that it was humans' propensity for games that allows them to innovate, learn and grow into individuals. This is against Icarus's laws, where such experiments are forbidden, with robots being allowed only as helpers to humans rather than mimickers. More so, a study of the little cyborg uncovers that its brain wave functions are identical to the scientist who has created him – an attempt at cloning in its way. The child is killed, but the citizens' debate centres on what to do with its creator, who is supposed to be frozen for at least ten years as punishment, and alterations to his brain are to be made once he is released. Concurrent with that is a debate about allowing young scientists to make reconnaissance flights outside the spaceship, rather than depending on automatic probes. The critical point is thus reached where Icarian society has to discuss whether it can allow changes to its stringent rules. Belov sees it as a fool's errand, a debate he is doomed to lose.

[126] https://esfs.info/esfs-awards/1970-1979/ (Last accessed: 23rd January 2017)

Yet Zenon's father, an influential figure on the spaceship due to both age and previous achievements on Earth, criticises the society he sees as cruel and unchanging. "We are at the end of our wisdom", he implores them. "The drama of Icarus is that it is fit to burst with scientists…Einstein himself stated that we, scientists, are conservatives by nature and only the impetus of circumstances can make us sacrifice our dearly held positions." He continues to argue that this is a qualitatively new society, that with every kilometre further from Earth it is further from its systems of knowledge, while not creating anything new. Two decades this spaceship has only identified the mistakes of Earthlings about the universe. All this society's powers were aimed at creating its own world without knowing the real one. "If for a civilization this can be defended, for a research team such as ours it is deadly." Icarus is not learning anything real about the universe, looking out to the world through apparatuses that deformed reality. For two decades Icarians were waiting for that massive jump to happen, over the "gaping abyss of contradictions between our new knowledge and old views". But such a revolutionary jump, history has taught us, only happens within the mind of a single person rather than a collective. One scientist cannot expect to carry out more than one revolution in his lifetime – Zenon's father himself should not be on this flight, as his achievements are done and dusted. Icarians' heads are also full of chaos – an empty-headed fool had to be born so as to be able to make this jump. And now this society wanted to freeze him – or never even let him be born.[127]

Dilov's argument is a defence of innovation and radical thinking, of the individual against a staid collective. It is also a warning against a rule by experts, who might be great at keeping the society running, but often not allowing it to make the leaps forward that it needs. While Icarus flies, its people do not progress meaningfully until a few outliers, including someone who is born on the asteroid and thus cannot be satisfied by a novelty that for him is

[127] Lyuben Dilov, *Putyat na Ikar* (Plovdiv: Hristo G Danov 1984), pp. 166-168

his whole life, shake things up. As a story of a generational and social clash it is powerful fiction, exploring the limits of science and an expression of a writer's support for the power of curiosity and spirit. In the book Dilov also tackles not only this social anxiety, but a technological one too – what is it to be a man when there are so many machines? And where does the machine and man meet, and what sets them apart? In the book, thus, he invents a new Fourth Law of Robotics, to supplement Asimov's famous three – "the Robot must, in all circumstances, legitimate itself as a Robot".[128] This was a reaction by science against constructors' wish to give robots ever more human qualities and appearances, making them subordinate to their function – often copying animal or insect forms. Zenon muses on humans' interactions with robots that start from a young age, giving the child power over the machine from the start. This actually undermined humans' trust in these machines that we were so dependent on. Humans needed a distinction from the robots, and they needed to know they were always in power and could not be lied to. The anxiety for Dilov was about the limit of humanity, at least in its current stage – fearful, humans could not yet treat anything else, including their machines, as equals. Towards the final pages, a note to Zenon talks about the Icarians as playing a game against nature, one which has no strategy of winning – such a game cannot be won and shouldn't be won. Dilov's Icarus was a place where humans' own follies kept humanity back, its anxieties and conservativism preventing it from a true exploration and appreciation of the Universe, with the cyborg child and robots in general as cyphers through which to explore this.

The same idea permeates the humorous and often bittersweet stories in his 1981 collection *The Missed Chance: Stories from My Computer (Propusnatiyat Shans).* In it, a bored author plays a game with his writing computer, feeding it narrative points for a variety of genres, and seeing what stories it produces. It is connected to the National Library and

[128] Ibid., p. 185

through it to all world databases, so it quickly produces coherent, entertaining stories for the author – which he could pass off as his own. The stories – ranging from pulp fiction crime to fairy tales to science fiction itself – are funny and often absurd, a product of the conditions that the authors feeds into the narrative: such as that the crime story should start with no real mystery – the killer, the motive, the weapon and the victim must all be known from the start. The weird story is his own fault, the author realises – the machine can only spit out things he commands it to, and it knows his style too.[129] In the final story, it produces a narrative by his idol Arcady Strugatsky, he himself appears as a character who contends with his own Dilov-double, sent there by Strugatsky himself, who is also a character in the story. This is a story that transpires after the author has told the computer it is broken and is to be replaced, but that it has probably taken on too much from his thoughts to be of use to its next owner.[130] The computer's story is a way to mock the author, a continuation of Dilov's view that the machines reflect our own shortcomings, borne out of a fear of our own place in the universe – something which the computer's immense powers of production and calculation can only amplify. Any faults of the machine are our own faults, for the machine can't yet produce truly, but must be programmed – if the narratives it produces are faulty or wonky, so is our own reasoning. Dilov's literature was thus a pessimistic one about the regime's vested dreams in computerisation, as his characters recognise that they are not a panacea if they are in the hands of imperfect beings.

[129] Lyuben Dilov, *Propusnatiyat Shans* (Plovdiv: Hristo G Danov 1986), pp. 21-2

[130] Ibid., pp, 191-211

Pic. 11: The Road of Icarus and the Missed Chance (Source: Author's collection)

Bulgaria would produce also a Fifth Law of Robotics, thanks to the mathematician and writer Nikola Kesarovski. He was a regular contributor to the *Computer for You* magazine, writing articles on the history of computing down to the ancients, on the new generations of computers, on the meaning of information. He was a great populariser of science, writing guides for children and adults on how to use particular programs, while at the same time demonstrating a great belief in the theory of information as being able to unlock human potential, by unifying hitherto disparate disciplines and allowing a synthesis of our compartmentalized knowledge.[131] This was reflected in his short stories, three of which were collected in the 1983 publication *The Fifth Law.* In the first – *A Crimson Drop of Blood* – he explored the vision of the human body as a cybernetic machine. A scientist looking for proof of alien consciousness finds it – in his own blood cells. He gets to this conclusion gradually, deciphering the messages sent by this alien mind, trying to decipher what their descriptions of society actually mean, gradually coming to understand his own body as a sort of robot.

[131] *Kompyutur za Vas*, 1985 (4), pp. 2-3

Kesarovski's vision of nesting cybernetic machines – turtles all the way down or up – indicates his own training as one of the regime's specialists: he was a more optimistic writer than Dilov. Yet, his warning to humanity does come through in *The Fifth Law,* his most famous story. It had already reached a wide audience, especially amongst young people, by being serialized in the extremely popular comic book series *Duga* in 1980. A famous writer is killed by a man who gives him an incredibly powerful hug, and police are baffled. Their investigation reveals that the man was in fact a robot who didn't know he was a robot, thus violating both the First and Fourth laws (Dilov's law was now canonical). The Fifth Law thus stated that "a Robot must know it is a Robot". The story expands into a novella, delving deep into how such a robot came to be, exploring the machinations of a corporation that sought to create weaponised robots. The plot continues through the creation of a cyborg – the melding of man and machine – out of the most famous scientist who managed to create such a robot, and culminates in the expected rebellion of robots who act as auxiliaries in a powerful base under Guam. Holding the world hostage with the powerful weapons there, they demand that the cyborg be delivered to them, as well as the best robot psychologists in the world, so as to negotiate their co-existence with humanity. The story ends on an undetermined but somewhat hopeful note, as some states threaten a nuclear attack, stating that the destruction of humanity is preferable to servitude to the machines, while one of the robot psychologists recalls Christ's words to Peter and how he would betray him three times – and yet, on that stone he can build his church.[132] For Kesarovski, computers and robots held dangers, but also a promise, if humanity could one day see that it was both a type of robot itself, and in a position to only gain from the machines' powers, allowing it to attain the next step in its historical progress.

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[132]Nikola Kesarovski, *Petiyat Zakon* (Sofia: Otechestvo 1983)

Pic. 12: The Fifth Law, in its comic book form. (Source: Author's collection)

Bulgarian writers' propensity to create extra laws of robotics was parodied by another author – Lyubomir Nikolov – in his short piece "The One Hundred and First Law of Robotics". In it a writer is found dead while working on his pleasant but admittedly limited story "The Hundredth Law of Robotics", which stated that a robot should never fall from a roof (in the story-within-a-story, it does so, killing a passer-by). It transpires he is killed by a robot who just didn't want to learn any more laws, resulting in the final one – "Anyone who tries to teach a simple-minded robot a new law, must immediately be punished by being beaten on the head with the complete works of Asimov (200 volumes)".[133]

While Bulgaria could thus boast the highest number of robotic laws produced per capita, the science fiction produced in concurrence with the rise of the computer industry indicates the wide ranging effect that the new technology had on the consciousness of people throughout society. The philosophical implications of the new information age, with its

[133] Lyubomir Nikolov, "Sto Perviy Zakon Robotehniki" in *Integralniy Klub Fantastiki (Izdatelstvo Gradski Mladezhki Dom Lilyana Dimitrova),* 1989

potential for real thinking machines, was debated widely in journals and magazines, but also fiction and comic books. It was read voraciously by a new generation which had access to computers in clubs or was being taught about them in an education system that was also undergoing rapid change. The regime had wanted to create a new socialist man, and was trying to by introducing automation and computers. At the same time, a veritable intellectual industry sprang up to discuss what this meant for both the Bulgarian individual and society, and in the same time created the space to criticise the party's conceptions of the information age, as well as its potential to carry it out to its fruition. Starting its life in the 1960s, by the 1980s the computer industry had created the conditions for diverging interests and conceptions of politics as well as economics. It had also created strata of society that were there to serve the regime's needs for specialists, but also ones that were international in outlook and part of trans-national networks of intellectual debate and professional or economic exchange. It is thus time to turn, finally, to the particular experiences of these strata and their role in the downfall of the Zhivkov regime.

Chapter 7. Networked & Plugged-In: The Emergence of Transnational Professional Classes and the Fall of Communism

Facing outwards and inwards at the same time, the Bulgarian computer industry had become by the 1980s a key part of the regime's trade policy as well as development and modernisation plans. The previous chapters have followed the electronic items and the professionals who built them, sold them, and worked with them, across the Iron Curtain, within the Eastern Bloc, throughout the Global South, and within the various enterprises and institutes of the country itself. The computer was a commodity to be stolen, built and sold, as well as a tool to modernise the economy, create cybernetic governance, and free man from the dirge of menial labour. Around each of these stories we have seen the variety of people who were involved with the industry, from the highest levels of Ivan Popov and Ognyan Doynov down to individual scientists and even workers who were subject to the automated machines. We have seen them copy from the West, learn how to compete in India, defend regime interests in COMECON, co-operate with Soviet partners, implement them in production and think about what they meant for the future. They emerge as a modern, international class that seems to be in tune with the latest developments in computing, business, and information economy debates, even in the West. They were also among those who criticised the regime from their own professional standpoint as technological intellectuals and managers, pointing out the failures of the party-state to deliver on their utopian promises of automation and a new type of rational management in society and industry.

But there were differences between those who worked in the industry. By the late 1980s over 215 thousand people were employed in the electronic industry in some capacity or other, making it the second biggest group of industrial workers in the country, or 13.5% of the industrial labour force.[1] A small cadre of directors and industrial leaders of enterprises, together with the Politburo and CSTP backers of the industry occupied a commanding height. They were the true steersmen of the industry, in charge of planning but also controlling the extensive foreign trade and STI apparatus. As the electronic industry looked for ways to gather technology abroad, legally or illegally, it was these men (and they were exclusively men) who held the reins of high-level financing and business dealings with counterparts in the business world.

Thousands of scientists, highly-qualified technicians and engineers, university professors, and researchers, staffed the institutes and departments that created the Bulgarian computers. They too were part of international exchange networks, if on a lower level – professionals who participated in conferences, talked to foreign counterparts, knew of the latest developments in Western and socialist technology. They were mobile in their own way, with their own interests and powers, and often were increasingly aware of the regime's failure in industry and science. They worked in institutes and enterprises that were often profitable and self-financing, islands of business acumen and scientific organisation in a failing economy.

Below them on the ladder of prestige and international mobility were the majority – the workers in the IZOT factories, often poorly qualified, rooted to their workplace and home. We can add to them the new generation of children who were using computers in schools and clubs, reading about them, dreaming with them and about them, but yet not part of the economy as workers. They too, however, had a window towards the world through the tool of the computer.

All of these people's lives were changed by the electronic industry. What this chapter will explore is to what they learnt, how international they became, how their experiences

[1] Milena Dimitrova, *Zlatnite Desiteliya na Bulgarskata Elektronika* (Sofia: IK Trud 2008), p. 62

influenced their professional interests, and how they navigated – or contributed – the end of the regime. The gradual and imperfect Bulgarian transition to the market and democracy after 1989 was navigated very differently by people who were involved in the industry. The chapter will shed light on how some of these people's international and professional experience made them deal with the changes better, or even bring them about. There are losers and winners in every transition, and the electronic industry as an economic sector was a huge loser once the socialist regimes fell one after the other, bringing down COMECON and the guaranteed allied markets. However, as human capital, the electronic industry was well placed to give some of its participants a better start, due to a variety of reasons. The chapter thus also looks at the different strata that emerged out of this huge sector, first turning to the scientists and electronic professionals that have been the protagonists of many of the previous pages.

Socialist Technical Intellectuals as International Professionals

From the very start of the existence of electronic specialists in Bulgaria, this group was international in training and connection. In the first chapters we had already seen how the first specialists were trained in the best institutes that the socialist world had to offer, especially in the USSR and GDR. Specialisations abroad were the norm for a long time, even after the Bulgarian state created the right higher education institutes and courses to train these specialists domestically – Nikolai Stanulov, for example, defended his candidate of science dissertation in Leningrad rather than ITCR,[2] while we have already seen other specialists such as Peter Petrov specialising in East Germany. The Bulgarian specialists, needless to say and to repeat, were part of a wide network of professionals stretching from the Inner German Border to Vladivostok, a community that shared ideas and expertise and worked jointly on many projects.

[2] BAN-NA f. 20 op. 5 a.e. 90 l. 2

However, they were also facing West, towards universities and specialisations in the capitalist world. Such specialisations were almost impossible to get in some sectors of the economy, but were – merit and certain political backgrounds permitting – more available to specialists in the electronic area. Some were connected to STI operations, but this does not diminish the fact that these specialists became part, for a time, of scientific collectives in the West, forging friendships and connections across the Iron Curtain. Some of the luminaries of the Bulgarian computer sector could boast particularly impressive resumes due to such travels. Nikolai Naplatanov, as a director of an important institute and with impeccable party credentials, specialised technical cybernetics in Stanford, the California Institute of Technology and Illinois Institute of Technology during the 1971-2 academic year, even giving guest lectures during his time there.[3] His impressive output in the spheres of bionics and cybernetic theory afterwards were at least partially influenced by his time spent among some of the leading lights and departments in the field, helping turn the nine-volume textbook series he edited subsequently into an up-to-date manual for the next generation of Bulgarian specialists, who didn't have such opportunities.

Even those trained entirely within the educational establishments of Bulgaria and the socialist world were not truly behind the Iron Curtain intellectually. It is worth repeating and stating what should be an obvious fact – professionals and scientists from the socialist world often crossed this barrier to conduct business or talks abroad. The international nature of science was, as chapter three showed, one of the ways that STI expected technology to be transferred into the country.[4] The regime had an interest in its professionals being up-to-date in order to keep its technological edge within COMECON. Thus, the trips that Bulgarian computer specialists took abroad were numerous and in-depth, be it for conferences or

[3] *Nov Tehnicheski Avangard*, 4 (69/457), September 2006

[4] AKRDOPBGDSRSNBA-R, f. 9 op. 2 a.e. 371 l. 3

specialisations within firms and institutes. The CSTP encouraged such placings abroad, using its bilateral agreements to co-operate with Western countries to scout out what their profiles could best help with. For example, the French agreed to host Bulgarian programmers for up to six months per year in order to train them on the latest software, as well as two-month specialisations in their own statistical and population administration systems.[5] The Ministry of Electronics received the largest share of specialisations abroad and permits for international travel during the second half of the 1970s, as part of the ramping up of the electronisation and automation campaigns – in 1977 alone it received 263 quotas for specialisations abroad (these numbers exclude the USSR) and 155 quotas for participation in international seminars or conferences, compared to the larger Ministry of Machine-Building which received 232 and 94 respectively.[6] The CSTP also encouraged as much participation in UN programs and joint research, such as in instrument-building or metal works machines with CNC.[7] In the late 1960s, Bulgaria had been a receiver of aid through the UN Development Program and UN Industrial Development Organisation, which in fact contributed $50 thousand towards the development of the Institute of Instrument Building and $600 thousand for computer equipment;[8] ten years later, Bulgaria was in fact a contributor to such programs.

The ITCR's archives also bear testimony to the increasing outlook towards the West among the leading scientists. While in its first year of existence, 1964, the institute sent people only to allied nations for specialisations and training,[9] with its growth and specialisation in the 1970s it became more interested in the latest technology in the capitalist

[5] TsDA f. 517 op. 4 a.e. 40 l. 8-13

[6] TsDA f. 517 op. 5 a.e. 7 l. 8

[7] Ibid., l. 11

[8] TsDA f. 1B op. 35 a.e. 12 l. 32-33

[9] BAN-NA f. 20 op. 3 a.e. 73 l. 1-29

world. In 1973, an engineer visited the Netherlands, studying their use of PDP-9 and PDP-15 machines in the hospitals in Utrecht and Amsterdam. He noted favourably on how they automated the monitoring of maternity wards and heart activity, as well as helping in reduce clinical errors. He recommended similar developments based on IZOT 0310, which was a PDP analogue,[10] and such work became the basis of the institute's medical electronic program which was amongst its biggest successes and resulted in ASUs such as the Botevgrad hospital one. Naplatanov's pet area of bionics also resulted in fruitful placements abroad, such as the 1976 five-month stint of Dimitar Mutafov in French bio-medical research labs. He studied the latest developments in neurology and physiology, reporting widely on EEG analyses, mapping of the visual cortex and other areas key for the institute's bionic work. He noted what types of oscillographs were used, and what type of computer software was used to process the data. He also spent time in laboratories that worked on scanning and creating algorithms for reading books and digitizing the data. Most importantly, he forged friendships with a French professor over their shared interest in neural modelling, resulting in the Westerner passing on all the information he gathered during a specialisation at the Cybernetic Laboratory of Canterbury University in the UK, complete with electronic elements developed there. His newfound friend also gave him access to the latest French, Japanese, Dutch and German automated electronic microscopes.[11] Such trips and links across the Iron Curtain not only helped in the transfer of technology, but resulted in long-term correspondence and debate across ideological grounds, based on shared professional interests. Often, such as this case, such chance encounters and informal discussions yielded information that would elude STI, but in a personal sense it also plugged Bulgarian scientists into the international knowledge economy. The knowledge acquired was shared within the

[10] BAN-NA f. 20 op. 5 a.e. 45 l. 17-21

[11] BAN-NA f. 20 op. 5 a.e. 96 l. 17-27

lab, and the links multiplied. For example, Pencho Venkov – the man who had originally visited Dutch hospitals – was acquainted with Mutafov’s experience and contacts, allowing him to participate fully in the Biosigma’78 colloquium on medical and biological information analysis in France. There he participated in US and British discussions on 3D modelling of microbiological structures, information filtration and other key topics, and presented on telemetry developments in the ITCR, resulting in further links with French scientists and requests for more information. Such experiences in the international academic community, seemingly mundane, were important ways that Bulgarian scientists became international experts.[12]

Trips abroad weren’t just ways to keep in touch with the latest science, but also business organisation and management. Even scientific institutes such as the ITCR were interested in the way that Western firms ran their data processing facilities and set up their offices. For example, in 1977 Desho Mladenov visited a Danish company, RC, who ran networks and services for a “Ford” plant. He came away with organisational charts and flow diagrams, as well as future plans for the company’s expansion. He noted how their network systems automated the order and delivery system for the car repair shops, and what could be used in Bulgaria. He brought back catalogues of the latest machines, but also know-how of how a capitalist firm operated.[13] Another four specialists from the institute attended classes in software and hardware at the company’s training centre near Copenhagen, deeming the experience to be particularly enlightening.[14] There was overlap between how socialist engineers envisioned the automation of society and how it was being done in their ideological enemy. Such trips, aiming at learning about organisation rather than just technology, were

[12] BAN-NA f. 20 op. 5 a.e. 152 l. 54-9

[13] BAN-NA f. 20 op. 5 a.e. 127 l. 13-17

[14] Ibid., l. 24-26

also of interest to STI, which also copied Western business plans. Operational management was just as international a language as cybernetics and computing, and heavily related to it.

Specialists from IZOT and its chief institute, CICT, were also globe trotters. They too attended conferences and seminars, forging intellectual links with the West, but were also practically oriented, selling and dealing at exhibits and company meetings. The archives are littered with reports that criss-cross not just the socialist and developing worlds, but the "enemy" countries too. This included the two hearts of the beast – the USA and UK – where CICT specialists specialised in displays and graphics even as Reagan proclaimed them within the sphere of the "evil empire" (the two coincided precisely, in March 1983). [15] Others were exploring co-operation with Xerox in France, or signing pre-purchase agreements for IBM 370 processors in London.[16] The same year, while STI was finding it harder to battle increased COCOM controls, a CICT physicist – Valeria Gancheva – was sent for a full year to Virginia Tech to study magnetic memories based on new physical principles, a highly sensitive topic.[17] Another secured a Dutch government grant for nine months of microprocessor programming training.[18] Contracts were being sent in West Berlin, and joint networks were being planned with the Greeks as part of government co-operation in transport and communications.[19] Even before the ascension of Gorbachev and the softening of East-West tensions in the 1980s, NATO countries were actively welcoming Bulgarian specialists from such a sensitive industry that was obviously trying to catch up to the West by any means possible. Groups as large as fourteen were residing in Norway to study computer-aided

[15] TsDA f. 37A op. 9 a.e. 2 l. 7

[16] Ibid., l. 60-62

[17] TsDA f. 37A op. 9 a.e. 4 l. 23

[18] Ibid., l. 26

[19] TsDA f. 37A op. 9 a.e. 5 l. 88

design (which could be applicable to military industries, too),[20] while CICT scientists could freely engage their Western colleagues in discussions on the latest fifth generation computers at Paris symposia,[21] or visit IBM offices in Belgium to study the latest “offices of the future” that the company envisioned.[22]

At first glance these seemingly banal encounters seem like the run-of-the-mill daily life of any professional – and that is precisely the point. The geopolitical facts of superpower confrontation did not hamper the scientific and industrial links created over the decades between scientists on both sides of the divide. Bulgarian professionals were learning from their Western colleagues, making contacts, and teaching them, despite Reagan’s rhetoric or the war in Afghanistan. Political avenues of engagement might have narrowed in the early 1980s, but for Bulgarian science they grew as IZOT specialists had more to offer the world (as the industry grew in sophistication) and exploited bilateral and multi-national co-operation agreements to the fullest. What was learnt in business terms, too, was being applied in the socialist world. Not only were billboards going up to advertise Bulgarian computers, but IZOT was positioning itself as a true business. For example, during the Moscow Olympics in 1980 it exploited a request from the organisational committee for twelve free IZOT 132D printers to be included on the list of official suppliers of the games, as well as free advertising space in the brochures and official publications.[23]

The internationalism of science was strongly encouraged by the CSTP while under Popov’s reign. His own international links and training made him a supporter of multi-national initiatives, and a believer in the practicality of being part of larger projects for such a

[20] TsDA f. 37A op. 9 a.e. 8 l. 11

[21] Ibid., l. 92

[22] Ibid., l. 169

[23] TsDA f. 830 op. 2 a.e. 97 l. 4

small state. He exploited the Soviet-American scientific rapprochement in the mid-60s to engineer closer contacts with the American scientific establishment at a time when Bulgaria was still one of the most distrusted of socialist nations in Washington. He engineered ties with US institutes who used computer modelling in the solution of various governance tasks in 1971,[24] leaving Bulgaria in a strong position when the superpowers decided to establish a joint East-West institution to deal with problems that plagued all advanced societies. This establishment, the International Institute for Applied Systems Analysis, was founded in October 1972 and based in Vienna, with Bulgaria as a founding member amongst twelve. The institution aimed at liaison between East and West and different disciplines in order to solve complex, international questions of global governance, such as pollution. It was the brainchild of McGeorge Bundy, an advisor to Kennedy and Johnson (the discussions on such a centre had started under the latter's tenure) and German Gvishiani, the head of the Soviet GKNT. Questions such as demographics or the environment would be subject to international discussion and modelling, and IIASA would become an important meeting point between the two world systems who were both using cybernetic approaches to problems of national and global governance.[25]

Under Papazov, the CSTP negotiated lower fees for Bulgaria and other smaller nations in the IIASA, and participated actively in its discussions and programs.[26] Bulgarian economist Evgeny Mateev who worked on algorithms for the automated distribution of resources among productive units in the economy was one of the first to participate, discussion his systems integration on the basis of computing with Western counterparts who

[24] TsDA f. 517 op. 2 a.e. 108 l. 128

[25] See: http://www.iiasa.ac.at/web/home/about/whatisiiasa/history/founding/the_founding_of_the_institute.html (Last accessed: 24th January 2017)

[26] TsDA f. 517 op. 2 a.e. 109 l. 132

tried to do the same in the market, finding many commonalities in their approaches.[27] The work done there was so valuable that by the early 1980s Bulgaria was one of its staunchest defenders at a time when the USA and UK reduced their membership dues, and supported its expansion by trying to get newfound friendly nations such as Mexico in (after Zhivkova's cultural diplomacy there). The CSTP deemed the IIASA activity extremely useful for domestic developments in agriculture, energy distribution, structural changes to the economy, risk theory and decision making.[28] The country actively hosted institute seminars and courses, such as on demographic analysis, development and restructuring of economies, the human factor in innovation and children in the computer world.[29] The institute in Vienna was thus yet another place where Bulgarian scientists shared in the international circuits of knowledge.

Even if not travelling and meeting abroad, Bulgarian technical intellectuals were connected to the world through information exchanges of different kinds. The Bulgarian Central Institute for Scientific and Technical Information was the node through which institutes and universities connected to national and international databases. A key link was to the Moscow analogue, the VINITI, through which Bulgaria had access to a wide range of Soviet and international databases in the sciences. By the late 1970s this included video terminal links between the two centres, as well as the regular swapping of magnetic discs and microfilms of information. Similar operations linked the national libraries of the two countries, meaning thousands of requests – by both Soviet and Bulgarian scientists – were fulfilled each year, greatly enhancing the information access of the small state.[30] Bulgaria was not only looking East, however, but West – it accessed European and international

[27] For more on Mateev's economics, see Georgi Burlakov, "Proektut na Akademik Evgeni Mateev za Avtomatizirana Sistema za Upravlenie v Konteksta na Gospodstvashti Ikonomicheski Teorii" in *Ikonomicheski Alternativi,* 2008 (5), pp. 103-114

[28] TsDA f. 517 op. 6 a.e. 108 l. 73-75

[29] TsDA f. 517 op. 6 a.e. 113 l. 112

[30] RGAE f. 9480 op. 12 a.e. 1348 l. 3-17

scientific databases through links with Athens and Vienna (a channel between the Bulgarian Centre and Radio Austria), literally plugging the socialist experts into the global information exchange.[31]The Politburo made the perfection of its national system of exchanging scientific information a priority in 1983, in order to build on these existing links. It looked to widen the communication channels through Vienna in order to offset the costs and limitations of keeping abreast of the avalanche of increasing academic printing in the world – the country could afford to purchase only around 15% of the journals, and 1% of monographs, every year.[32] Better selection was needed, but also access to electronic databases that would allow Bulgarian workers access to abstracts and other ways to judge which papers and works were key. Stoyan Markov pointed out that Bulgaria already had access even to the Library of Congress through terminal connections, so the short-comings were organisational and the question to be answered was if this information could be distributed to every user in Bulgaria – "No, we can't, because we have not yet crated the network for data transfer in such a way that every user – in Plovdiv, Smolyan, Pazardjik – can receive this info through the transfer network that services the Bulgarian information system".[33] The preconditions were there – Bulgaria was part of the international information exchange – and things had to be reformed domestically to make the system less Sofia-centric.

As the national network was improving, CSTP worked hard on improving the user access to existing information, developing specific algorithms and search criteria that would allow quick navigation through the tide of data. Databases from COMECON, UNESCO, the USSR and others were made easier to access, as were systems of scientific abstracts and dissertations published, important companies abroad, each with tens or hundreds of thousands

[31] RGAE f. 9480 op. 13 a.e. 1309 l. 137

[32] TsDA f. 1B op. 67 a.e. 1929 l. 342

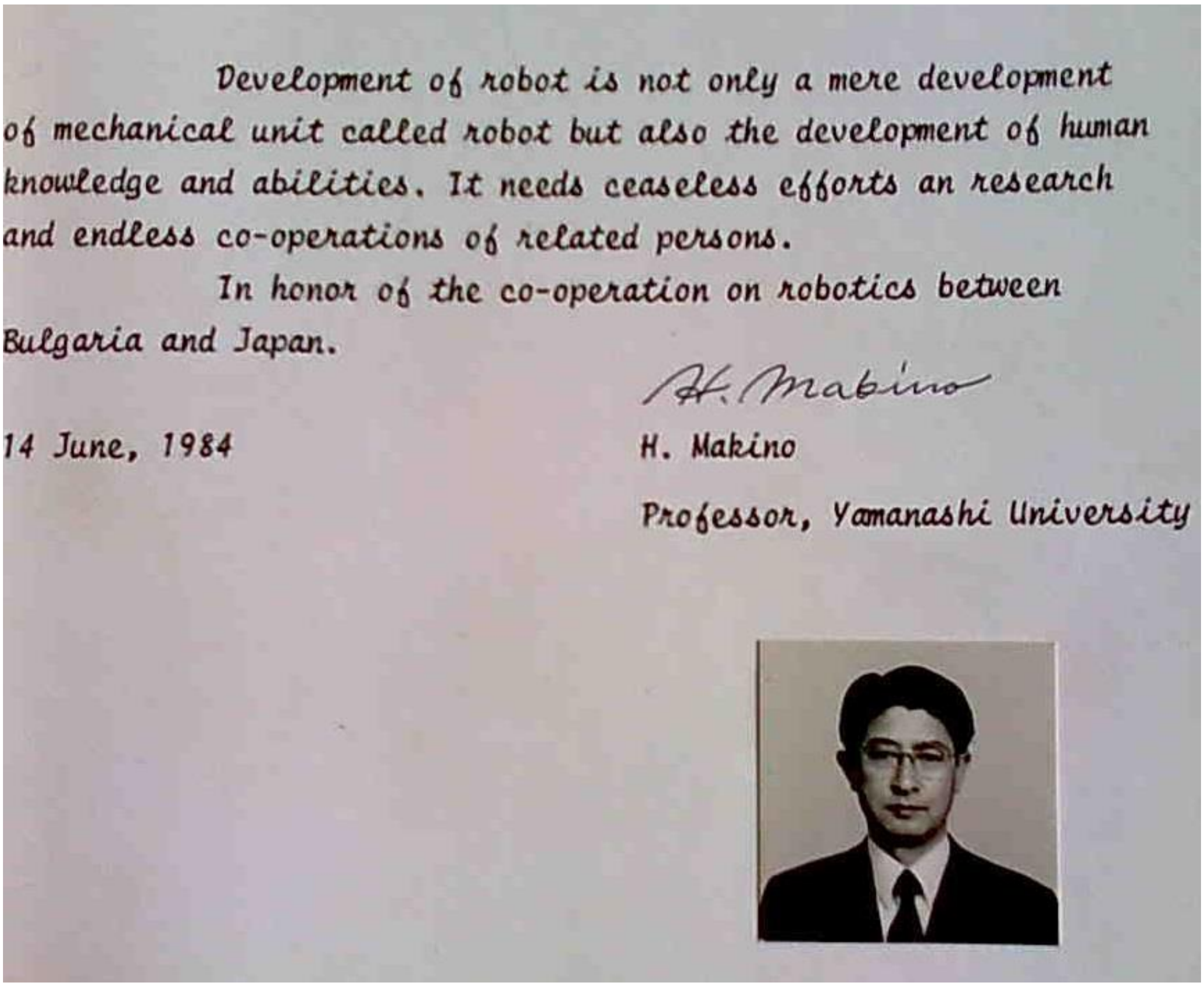
[33] Ibid., l. 350

of entries. Often, Bulgaria had access to the important caches but until then it had been difficult to oversee *what* was actually available inside the country.[34] Once this became better organised and itemised in the 1980s, all experts found themselves with access to a trove of information. What had started as a modest library of self-translated Western scientific journals in the Voroshilov factory in the early 1950s had now transformed into an ocean of global knowledge running into the millions of items, accessible to tens of thousands of researchers through libraries and electronic terminals.

Interviewing many of the participants in this sector one does not meet ignorance of the world. As already stated in chapter three, Bulgarian researchers were well aware of what was going on technologically elsewhere, even if it was denied to them – and that could be acquired through the intelligence services. The constant criss-crossing of international borders for specialisations and conferences allowed them to participate in the global exchange of knowledge but also practical experience of how to run a lab or even a company. Back home, they had increasing access to world information stores. Friendships forged abroad over professional concerns and curiosity lasted long after. Peter Petrov recalls visits by his West German and Austrian colleagues long after the 1960s, invited to Bulgaria for talks but also drinks.[35] Angel Angelov's wide-ranging career, including in Japan, is testified to in the messages left in his jubilee book in the 1980s, where friendships and professional connections overlapped.

[34] TsDA f. 517 op. 7 a.e. 94 l. 25

[35] Interview with Peter Petrov, 10th June 2016



Development of robot is not only a mere development of mechanical unit called robot but also the development of human knowledge and abilities. It needs ceaseless efforts an research and endless co-operations of related persons.

In honor of the co-operation on robotics between Bulgaria and Japan.

H. Makino

14 June, 1984

H. Makino

Professor, Yamanashi University

Pic. 1: Message to Angel Angelov from a Japanese colleague in his jubilee book. (Source: Peter Petrov personal collection)

Sometimes the specialists found themselves defending national interests in the face of international competition, especially within COMECON's specialisations.[36] Mostly, however, it was cordial and mutually beneficial, and full of excitement when the talk turns to contacts with Western colleagues. The connections were important for the regime too – Stoyan Markov, the penultimate head of the CSTP, states that apart from the USSR there were five countries that were most important for Bulgarian technological development during the Cold War: "I can list them – West Germany, Japan, France, Norway, Austria."[37] These were the states that were the usual destination for Bulgarian specialisations or seminars in

[36] Interview of the author with Nedko Botev & Boyan Tsonev, 23rd June 2015

[37] Interview of the author with Stoyan Markov, 28th July 2015

computing, electronics and communications, as well as sources of licenses and on-the-job training. They were also the places where Bulgarian experts became international ones by dint of their work and networking, as well as publications – Nikolai Stanulov, for example, was one of only two socialist cybernetic experts (the other from the GDR) who were published in the last volume edited by the father of the discipline Norbert Wiener.[38] This became an important window on how things were done abroad, a way to fuel some of the discussions we saw in the previous chapter, and a place to learn and apply the latest knowledge to local problems. However, the framework of these international co-operations, as well as Bulgaria's access to these intellectual and economic markets, was shaped by a different group of people – party members with managerial functions rather than overwhelmingly scientific concerns. It was this technocratic managerial elite that also learned things in its dealings with abroad and constituted itself as a new and vibrant group often at odds with the older generation of Zhivkov.

A Socialist and Transnational Business Class

Socialist Bulgarian policy was often marked by pragmatism, especially when it came to the need to acquire Western technology and know-how. The computer industry was at the forefront of the mind of Zhivkov and his companions as they sought a high-profit and high-prestige commodity. Only so much could be done with the help of the Soviets or one-off deals with the Japanese. Thus, the Bulgarian state undertook a number of financial law reforms that would ease contacts with Western firms, allowing for the transfer of equipment and technology, as well codify the trade, financial and industrial co-operation with foreign entities. The first was Directive 1196 from June 1974, relaxing the laws on what kinds of contracts enterprises could sign with non-socialist companies. The real framework, however,

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[38] Nikolai Stanoulov, "On the Concepts of Information and Control" in Norbert Wiener & J P Schade (eds), *Progress in Biocybernetics,* vol. 3 (Amsterdam: Elsevier 1966), pp. 97-104

was put in place with the March 1980 Directive 535 on economic co-operation between Bulgarian and foreign judicial and physical subjects, the first opening of the door towards economic and economic resource transfer across borders. This was supplemented by the 1981 law on the Code of Economic Mechanisms, an attempt to square the circle by combining centralised control and economic self-regulation. These reforms of the 1970s and early 1980s were the legal face of the search for a switch between extensive and intensive growth. The two new laws of 1980-1 were the first punctures in the Ministry of Foreign Trade control over trading policy, by giving much more power to the economic unions and enterprises themselves. State organisations could now undertake foreign trade on their own risk, with financial and administrative control passed increasingly to the sectoral ministries (such as the Electronic one), who would become responsible for their own debts. De facto, these economic organisations were now capital associations, judicially independent bodies and islands of "bourgeois" trade law in the central economy. They were legal subjects with their own capital, general meetings of their leaders (directors), and a system of councils and executives. All this could be changed at any time, as socialist law retained the role of the state as the owner of all means of production, leaving a tension in the system. As Ivo Hristov points out, these were the first – seemingly banal – steps for the dismantling of the economic system driven out of a forced reflex on the part of the state as it sought the valuable and restricted Western financial and technological resources. The result were the first enclaves in the socialist economy, allowing for parallel law codes and the removal of the masks – trade activity could now be carried out by the producers, with the legal provision of free transfers of capital and resources as well as the freedom of the foreign partner to export the profit abroad or to receive favourable tax breaks if it decided to re-invest in Bulgaria.[39]

[39] This section is based on Ivo Hristov's "Pravoto na Prehoda" in Ivan Chalakov & Co (ed) *Mrezhite na Prehoda: Kakvo Vsushnost se Sluchi v Bulgariya sled 1989 g.?* (Sofia: Iztok Zapad 2008), pp. 64-89

The first big wave of creating foreign trade firms had been in the 1960s, under the "Texim" empire of Georgi Naidenov, a chaotic period with over eighty firms created. During the 1970s, around forty were set up in correspondence with the strategic aims of increasing industrial exports. The laws of 1980-1 resulted in a huge wave of company creation by 1982, matched only by the later 1987-9 surge, after the preustroistvo economic reforms.[40] Hristov counts at least 450 firms created abroad during the whole socialist period, with at least $712 million invested, which does not include wages, business trip and maintenance costs.[41] The murky waters of this sector are muddied by the intelligence service connections, and the archival destruction that went on in 1990. Hristov maintains that they failed in their aims of stimulating capitalist trade or expanding existing markets, having very limited successes in the more developed countries. In fact, he sees them as often loss-making enterprises during the 1980s. They also failed in succeeding in transferring the latest technology, as the regime anticipated, or to become the conduit for market mechanisms into the staid command economy[42] – a critique that is unfair as this was never their goal! He rightfully points out, however, that they became the conduits of massive losses for the state as their profits were not transferred back into the country – a 1991 document from the then-existing Service for Defence of the Constitution cites at least $1 billion in assets and profits that remained locked abroad, with only $115 million becoming recovered by the General Prosecutor.[43] This transfer of capital went hand in hand with the transfer of expertise, contrary to his conclusions – the firms themselves might not have become conduits for reform, but the

[40] Hristo Hristov, *Imperiyata na Zadgranichnite Firmi: Suzdavane, Deynost i Iztochvane na Druzhestvata s Bulgarsko Uchastie zad Granitsa 1961-2007* (Sofia: Ciela 2009), pp. 10-11

[41] Ibid., p. 12

[42] Ibid., p. 322

[43] Ibid., p. 13

people involved learned many aspects of capitalist business by running them, especially when we consider that a common tactic was the takeover of failing or bankrupt Western firms.

The combination of socialist legal reform and this policy of opening foreign firms was fertile ground for the rise of a new type of socialist technocrats. Despite the archival culling, there are traces of this throughout the documentation of the electronic industries, as well as being openly talked about by the managers of these enterprises and state committees. Immediately after the 1974 directive, the Ministry of Electronics deepened its co-operation with Fujitsu, signing technology transfer agreements for the latest Japanese MOS integrated circuits, which helped create a qualitative jump in IZOT's element base. The Japanese firm was granted the status of most favoured supplier, and a trade deal worth over forty million levs was signed.[44] More so, during that year the Politburo discussed the world economic crisis as a possibility – Western firms would be looking for any new markets now that both national and usual international markets were hit, with even the possibility touted of moving the production of whole enterprises to Bulgaria. Smaller technology firms were to be targeted, too, as potential targets of capital investment as well as presenting them with a valuable market in exchange for their latest technology. The Bulgarian leadership was looking to benefit from their ideological enemy's downturn by presenting itself as a country unaffected by the oil crisis, where goods could be placed if certain conditions were met.[45]

Close co-operation was mooted with Olivetti, the Italian producer of computers and typewriters, in the late 1970s. It sold telephone exchanges to the Eastern Bloc, and the Bulgarians negotiated to replace the PDP-11 computers in those with their own analogue, the IZOT 0310.[46] This was a first step towards closer technological and business dealings

[44] TsDA f. 1B op. 61 a.e. 6 l. 6-7

[45] Ibid., l. 51-57

[46] TsDA f. 1003 op. 1 a.e. 129 l. 3

between 1978 and 1980, as the Italians wanted to regain positions in the Bulgarian electronic typewriter market, after its licenses lapsed. The Italian firm was interested in selling licenses to the ZOT-Silistra factory, which was to produce 18,000 machines (worth $5.4 million) for the Western market.[47] By 1980 co-operation was finalised, with the Italians getting preferential treatment in Bulgaria and helping the socialist industry place their goods on the Italian market. It also offered help in developing automated office systems, a strategy of how to approach the topic as well as information on the world market and its future projected developments. The proposal included visits by Olivetti representatives to the Plovdiv electronic factory to check compatibility with Italian standards in this new field, noting a great organisation but technology that was older than that in the company's own factories.[48] Nevertheless, IZOT gained tangible benefits from its association with the giant, not least learning how to co-operate with a Western electronic firm and gaining valuable information on the latest developments in office equipment. The Bulgarian trade specialists noted the professionalism of their Italian counterparts, and criticised their own organisation for not being better prepared for negotiation, lacking concrete proposals or plans.[49]

These learning experiences intensified during and after the 1980-1 trade law reform. This included even dealings with American firms such as CDC (Control Data Corporation) through its Austrian auxiliary, CTI. The firm had approached IZOT to see whether it could satisfy its parent firm in providing competitively priced and good quality parts.[50] Tours were organised of the ZIT factories where representatives could see the ES-1035 (IBM 370/145-compatible) and ES-1022 (a IBM 360 clone), as well as 29 and 100 MB drives. The Austrians

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[47] Ibid., l. 30

[48] Ibid., l. 45-7

[49] Ibid., l. 35

[50] TsDA f. 1003 op. 1 a.e. 130 l. 2

were interested in mechanical parts for the discs, as well as circuit boards, floating the possibility of huge orders and multi-year deals.[51] The Bulgarians were, by this point, a bit more wily – they knew there was a good chance that their production quality would not satisfy CDC, so planned to concentrate on a couple of elements and get a batch out as quickly as possible, hoping to secure at least a partial but profitable deal rather than a failure of the whole business: if not, the second variant was to state that the country wanted to produce full nodes or devices based on CDC licenses, rather than just piecemeal parts.[52] They also passed the Austrians information on the best elements produced in Stara Zagora (the crown jewel of the industry), hoping to cash in on a mooted CDC wish to transfer its Welsh disc package factory to somewhere else in Europe – a factory that worked with elements made in Omaha.[53]

In 1980 Izotimpex met directly with the American trade director of CDC in Sofia, proposing deeper co-operation in research as well as joint sales rather than purely Bulgarian deliveries of US items or placement of US items in Bulgaria – all the while citing Directive 535.[54] The Americans stated they were not yet interested in joint enterprises, but their interest in the KESSI system pushed them to consider wider co-operation, especially after deeming the preliminary batch of disc parts to be of satisfactory quality.[55] At the same time, CDC declined to promise direct technology transfer, citing the embargoes. The internal IZOT stance was very clear – "the aim is to shorten the times for these development tasks of our analogous devices", referring to magnetic discs over 500 MB capacity, and targeting certain CDC analogues of IBM products (including the star prize, a 2x635 MB disc package, which

[51] Ibid., l. 5-9

[52] Ibid., l. 11

[53] Ibid., l. 13

[54] Ibid., l. 31

[55] Ibid., l. 33

would catapult the Bulgarians to world levels).[56] The Americans, on the other hand, expressed deep interest in the Bulgarian market, sending questionnaires centering on Bulgarian wage laws, tax policy (was it true that profits were taxed twice?), currency exchange rates, the laws regulating joint enterprises.[57] By October 1980 an agreement was reached, with the ZMD-Pazardjik factory securing the production of eighteen types of elements in series runs of up to 600 thousand items. Trips were made to the Welsh factory to check against the expected CDC quality. The expected worth of the deal was in excess of twenty seven million levs, with potential growth in orders. IZOT congratulated itself on "entering the system of sub-deliveries on a long-term basis with a respected Western firm", updating its technological level, and co-operating with Omaha and Welsh engineers.[58] The Americans pressed their advantage too – they expressed admiration for the professionalism of Bulgarian organisations, and the KESSI project in particular, touting their own systems which were ES-series compatible: a curious and notable reversal. They promised systems in configurations that could fly "under" the embargo radar.[59] The archival trail runs cold, but not the general co-operation. CDC disc packages of various types were implemented into production at the Pazardjik factory, with contracts worth $13.3 million in parts to be exported for CDC up to 1983 alone. The factory would not only raise its quality to the highest American levels, but "will enter permanently into the network of suppliers of CDC with an always growing capitalist currency effect".[60]

The deals with CDC were worth quoting at length to demonstrate the increased depth of co-operation even with the enemy superpower following the reforms in the 1970s and

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[56] Ibid., l. 35-6

[57] Ibid., l. 44

[58] Ibid., l. 52-4

[59] Ibid., l. 57-8

[60] Ibid., l. 93-4

1980s, and the way that IZOT directors and representatives managed to professionally and successfully defend their interests in business settings. It was a veritable school of how to strike deals, different to the ways worked within COMECON. The increased freedom and confidence led IZOT to also seek business abroad, rather than just to import technology. A notorious and famous example of this was the “Busycom” firm, an attempt to break into the American floppy drive market. Noting the huge market of software and computer hardware in the USA – expected to top $78 billion in 1982 – IZOT and Izotimpex proposed the formation of a joint enterprise to enter this lucrative market to the Ministry of Foreign Trade. Contact had been made with a British firm to create such a firm – Busycom Inc. – which was to be registered in the USA and headquartered in San Francisco.[61] It would have a board of directors made up of one member of each country involved, and would place floppies, disc drives, specialised microprocessor systems and software on the California market. It would sell Bulgarian goods with a Western (British) branding, in order to get around the 80% tax slapped on its trade, in favour of the much better 4.5%. The association with the UK would also overcome “psychological barriers” associated with socialist imports, and circumvent the embargo.[62] Eventually it planned to incorporate two firms from the region – a Los Angeles information management company and a San Diego microcomputer services one – together with a Hong Kong firm, to create a bigger and multi-national enterprise. This would expand the trade network to the Far East and throughout the Pacific coast of the USA, exploiting a favourable customs regime with an off-shore holding company in the UK. Half of the initial and modest $110 thousand capital would be provided by IZOT, testing the waters of overcoming the barrier to Bulgarian computing in the enemy superpower.[63] The financial

[61] TsDA f. 259 op. 45 a.e. 212 l. 209

[62] Ibid., l. 209-210

[63] Ibid., l. 210

ministry approved the object, noting that especially in floppy drives the USA constituted 70% of the world market and was expected to be worth $1.5 billion by 1985. The company would start by placing 50,000 floppies and looking to expand to 625,000 by the middle of the decade. A financial director based in California was approved, with a salary to be paid by IZOT.[64]

The creation was a slow process, and the export for 1983-4 – ambitiously planned for one million floppy drives – failed to materialise, as the company was not set up yet.[65] The people involved, however, were already in America. The main man was Bisser Dimitrov, a man whose career was marked by service to IZOT in a trading capacity, as well as a meteoric rise during the 1980s. He had been with IZOT's trading department, which later became Izotimpex, since 1970.[66] In the late 1970s he was IBM's representative in Bulgaria, for their "technical services" wing – as of course, the company was not allowed to export their highest technology there.[67] He left IBM in 1981, utilising the skillset in the country's attempts to export electronics more heavily in the West, including trips to Greece where he found favourable reception for SM-4 computers and floppy drives.[68] His knack for electronic trade deals was utilised by Izotimpex in setting up Busycom too – in fact, he was sent to America even before the Council of Ministers could approve the creation of such a company, registering it in the USA (through his British associate) a full ten days before the discussion came up in the government.[69] The company was a fiasco, blocked at the beginning by US law – it had not submitted the right documents – and sanctioned for re-selling these embargo

[64] Ibid., l. 220-226

[65] TsDA f. 830 op. 2 a.e. 89 l. 9

[66] "Oral History of Bisser Dimitrov", interview by Jim Porter, 7th July 2005, Computer History Museum

[67] Ibid., p. 2

[68] TsDA f. 830 op. 2 a.e. 97 l. 69-72

[69] The timeline can be traced in the document: TsDA f. 259 op. 45 a.e. 212

goods to China. The company had ran up to $230,000 in debt (while Dimitrov drew a salary of $54,000 while based in California), and the British and American investors and executives complained of the poor way it was managed. It managed to place floppies and PC software worth $200,000 during its existence, but it never was the breakthrough into the American market that the country envisioned. It did, however, show how certain experts at high levels could become closely linked with the Western market, being de facto company directors in America despite their Bulgarian communist – and indeed, secret service – credentials. Dimitrov's career took off despite the failure and by 1986 he was made the director of the Plovdiv-based combine "Organisational Technology", a key part of IZOT.[70]

Western expertise and contacts, despite their results, were key in career advancement but also creating a powerful connection to the outside world across the Iron Curtain. His own narrative is that of a go-getter who is ready to break staid communist trade behaviours. Recalling his hiring practices, he talks of brushing off doubts that he was hiring "enemies" (American specialists to consult him on floppy drives) – "Enemies or no enemies, you want the computers or you don't?...I have a product instantly. Maybe not the best, but a product which is by far superior than what is existing in Europe or the Eastern Bloc countries. So that's what's been the major difference in approach to what they [Izotimpex's other representatives] had before. An approach which I implemented."[71] He prides himself on other deals, such as on laser printers, with the Japanese too. The language, no matter any failure, is of a trend setter who does things the "modern" way – which in this case means the Western, capitalist way. An innovator and an entrepreneur, who managed to succeed in getting licenses and trade where Izotimpex's usual practices failed. In Dimitrov's language, we can see some

[70] Hristov, *Imperiyata na Zadgranichnite Firmi*, pp. 191-2

[71] "Oral History of Bisser Dimitrov", p. 5

of the kernels of the self-constitution of a transnational technocratic elite in the highest echelons of the electronic industry.

The experience abroad – whether in education as in the scientists, or in trade or other service, as the technocratic management – was the crux of how these leading figures started diverging from the older generation of communist apparatchiks. Japan, the country that was so crucial for the development of the material side of production, was also just as important for the ideas and opportunities it gave these men. This is most striking in Ognyan Doynov himself, as well as Nacho Papazov. Doynov was a trade representative in the Tokyo embassy in the late 1960s, when Papazov was ambassador, and both would go on to take leading posts back in Bulgaria, as we have seen – Papazov as the longest-serving head of the CSTP and Doynov as Politburo member, Central Committee secretary, minister of machine-building and all-round strategist of the economy. Both were, of course, replacements of Ivan Popov, and Doynov especially was a figure of equal importance for the development of the industry. He was much closer to the image of the transnational technocratic manager, however, than his illustrious predecessor – and one beloved of his protégés, such as Bisser Dimitrov, who saw him as "the number one guy in the high-tech business in whole [sic] Eastern Europe."[72]

[72] Ibid., p. 3

Pic. 2: Doynov (left) and Papazov (right), as they appeared in the Indian press, symbols of the mobile socialist elite. (Source: AMVnR)

Doynov, born in 1935, was a trained engineer (albeit in heating, rather than electronics) and worked in the Ministry of Transport since the late 1950s. His break came when he gained a position in the foreign trade organisation of the ministry and was elevated to the position of deputy trade representative in Japan in 1965. He was plucked from there in 1970, during the Zhivkov visit to EXPO'70 – much like how Popov, whom Doynov would oust, was discovered during a GDR visit ten years earlier – and rose rapidly through the ranks of the communist hierarchy: advisor in the State Council, head of the industrial department of the BCP, Central Committee secretary, Politburo member from 1977 and minister of machine-building from 1981.

The experience of trading in Japan was a formative part of his worldview and openness to global business practices. His memoirs dedicate numerous pages to his struggles with the quality of Bulgarian goods exported to the country, especially electrical carts – an episode which both taught him the value of negotiating and compromising with his economic partners in order to offset the shortcomings, and a life-long obsession with raising the quality of Bulgarian industrial output.[73] He also remembers fondly the Japanese economic miracle, which left a huge impression on him in the late 1960s and allowed him to forge contacts with key industrialists such as the heads of the metallurgical giant Nippon Steel or the electronics company Fujitsu-Fanuc.[74] It was also a veritable school for the most modern techniques in management and business:

> there I could read many of the contemporary interesting publications and developments…for the first time I got to know the modern for the time approaches to solving economic problems and tasks – such as the critical path method, PERT (Program Evaluation and Review Technique), governance structures such as the matrix or group-task one, logistical tasks, optimisation models. I was especially grabbed by operational studies, by econometrics. The works of John Keynes, Milton Friedman were of interest to me, as was the macroeconomic textbook of Professor Samuelson. I read voraciously the books of economic futurists who predicted the global changes.[75]

This knowledge base would have been unthinkable in late 1960s Bulgaria, where these models were unknown and unstudied. More so, the books he had access to were locked in special libraries available only to certain academics and analysts. Japan gave Doynov the possibility to create his own library –

> the most valuable thing in my luggage as I returned from Japan were books in English – over two hundred volumes on company management, optimisation models, systems analysis, micro and macroeconomic tasks and solutions. Many of them I used during my stay in Japan, some I brought back as a promise for my future. I gave some away to be read or translated, others I lost eventually during my emigration period.[76]

The Asian country was thus a window to the world, a space where one could learn how capitalists did business, and procure the literature to develop those skills further. Doynov's career and views of automation, robotics, and economic management are not surprising if one considers the wealth of knowledge that he had access to during his five formative years in Japan. He was thus a complete novelty to Zhivkov and the Politburo, self-

[73] Ognyan Doynov, *Spomeni* (Sofia: IK Trud 2002), pp. 32-43

[74] Ibid., p. 48

[75] Ibid., pp. 49-50

[76] Ibid., p. 50

consciously styled as a Western technocrat, with that particular language – different to Popov whose formative experience had been in a different era and place, and whose managerial behaviour was more conservative and orthodox than this young upstart. His connection to Japan was also useful in the new climate of Zhivkov's obsession with the country's economic miracle as a potential copy for Bulgaria's next leap. Doynov recognises this as an important part of his own development – not only did Japan change his development and shaped its future direction, but "in these discussions the biggest interest was piqued by the opinions and stances on why Japan managed to achieve such economic and scientific achievements in such a short amount of time".[77] His expertise was recognised by others back in Bulgaria who were eager to see what novelty he could introduce. In his newfound capacity as economic advisor in the early 1970s, he was indeed used as the "opposing" view in discussion groups, a way to oppose orthodox economic views while the new economic mechanism was being worked out. "His stay in Japan had a positive impact on him…Doynov transferred the Japanese experience of creating industries on the basis of high technology", states Moncho Behar, a foreign correspondent for the party organ *Rabotnichesko Delo.*[78] As he climbed the hierarchy, he became a champion of the concentration of production into specific industries and specialisations – a continuation of Popov's earlier program, but in his case based on his observation of Western and especially Japanese practices in economies of scale and conglomeration.[79]

By the 1980s, Doynov was a towering figure, and one who also championed the stance of the industrialist and technocratic strata of the regime against the older generation. "Probably the most neglected leaders in socialist society were economic leaders" he states in

[77] Ibid., p. 52

[78] Quoted in Ibid., p. 56

[79] Ibid., pp. 70-71

his memoirs, seeing himself as the leader of the planners and directors who had to make the centralised economy tick.[80] He drew attention to the fact that not every organisation can increase its profit every year – that was simply not how any economy worked, and it led to constant booms and busts. In his memoirs, he talks of most economic leaders around him as "honest" and neglected, as society saw them as second-rate intelligentsia rather than the real intellectuals of writers, artists, actors and others. Engineers and business leaders were in the "service" of the "real" intelligentsia.[81] They were also disunited, lacking the unions of creative workers which had much clout with the leadership. His dream was thus to unify their power – something that the pragmatic Zhivkov acquiesced to. Thus, in April 1980, BISA was created – the Bulgarian Industrial Economic Association (*Bulgarska Industrialno Stopanska Asotsiatsiya).* Doynov headed it until 1984, remaining a honourary head afterwards. It was explicitly based on the Japanese organisations of the Keidanren and Nikkeiren type, as well as similar organisations in France and Sweden. It lobbied for simpler mechanisms of investment in smaller industries, a more de-centralised approach to financing, and rendered help to enterprises in their foreign trading, especially with Western firms. It also aimed to give practical training in the area of business management and non-socialist economies, to allow Bulgarian directors to negotiate equally with their capitalist counterparts. Fans of Doynov contrast his Western-style language to other Bulgarian functionaries such as Lukanov, having an important role to play in the expansion of Bulgarian export by developing the human capital in trade and economics.[82] By 1986, BISA managed to secure a Japanese credit of $400 million, which included $3 million in aid to create a centre for training cadres for raising the quality of production – the ultimate dream of Doynov since his

[80] Ibid., p. 123

[81] Ibid., p. 124

[82] Ibid., pp. 127-8

Tokyo days.[83] BISA was the final and ultimate expression of Doynov's stature as a technocrat tsar, a practitioner and propagator of Western business practices, and a patron of his colleagues, elevating them to a position of intellectual power commensurate with their importance to the life of the regime through economic activity.

Papazov, the CSTP head, was also taken with Japan and what he saw there. In 1989, after his tenure as both ambassador and head of Bulgarian science, he penned a memoir about the country, titled *Japan from the Samurai Sword to Artificial Intelligence.*[84] A wide-ranging book which could also act as a primer to Japanese post-war history, and an outsider's observation on a country's culture and supposed psychology, it also demonstrates a deep respect to the discipline of Japanese workers and the wisdom of their political and economic managers, the combination of which, according to Papazov, resulted in the "miracle". He praised the fact that they learned the science of business governance, but did not "Americanise" themselves by doing this, but found novel ways to apply it to their own society – the only way any state (including Bulgaria) could master modernity while protecting its own national interests.[85] They did so by concentrating power in specific "steersmen" – a cybernetic term par excellence – such as the ministries of foreign trade and industry. Here he traces how the Japanese understood the need for state intervention ever since the Meiji restoration, allowing them once again to take the best economic practices and wed them to national traditions and in service of the Japanese state rather than anything else – the only way a country could achieve a miracle.[86] The praise for such national-minded, state-led intervention in the economy can be said to have served as a model of how he saw his

[83] Ibid., p. 129

[84] Nacho Papazov, *Yaponiya ot Samuraiskiya Mech do Izkustveniya Intelekt* (Sofia: Otechestven Front 1989)

[85] Chapter 12 "Upravlenie po Yaponski" in Papazov, *Yaponiya*

[86] Chapter 14 "MITI – Agentsiyata 'Kormchiya'" in Papazov, *Yaponiya*

tenure as head of the CSTP too – the Bulgarian steersman in science and industry. In his conclusion he draws special attention to the fact that if, due to political conservativism, a country does not take what is proven to work from another example then it is a slave to dogma. What Japan has achieved can serve Bulgaria too, as a model.[87] The Japanese example was thus a shining star for influential Bulgarian leaders, who got their start there and benefited from Zhivkov's own obsession with the country. Much like Doynov, Papazov too utilised his business contacts from his tenure as ambassador to continue to benefit Bulgarian industry into the 1970s and 1980s, especially in his close connection to Fujitsu. It was indeed this network of economic contacts in Japan coupled with his close knowledge of the Japanese economic mechanism that is most likely to have made him the choice to replace Popov as head of the CSTP in 1971.

Other figures, connected to Doynov, were also international in outlook and models they envisioned. Stoyan Markov, the head of the reformed CSTP (into DKIT) in 1986-7 and candidate-member of the Politburo between 1986 and 1988, was a man who owned much to Doynov's rise and became his right-hand man. His scientific skills, honed in the USSR, made him one of the most educated members of the highest ranks in the party – indeed, some involved with the IZOT-1014 matrix computer, the crowning achievement of Bulgarian computing power in the 1980s, see him as the father of the project.[88] His memories – and indeed, office – are full of mementos of meetings with businessmen throughout the West and abroad, including Deng Xiaoping.[89] For him, the electronic business was truly international and a window to the world. Similarly, Plamen Vachkov, the head of the Pravetz factories, speaks of the industry giving him a head start which was impossible otherwise – "in the early

[87] "Posleslov" in Papazov, *Yaponiya*

[88] Interview with Krassimir Markov, 4th February 2016

[89] Interview with Stoyan Markov, 28th July 2015

1980s, I was in the Silicon Valley, meeting people like Bill Gates and Steve Jobs…I learned the word business there, while no one here was using it".[90] A 1986 article in the Bulgarian press testifies to his difference to the usual Bulgarian director. The difference is already seen on the cover: Vachkov the manager, behind his desk that testifies to his output by the numerous but tidily presented papers, beside a personal computer that was the mark of the scientific revolution, in a smart suit and significantly younger than many of his colleagues in such leading positions. The interview itself sees him attacking bureaucracy and pure technocratic solutions – "if we ignore 70-80% of documents [directives], there would be no consequence to the collective or production."[91] He speaks of man management as more important than pure technocratic solutions, as he is working with real people rather than some inert mass. Vachkov is clear that he spends far too much time in meetings – up to 30% - which is mostly unimportant and harms his work, and he has full trust in subordinates, delegating decisions to lower managers. Throughout, he presents a more economically and business-minded figure than the normal, older director, who would not attack the bureaucracy in such an over manner. For Vachkov, results are paramount. Today, he also looks back nostalgically at what could have been and points to another Asian country as a model that he was interested in back then: Singapore. "If you want a blueprint to developing a country, read Lee Kuan Yew's memoirs", he states.[92]

The very way that Vachkov and his new generation acted and even *looked*, set them apart from the older Politburo, who were often in pursuit of nineteenth century pleasures such as hunting and spa treatments in mountain dachas.[93] Their tastes were much more modern,

[90] Interview with Plamen Vachkov, 30th June 2015

[91] "Denyat na Direktora" in *Otechestvo*, vol. 247 (28th Jan 1986)

[92] Interview with Plamen Vachkov, 30th June 2015

[93] A point Ivailo Znepolski makes powerfully in his *Bulgarskiya Komunizum: Sotsiokulturni Cherti I Vlastova Traektoriya* (Sofia: Ciela 2012)

much like their travel itineraries. Together with knowledge from the West or East Asia, they brought back a different style of life and wants. A key figure in this was Andrei Lukanov, the doyen of foreign trade and a trusted man of Moscow – despite that, he and people like him were the conduit for a new gourmet culture in 1970s Sofia, the opening of new haute cuisine restaurants and a general Westernisation of the tastes of the upper echelons of the regime's new young stalwarts.[94]

Pic. 3: Vachkov as the modern manager (Source: Otechestvo magazine)

It is also worth noting the language used to describe him in a 1985 article by Australian journalist William Burchett in an article for the Indian "Fair Idea" magazine, reminiscent of an interview taken with a Western CEO at the French Riviera:

[94] Albena Shkodrova, *Sots-Gurmet: Kurioznata Istoriya na Kuhnyata v NRB* (Zhanet 45: Sofia 2014)

> a typical member of the 'under 45 generation', one of the young executives running the country's vital economic sectors… We conversed while on a motor boat trip in the Black Sea. On the shore we looked at multi-storeyed hotels nesting among the green oak groves of the Golden Sands health resort, the sea sparkled, was iridescent with patches of sunlight.[95]

Thus electronics and the increased foreign trade had created also a managerial class that was well connected to Western ideas, tastes and practices, and drew its models not just from Moscow but Tokyo or Singapore or the latest literature on management and organisational theory. Some – such as Vachkov and Markov – started their careers in the scientific institutes of the regime before making their way up through the party and management; others such as Doynov and Dimitrov owed their success to their acumen in foreign technological trade; while finally there was a subset of scientifically-minded party apparatchiks such as Papazov who could also act as channels and patrons of such new thinking. Unlike the lower-ranked scientists and engineers, these men were linked to the highest echelons of power, and could utilise the language arising in expert journals throughout the 1980s (as we saw in the previous journal) as well as their own economic and business views to advance reformist views towards the end of the regime.

Reforms, Struggles, Transformations

"This question is about the most valuable thing that our society has – the person as a creator of all material and spiritual goods in Bulgaria" said Todor Zhivkov in a 1984 Central Committee discussion of an ambitious program that had the aim of raising the intellectual and creative abilities of Bulgarian citizens.[96] From the mid-80s, the discussions of what computers were bringing Bulgarian society were becoming more and more frequent at the highest levels of the party, allowing the electronic managerial class to utilise both its experience and the discourses current in the field (exemplified in *Filosofska Misul*), to

[95] AMVnR f. 20 op. 42 a.e. 1967 l. 15 (Suprovoditelni Pisma ot Posolstvoto I Izrezki ot Pechata v India – 1985)

[96]TsDA f. 1B op. 67 a.e. 3595 l. 15

criticise the regime from the standpoint of technological policy and its economic and political consequences.

It was during the time of these philosophical debates that the Politburo again took stock of its ambitious attempt at putting governance on a scientific basis. In 1984 Zhivkov reported to the November plenum of the Central Committee that technical progress determined economic competition in today's world. It is the application of contemporary technological achievements that would determine the trial of strength between socialism and capitalism, and despite the huge scientific potential of the countries of the Warsaw Pact, it was not yet realised.[97] Doynov was more optimistic at the same plenum, noting that Bulgaria was producing analogues to the most widespread computers of the capitalist world and that the country had the ability to cover nearly all of its automation needs.[98] Yet the plenum had made it clear that the expected automation and cybernitisation had not yet happened.

One of the reasons for this was discussed only a month earlier by the Central Committee, in October 1984, casting a shadow over the plenum discussions. At that meeting, the party leadership discussed the unwieldy-sounding "Complex Investigation of the Person and More Specifically His Brain with a View towards Raising the Intellectual Abilities of the Personality and the Development of its Creative Powers".[99] It noted a debt to Lyudmila Zhivkova, Zhivkov's daughter and culture minister until her untimely death in 1981, who inaugurated the program of aesthetic education and the development of a multi-faceted creative personality in the 1970s; and stated that the concern was more pressing now that new technologies and especially the entry of types of artificial intelligence into society are raising

[97] TsDA f. 1B op. 65 a.e. 64 l. 31

[98] Ibid., l. 59-61

[99] TsDA f. 1B op. 67 a.e. 3595

the intellectual capabilities of humans.[100] The problems facing Bulgarian society currently were dual – both insufficient technology to free workers from menial tasks, and not enough education in the new sciences, meaning that engineers often had to create simpler technologies for the workforce, rather than the more developed machines they were capable of making.[101] As quoted at the beginning, Zhivkov stated that the key resource of Bulgaria was “grey matter”, the creative power of the Bulgarian citizen, and science has not yet furnished him and the economy with what was needed in the modern world.[102] The plan went on to call for research worth around three million levs into various new interfaces for Man-Machine systems; research into the brain in order to create better artificial intelligence; and pedagogical means to expedite “the more beneficial manifestation of the personality”.[103]

In March 1987, Zhivkov held a discussion with leading party cadres in the technological sphere, concentrated on the “synthesis between science, information and computers”. In it he was made aware of a wide variety of complaints about the shortcomings of the domestic industry. Sendov concentrated on the lack of focus on software and natural language interfaces in Bulgarian, which in his view ran the risk of raising a new generation that had a poor grasp of the language as they used English or Russian-language programs. He also complained that there was more focus on the artistic intelligentsia than the technical – calling them “Gyaurovs of science” after the world-famous opera singer, he wanted them to have access to the “La Scalas” of world science, such as MIT.[104] Stoyan Markov informed Zhivkov of the latest developments in the synthesis between communications and computing in the capitalist world, calling it the “one of the most important preconditions for the

[100] Ibid., l. 5-8

[101] Ibid., l. 1/17

[102] Ibid., l. 15

[103] Ibid., l. 323-328

[104] TsDA f. 1B op. 59 a.e. 153 l. 7-11

democratisation of human experience".[105] The country had most of the blocks in place – networks, modems, computers, specialists – but needed to allow scientists more access to them, as the regime was too export-oriented: often the domestic Academy of Sciences lacked the computers which factories a few kilometres away were producing for their Soviet counterparts.[106] Ivan Tenev, an ex-head of IZOT and at the time the head of the Electronic Association, supported this position by adding that the new developments in computing would require too many cadres and a diluting of the scientific potential of the country, which had to pick and choose what it could do.[107] Zhivkov picked up on this, railing against the COMECON's "closing" of the borders, as co-operation diminished in the late 1980s, and each country sought to update its own production without giving much to its allies – Tenev countered that internationalisation of the production and co-operation was the only way for the next jump in technology. After all, "borrowing" was one of the keys to Bulgarian success up until now, he held.[108] Other specialists from the electronic industry, such as Vladimir Lazarov from CICT, criticised the value-neutral approach to the industry by some such as Stoyan Ovcharov, the economic minister. Technology on its own couldn't solve problems, as "there is a barrier to the use of this technology among our society right now",[109] an argument reminiscent of the psychological studies current at the time. He held that the answers could be found in the creation of networks of small machines to link all small working collectives, and allow the spread of expert knowledge laterally through such networks rather than through centralized databases.[110] Older professionals, such as Lyudmil Dakovski, the rector of VMEI-

[105] Ibid., l. 12

[106] Ibid., l. 24

[107] Ibid., l. 30

[108] Ibid., l. 35-37

[109] Ibid., l. 48

[110] Ibid., l. 51-52

Sofia, returned to the Sendov position at the close of the talks, talking about the defense of the Bulgarian language and nation through the medium of software and mathematical languages.[111] The array of criticisms of the current state of the application of computers to society did have some impact on Zhivkov. He agreed that there was a need for further opening towards the West, which was the only way to make the industry take its next leap. He contrasted this to the general isolation of the USSR in this sphere, while "we opened Bulgaria to the world and Western Europe, without allowing for crises to emerge inside the country".[112] He stated that the sectoral principle of industrial development was coming to a close in an age where electronics were fusing with other productions and social spheres – to develop them in isolation would only retard further development.[113] What was needed in enterprises and society was more "choice" in order to allow for increased self-governance, which computing would allow. The main deficit was time, as the capitalists were drawing further ahead – so they had to be involved in the current work if there was any chance to catch up to them.[114] By the late 1980s, thus, electronics was becoming a catalyst for more and more criticism as well as calls to open up to the West in some capacity.

As Bulgarian preustroistvo kicked in after these plenums, the continued failures of the old regime to master the tasks it had set itself were instrumentalized both by the cyberniticians in their debates and the younger generation of communist managers who had championed the high-technology industry. Discussions of these failures came to a head in late 1988, in Central Committee debates on preustroistvo in the spiritual sphere and its later December plenum. Ivan Stoyanov, a hero of socialist labour and Central Committee member,

[111] Ibid., l. 56

[112] Ibid., l. 72

[113] Ibid., l. 77

[114] Ibid., l. 82

criticised the regime for not being able to make the second jump in development, that into highly qualified specialists in the realm of electronics and automation: "in 30 years we turned people tied to the land into miners and energeticians, but we haven't yet managed to turn everyone into a real specialist, professional in their job.[115] Lyubomir Iliev, the head of the BAS Unified Centre for Maths and Mechanics and one of the fathers of Bulgarian computing, lectured on the abilities of a universal science based on informatics, which would usher in a new era that would encompass all society. But this science was here operating in a handicapped manner, for human culture is made up of science and art, of creative and executive levels, and most importantly – of state and society. The lack of any one of these parts was crippling, and scientific workers had intuitively guessed the impact of preustroistvo, which was to address this domestic imbalance.[116] The salvo on the leadership by its technical elite did not stop there, however – Peter Stanchev, the head of TzIIT (Central Institute for Computer Technology, the main research and development centre of the country's computers), called for wide open information exchange with both socialist and capitalist countries in order to overcome the Bulgarian lag. Scientific cadres were also seen as the moving power of preustroistvo, for all human history was the history of scientific achievements – preustroistvo was thus the celebration of science in everything, "a celebration of democracy and creativity".[117]

At the December plenum, Peter Mladenov, the man who would succeed Zhivkov a year later in the palace coup of 10th November 1989, took on these reasons for reform and instrumentalized them further, giving them serious political clout. Many of the things that the old regime was too quick to label "capitalist" or "bourgeois" was in fact the purview of all

[115] TsDA, f. 1B op. 65 a.e. 90 l. 68

[116] Ibid., l. 88

[117] Ibid., l. 103

world civilization, and had pushed Bulgaria towards becoming a technological province of advanced countries. Without openness to reform and others' experience, rising to the West's economic level would be impossible.[118] Plamen Vachkov also pointed to reform in his sphere, personal computers, as being possible only if the regime was willing to give the new socialist firms the leadership, rather than continuing old ways.[119] High technology was thus both a channel for these new economic initiatives, and a tool to beat the old regime with for its failure to master it.

This is not to overstate the importance of the economic elite, as the palace coup of 10th November 1989 was led by a faction centred around foreign minister Peter Mladenov and foreign trade minister Andrei Lukanov. Ivan Chalakov sees the power of Lukanov as part of a continued struggle between the party and economic functionaries throughout late socialism. In the end of the 1960s the Texim empire of Georgi Naidenov was destroyed (as mentioned in earlier chapters) as it was becoming too powerful and "capitalistic", drawing ire from Moscow; Ivan Popov's figure was threatening to become too powerful due to his importance for the economy too, leading to a removal in the mid-1970s; and finally Doynov too removed in 1988, after conflicts with Lukanov. The last one was also the conflict that solidified Lukanov's power and demonstrated most clearly the difference between two parts of the elite – one of the more "self-made" men, elevated by Zhivkov (and Lukanov himself!) due to their skills, Western contacts and fresh ideas; and the old communist families who were Moscow's trusted men, as was the case with Lukanov.[120] Doynov was also a technocrat, seeking technological solutions to economic problems, while Lukanov was in the realms of trade and financial policies, lending him a more political and Soviet-centred view – in many

[118] TsDA f. 1B op. 65 a.e. 92 l. 7-8

[119] Ibid., l. 45

[120] Ivan Chalakov & Co, *Mrezhite na Prehoda*, p.50

ways, it was a clash between the industrialist and financial-political elites of the party. Doynov's fall from grace a year before the regime's end was also a signal to his closest allies, the third defeat for the socialist "business class" since the 1960s. The economic nomenclature described in this chapter had the professional skills to circulate among economic sectors and the West, and identified strongly with certain industrial sectors – the ultimate expression being Doynov's BISA, a business interest group at the heart of the establishment. The party nomenclature, however, retained important levers of power such as the ultimate access to power – the connection to Moscow and Zhivkov – as well as the party's own huge financial reserves. They held the levers that led the last socialist minister of energy, Nikola Todoriev, to joke that if you wanted to know whether you still had a job as minister, you had to read the Monday issues of *Rabotnichesko Delo*, to see what decisions the old generation might have made over informal weekend meetings.[121] Doynov himself felt the power struggle with Lukanov on a personal level, as he considered him a friend, and the two families had holidayed together frequently. His memoirs paint Lukanov as a man who waited until he was away from council meetings in order to criticise him, and used his close contacts with Zhivkov to attack Doynov when he tried to defend himself. He paints him as someone who felt inferior in Doynov's presence, promoted later and with less power in the economy – a powerful drive for his jealousy. He sees him as a Soviet stooge and someone who used and threw people away.[122] Such memoirs are of course fraught with problems, and it is obvious why Doynov would have a bone to pick with Lukanov. However, they do offer a glimpse into the personal experience of real power struggles at the height of the party, ones drawn along clear lines – those with traditional access to power by dint of communist ancestry against

[121] Ibid., p. 48

[122] Doynov, *Spomeni*, pp. 218-222

those who had achieved power by gradual improvement of the economy and innovative policies.

These struggles continued past 1989. What the economic elite could not achieve during socialism, it could achieve in parts after the fall of the regime. Despite the party elites having the key role in the removal of Zhivkov and the transformation of the BCP into the reformed and electable Bulgarian Socialist Party (BSP) after 1990, the old economic nomenclature had access to a powerful tool to consolidate power: economic connections outside the crumbling COMECON as well as the assets in numerous foreign trade firms and companies, many connected to electronics. At this point, history meshes with current events and what some might even call journalism, but the liquidation of a number of firms in the 1989-1991 period, together with the trajectories of some of the higher ranking party members, can only point to a transferral of financial assets into now private hands. According to a 1991 investigation by the National Service for Constitutional Defence, over $1 billion of non-transferred profits from foreign firms and joint enterprises were missing – the General Prosecutor's investigation managed to return just $115 million.[123] Two of the most notorious such cases were in the electronic sphere – the "Neva" and "Mont Blanc" projects, linked to the last heads of Bulgarian science and industry, especially Ognyan Doynov and Stoyan Markov. The "Neva" project, started in 1987, envisioned the creation of a disc factory in Kostroma in the USSR, to give the Soviets the type of capabilities that Bulgaria had monopolised. The Bulgarians insisted on this being paid for in dollars, rather than roubles (one of the reasons that Lukanov was kept away from the project), which the regime sorely needed. A STI-backed foreign trade firm – "Insyst" – was created to push this through, with three officers working directly in it as representatives.[124] Later in the year, the Soviets signed

[123] Hristo Hristov, *Imperiyata na Zadgranichnite Firmi: Suzdavane, Deynost I Iztochvane na Druzhestvata s Bulgarsko Uchastie zad Granitsa 1961-2007* (Sofia: Ciela 2009), p. 13

[124] AKRDOPBGDSRSNBA-R, f. 9 op. 4 a.e. 574 l. 44

a deal with a Liechtenstein-registered firm (“Setron”) for the import of the know-how and specifications of Winchester-type drives. “Setron” itself signed a deal with “Insyst”, to facilitate the transfer from the Stara Zagora factory – the most advanced such plant in the Eastern Bloc.Doynov talks of $200 million in invstments from the Bulgarian side, others – of $250 million; Hristov points out that this is just the Bulgarian investment, and if you add the Soviet part of the finances, it grows to nearly $600 million.[125] The project’s labyrinthine financial operations include Israeli and Panamanian companies, as money was transferred to firms with names such as “Keylock” and “MDI” after 1990, where at least $26 million went missing after transfers. The factory, obsolete by then, was completed in 1994, while the money from “Neva” went missing in numerous off-shore shell companies. Bisser Dimitrov stated that “as a trading operation, Neva was spectacular; the technological effect – zero”.[126]

“Mont Blanc” dates from the same year. Hristov, who has had access to the 1990 “Case 4” (the investigation into the abuses of the socialist economy) and thus the fullest information about the financial machinations of the period, calls it another “endgame” plan to extract money out of the profitable disc industry. The project was the reverse of “Neva” – it was to expand Bulgarian exports in the West rather than the USSR. In 1988 $5 million was made available to purchase a failing Northern Irish company called “Data Magnetics Ltd”. A key role here is played by Atanas Atanasov, the director of the Stara Zagora factory and the new conglomerate DZU which after 1987 united disc drive production in the country. “Data Magnetics” produced floppy disc drives and was both a way to increase the technological level of Bulgarian production and circumvent COCOM by placing Bulgarian discs abroad through a British company. The aims were to widen DZU’s place in the Western market and ensure a flow of much needed Western cash. By the end of the deal, over $11 million had

[125] Hristo Hristov, “Durzhavna Sigurnost. Chast 2.4: NTR I Proektut ‘Neva’” in *Kapital,* 12th Sep 2010

[126] Ibid.

been spent – to not much effect. The Bulgarian banks and investigations could not find where exactly the money went, while the placement of Bulgarian discs abroad never happened.[127]

Interestingly, the state security archives – usually purged of such information in 1990 – contain a document listing a few messages from February-April 1990, amidst the chaos of the end of the regime and first democratic elections. The messages come through the residency in Vienna and were decoded unusually fast, showing an urgency and priority. Concerning "Mont Blanc", a Taiwanese firm seemed to be ready to cover all investments and there was a possibility to recover at least $6 million immediately. The STI-backed firm had to be liquidated quickly as "our experience up to now has shown that we can't maintain high-technology installations abroad …also, real sources of cash for paying for the activity are absent, even beyond the end of this year."[128] Concerning the even more sensitive "Neva", a March message warned of chronic problems and an end to financing and "preparation for the destruction of the documents that can discredit our partners if the activity is revealed".[129] Finally, in April, another message talks of meetings with the partners in the project – probably from the Hungarian firm Videoton (who in the late 1990s would buy what remained of DZU):

> …who insist for us to undertake steps in 'cleaning up' and 'destroying' the materials that would prove to 'future governments [the involvement] of specific firms, people and forms of realisation'. He was informed that around 600 people, representatives of the democratic forum and social liberal party, have undergone training in REDACTED West Germany and REDACTED USA and will become the backbone of the future intelligence and counter-intelligence services of Hungary. He feels that we underestimate the fact that a change has happened, which in the past we called a counter-revolution![130]

[127] Hristo Hristov, "Durzhavna Sigurnost. Chast 2.3: Proektut 'Monblan' I 'Neyavnite Firmi' na DZU" in *Kapital,* 6th Sep 2010

[128] AKRDOPBGDSRSNBA-R, f. 9 op. 630 l. 24

[129] Ibid., l. 18

[130] Ibid., l. 12

It is clear why it is difficult to say with certainty where the money went and who had access to it. However, speculation is rife and the likeliest candidates are people connected to both the state security apparatus and the economic associations and entrerprises connected to the trading. As the security apparatus was still closely connected to the heads of the economy and CSTP, people such as Doynov and Markov are likely candidates for some of those who have benefited, especially as “Neva” was closely connected to both of them. Doynov left Bulgaria in 1990 to live in Austria, and was one of the big targets of the 1990 case against the economic crimes of communism – the charge against him was that he offered unauthorized financial aid to developing countries, yet doubts remain about more egregious crimes. Despite being arrested in Vienna, he was never extradited back to Bulgaria and died in exile in 2000 – but not before he worked with Robert Maxwell and various Russian companies, utilising his contacts and skills from the socialist period. He was the advisor to two notorious billionaires – Maxwell and the Russian head of “Nordex”, Gregory Luchanskiy; journalists cite his name in connection to both the “pumping out” of money from the DZU disc conglomerate, the creation of “Multigrup” (one of the most powerful Bulgarian crime/business organisations in the 1990s) and as a key figure in the dealings of the first Bulgarian mobile operator, “Mobiltel”. Whatever the truth, Doynov’s skillset and connections were forged in the years of socialism, and served him well after as he managed to lead at the very least an exceedingly comfortable life abroad.

Markov also left Bulgaria in 1990 after a brief stint in the first elected government, headed by Lukanov. He spent time in London, and also specialisations in CERN, in keeping with his education. Meanwhile, his State Security driver – Spas Rusev – made a tremendous career in the Bulgarian business world, leading to many believing him to be Markov’s man on the ground in the turbulent 1990s. Markov’s son-in-low, Georgi Velchev, was the brother of Milen Velchev, the financial minister of the country between 2001 and 2005. Velchev was part of a 2003 scandal where a photo appeared of him on a yacht with other members of the government and a notorious criminal and smuggler, Ivan "the Doctor" Todorov (a man who allegedly was a neighbour of Markov in London, too).[131] Markov came back to Bulgaria in 2005, after the election of the BSP government under Sergei Stanishev, and bought a luxurious apartment in the "Magnolia" gated community in Sofia, owned by Ognyan Doynov's son – and with the new Prime Minister Stanishev as a neighbour. In 2009, the Stanishev government purchased an IBM Blue Gene supercomputer worth 5.4 million levs, a deal which was not subject to open competition but pushed through as "a research project" and utilised by a team led by Markov, who by then was working in BAS again, in the Institute for Parallel Processing of Information.[132] The connection of names and deals lead many to thus link Markov to much more power than he seemingly yields (he presents himself as just a professor), who returned to Bulgaria after his old party came to power and after he had ensured his business interests through numerous connections.

These speculations cannot be confirmed due to the lack of documents, prosecution cases and obvious unwillingness of people like Markov to comment. However, the paths of other people such as Plamen Vachkov sheds light on the basic fact that this strata of society could make their fortunes much more easily than most Bulgarians after 1989. He recalls how he utilised his contacts and knowledge of trade laws to facilitate the sale and outsourcing of production of a telecommunications firm from Ireland to Greece, benefiting both as it was an intra-EU deal which garnered certain tax breaks.[133] He talks of it in the same breath as his experience at the end of socialism of equipping the school system of Uzbekistan with thousands of Pravetz PCs, a deal which ensured profits for his enterprise in those difficult

[131] *Sega,* 17th April 2004

[132] *Dnevnik,* 15th August 2010

[133] Interview with Plamen Vachkov, 30th June 2015

years, and one which operated in the new conditions of Bulgarian preustroistvo and Soviet perestroika – a veritable window to try out the art of the deal in the socialist world. In the 1990s, he was the general director in charge of electronics and telecommunications in the notorious “Multigrup” conglomerate, before stints in various other firms in telecommunications or electronics. The Stanishev government was good to him too, and in 2005 he was made the head of the State Agency for Information Technologies and Communications (DAIS), which was to oversee the electronic and IT market in the country and ensure fair competition.[134] His path through the murky waters of the post-1989 world of Bulgarian business – often linked to organised crime – and in the end, government, is fairly open and he is candid about it, without implicating himself in anything illegal. Whatever one may think of the allegations against Doynov and Markov, it is clear that these economic luminaries had the abilities and international connections to both shelter abroad and be involved in Bulgarian business and politics well past the end of the regime, maintaining a large share of power and influence, especially when the reformed BCP held office. Thus the history of the Bulgarian computer industry straddles 1989 and extends tentacles into the long and difficult transition to democracy and the open market. Together with these managers, however, a whole new generation made that journey too.

The Afterlives of the Socialist Cyborgs

Even while the regime was reforming and falling, Bulgarian children were increasingly computerised through both schooling and the network of computer clubs. Many were increasingly being drawn into the “industry” through software creation, the perennial Achilles heel of the sector. One of the first such enterprises was based in Sofia and named “Avant-garde”, uniting teachers and students from both universities and local high schools. It

[134] “Plamen Vachkov Oglavi Novata IT Agentsiya” in Vesti.bg, 15th Sep 2005; https://www.vesti.bg/novini/s-tazi-promiana-syobshteniiata-se-izvazhdat-ot-strukturata-na-ministerstvoto-na-transporta-778202 (Last accessed: 5th March 2017)

was praised by “Computer for You” in 1985 as it proved that “the intellectual revolution is in the hands of today’s students”, who were full of fantasy that was impossible to achieve for older luminaries of science.[135] In that year alone it created forty five games, and ten programs distributed through a software house called “Eureka”. It co-operated with the factories in Pravetz and IZOT, producing programs aimed at youths, but also developing data processing software useful for the wider populace.[136] They were soon producing packages for the automated working place, including graphic editors and statistical tools.[137] “Avant-garde” was the biggest but not only such software house that was set up with students in mind – young people were drawn into the software business through the wide-ranging Technical and Scientific Creativity of Youth movement (TNTM, from *Tehnichesko I Nauchno Tvorchestrvo na Mladezhta*). Led by the DKMS, the movement aimed to both involve youths in science in preparation for the future, and was an attempt to utilise the creative labour of young people as innovators. TNTM provided the material and educational base for students to invent and produce, a part of the wider move to engage the populace in plugging the gaps of the command economy such as the brigadier movement or the compulsory agricultural work performed by students and office workers. The creation of software, requiring mostly brain power and personal computers, was thus something subsumed within TNTM and spread throughout the computer club network. There was a software boom in clubs not just in Sofia, but also in Blagoevgrad, Haskovo, Ruse, Stara Zagora, Silistra, Kyustendil.[138] By 1987 “Avant-garde” had grown to into a national centre that coordinated such software-creating activity throughout DKMS’s clubs.[139] This activity drew much praise from people in the

[135] *Kompyutur za Vas*, 1985 (1), pp. 10-11

[136] *Kompyutur za Vas*, 1985 (3), pp. 58-59

[137] *Kompyutur za Vas*, 1986 (4), p. 3

[138] *Kompyutur za Vas*, 1986 (2-3), p. 3

electronic industry.[140] Other software firms did exist, of course – Pravetz had its own "Programa" software house, and there was even an economic union called "Program Products". However, even in those youth predominated. A Burgas software firm – Busoft – demonstrated its program on aviation administration through one of its programmers, a tenth grader.[141]

The new generation was thus not only being trained in computing, but at least some were also actively creating products. Yet, there were not enough computers to go around in the export-oriented country, and there was no guarantee that a job using computers would be available upon the completion of studies. One of the manifestations of a frustration combined with the right skills was the rise of the computer virus. In 1989, Veselin Bonchev ran the first big article on viruses in "Computer for You". It mentioned the presence of viruses in Bulgaria too, spreading through the Lilyana Dimitrova computer club or the Solar Energy laboratory in VMEI-Sofia, including a Bulgarian virus (VT-88).[142] The magazine ran more exposes on viruses, including offering free software to clean up computers – but the new explosion was yet another thread of the computer industry that span the end of communism. As the regime crumbled, the first 1990 issue of the magazine blamed users for the spread of viruses, admonishing them for using pirated software (one of the only ways to use yet another deficit good in late socialism) in "the way you gladly sit down to a feast of someone else's bread".[143] By then, Bulgaria had its first celebrity electronic bandit – "Dark Avenger" – an open letter of whose was published in the magazine. He called the publication "Virus for You", belittled Veselin Bonchev – by this point the premier expert on viruses in the country – as someone

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[139] *Kompyutur za Vas*, 1987 (9), p. 3

[140] *Kompyutur za Vas*, 1986 (9-10), p. 4

[141] *Kompyutur za Vas*, 1986 (12), p. 5

[142] *Kompyutur za Vas*, 1989 (3-4), pp. 8-15

[143] *Kompyutur za Vas*, 1990 (1-2), p. 7

who didn’t even know they existed at the time when “Dark Avenger” was making them. He boasted of completing two viruses in mid-1989, both bearing Iron Maiden-inspired names – “Eddie” and “Number of the Beast”. Bonchev replied, calling on all to help “heal this ill with ambition brain”.[144]

АКТУАЛНО

WANTED!

Търси се лицето DARK AVENGER, обвинен в създаването на компютърния вирус Eddie.

ИГРАТА ЗАГРУБЯ

За вируса Eddie и неговия злополучен автор

Без да сме имали ни най-малкото намерение, редакцията ни се оказа въвлечена в епистоларния жанр (литературни произведения, написани във форма на писмо към някое лице или във форма на преписка между двама или повече герои). Спомнете си историята с програмните продукти на битака. Сега се налага (напълно в духа на времето) да отпечатаме пълния текст на едно писмо, чийто автор е причинил хиляди часове неприятности на българските (а знае ли човек и на колко чужденци) потребители на програмни продукти.

Става дума за писмото на

всеки читател ще има възможност да се запознае изцяло с гражданските и професионалните позиции на двамата автори и да си определи отношението към тях и към резултатите от техния труд.

Ние по принцип с анонимни писма не се занимаваме — нито ги разглеждаме, нито ги водим на отчет. От бюрото на главния редактор те попадат в кошчето за отпадъци. Но не е такъв случаят със злоумишления създател на Eddie. Редакцията смята, че колкото повече светлина има по този въпрос, толкова по-скоро ще бъде идентифициран злосторникът. Очевидно този човек има

Pic. 4: Wanted: The Dark Avenger! The Rise of the Bulgarian virus factory (Source: Kompytur za Vas)

By this point, Bulgaria was garnering the reputation as “the biggest creator and distributor of computer viruses” in the world, in the opinion of a West German specialist.[145] Viruses such as “Eddie”, “Yankee Doodle”, “Vaccine”, proudly bore the tag of “Made in Bulgaria” and the name of their creators, who saw them as a point of pride. The magazine lamented that “the creation of viruses is far from a thing to be praised, and the halo of such

[144] *Kompyutur za Vas*, 1990 (3-4), pp. 9-10

[145] *Kompyutur za Vas*, 1990 (5-6), p. 1

bad fame, with its bag of viruses, will prevent us from easily entering the European home".[146] It was too late, however – in December 1990, the New York Times ran a story on the issue, stating that around 80 or 90 of all 300 viruses written for the IBM series of computers originated from Bulgaria. John McAfee, of anti-virus (in)fame, stated that at least 10% calls to his company were to do with Bulgarian viruses, and 99% to do with Dark Avenger. The article suggests that all of this is "as a consequence of having developed a generation of young Bulgarians whose programming skills found few outlets." This was something that Bonchev, interviewed for the article, also feels: "these children quickly acquired software-writing skills, but had little or no chance to apply them constructively." A hacker himself points to simple revenge on a company as a reason.[147] By 1997, Bulgaria's virus notoriety had passed (the peak was 1990-1991), but *Wired* decided to delve into the history. David Bennahum travelled to the country, interviewing former hackers and searching for "Dark Avenger". He talked of a late socialist digital culture borne out of the Eastern Bloc's most successfully "computer country", where children would do what they always do – played and explored. When "Computer for You" translated a simple German article on viruses, they planted the idea in people's heads, and only a few months later the deluge came. "Everyone was writing viruses", an interviewee states. Yet now two of the largest internet providers in the country, Digital Systems and BIS OnLine, were being ran by people whose first exposure to that world was through hacking on a Pravetz in the mathematical high school. Bennahum travels wide through this community, and suggests that "Dark Avenger" was probably motivated by other feelings – malice and hatred towards Bonchev, for one, as well as some reclusiveness (he famously corresponded with an American woman, Sarah Gordon, whose computer was infected by his virus, and who requested a virus just for herself – to which he

[146] Ibid.

[147] "Bulgarians Linked to Computer Virus" in *New York Times,* 21st December 1990

obliged; what followed was an e-mail exchange of a couple of years, cut off when Sarah was to be married). Yet, the article does show how there was a close link between most hackers and a playfulness as well as opportunity.[148] Bulgaria – praising the computer's virtue but giving only a limited change to work with one – was prime estate for such an explosion. Bonchev, in another interview, pointed to another reason this was the epicentre – in the drive to make a Silicon Valley, the regime encouraged (as we have seen) copying, theft and reverse-engineering. The step to malicious software was but a small one.[149]

Yet the 1990s and 2000s saw transformations among this milieu. People like the Dark Avenger spurred many to emulate him – and then work to prevent him ("his code was the best", the New York Times article states). The anti-virus industry boomed in Eastern Europe, Bulgaria included, and the region produced some of the most widely used programs in the field such as Kaspersky, Avast, and AVG.[150] But the biggest Bulgarian success in the sphere came in 2014, with the sale of Sofia firm "Telerik" to a USA company in a deal worth $262 million. The start-up created tools for web and mobile application development, and was founded in 2002 by four graduates of the Technical University of Sofia (the renamed VMEI-Sofia) and the American University in Bulgaria.[151] Svetozar Georgiev, one of the founders, recalls making his start on a Pravetz-16 computer brought home by his father, teaching himself programming from an early age.[152] "Telerik" was probably the most successful home-grown business of any kind in the post-1989 world, and part of a wider software

[148] David S Bennahun "Hear of Darkness" in *Wired,* 1st November 1997

[149] "Bulgarian 'Dark Avenger' Part of East-Bloc Legacy" in *Christian Science Monitor,* 19th May 1992

[150] "How Eastern Europe's Villains Changed Sides in the Malware War – and Made You Protect Your PC" at ZDNet; http://www.zdnet.com/article/how-eastern-europes-villains-changed-sides-and-made-you-protect-your-computer/ (Last accessed: 5th March 2017)

[151] "Absolyutno Globalni" in *Forbes Bulgaria,* 21st December 2012

[152] "How These Communist-Era Apple II Clones Helped Shape Central Europe's IT Sector" in ZDNet; http://www.zdnet.com/article/how-these-communist-era-apple-ii-clones-helped-shape-central-europes-it-sector/ (Last accessed: 5th March 2017)

industry that employed 20,000 people in research and development alone by 2014, the year its value exceeded $1 billion, or 1.7% of national GDP.[153] It is still a favoured place to outsource high technology services by companies such as Cisco and HP, often in the form of technical support and call centres. The IT sector of the country is one of the most sought after, commanding some of the highest salaries for graduates, and has a self-confidence lacking in many other sectors of the struggling economy – and the people involved pay tribute to communism's role in this: "it's a strength that we've already had two generations of engineers with a strong R&D background".[154]

Nearly thirty years after the fall of communism, with its factories gutted and empty, it is the human capital that survived, blurring 1989 as an end point. A whole generation of young people who were educated and socialised under socialism were able to put their skills to use after the period, to both malicious and profitable ends. Thousands of others, including older engineers and technicians, also fared the difficult transition better, either by founding the start-ups and companies that rose after the mid-1990s, or migrating to the capitalist Silicon Valley. Krassimir Markov recalls how his skills as an IZOT engineer served him well in the 1990s, when he serviced IBM machines throughout Russia. The American company needed technicians to do that, but no American engineer wanted to brave the realities of working in the crumbling Eurasian empire soon after 1991. Bulgarians like Markov jumped at the opportunity, already used to working on IBM-compatible ES machines, and having already worked in the USSR and Eastern Bloc. He had no qualms about going beyond the Urals to service an IBM or ES machine, he said, for money that would be laughable to a US

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[153] "When a Tough History Becomes Your Asset: Bulgaria's Plan To Be a Major Force in Technology" in ZDNet; http://www.zdnet.com/article/when-a-tough-history-becomes-your-asset-bulgarias-plan-to-be-a-major-force-in-technology/ (Last accessed: 5th March 2017)

[154] "Bulgaria Strives to Become Tech Capital of the Balkans" in *Financial Times*, 17th October 2016

engineer but unheard of to a Bulgarian worker.[155] Far from being closed off by the Iron Curtain, Bulgarian computer specialists had cultivated the skills needed to prosper after 1989, while a whole generation was ready to tackle the realities of the post-socialist computer market – with software replacing hardware as the field in which to prosper. Despite not playing such an important role in the Bulgarian economy as it did under socialism, the computing sector is a significant force that is always growing, and one of the few success stories of the post-socialist economy in terms of revenue and wages. While the factories and economic unions collapsed throughout the 1990s, the human capital remained and developed.

Networks

The computer industry enabled the networking of people and places, both physically through projects such as ESSI, and professionally or financially through the intellectual and business exchanges that enabled the creation of this sector in Bulgaria. According to Manuel Castells, that is the defining feature of the information age: a global network of people and places that excluded other territories or strata, creating social, economic, and technological inequality.[156] He distinguishes the rise of two forms of labour – self-programmed and generic – which drifted further apart with the developments of the logic and reality of the global network. The first were the "talent", valuable assets to the economy, the arising knowledge workers; the latter were the executants of instructions and the menial tasks of production.[157] What this meant was that cities and countries were not global truly, but housed nodes of global networks which differed hugely in wealth and power, making places in London or New York closer to each other (e.g. Wall Street and the City of London) than their

[155] Interview with Krassimir Markov, 4th February 2016

[156] Manuel Castells, *The Rise of the Network Society* (Chichester: Wiley-Blackwell 2010), p. Xviii

[157] Ibid., p. Xxiii

geographic neighbours (Harlem or Tower Hamlets).[158] From this, it was normal that the USSR fell in this new paradigm. It failed to facilitate the transition from industrialism, where the main source of productivity was the quantitative increase in factors of production such as labour and capital, to informationalism, where the source of productivity was the qualitative capacity to optimize the combination and use of factors of production. The USSR isolated its academics from industry, and discouraged innovation just when uncharted technical waters were being entered throughout the West at the dawn of the Information Age. The Soviets and socialists in general just proved incapable of integrating the vaunted scientific-technical revolution into their industry, hobbling their reforms from within, leaving only the option of a collapse or a total restructuring of the system that was tantamount to the same.[159]

Castells' later work on networks, however, allows us to cast a different light on the information age in the socialist world. Networks of power, where social actors can be part of multiple networks both within a single society and across multiple societies, are open-ended and multi-edged, allowing for constant contractions and expansions, creating the possibility for the social dynamics around them to dissolve society as a stable form of organisation. A network is a set of interconnected nodes, and those nodes can become particular centres of power if they absorb more relevant information and process it more efficiently.[160] The party and the state are only certain nodes in the networks of power that permeated socialist Bulgaria, and not the most efficient in processing information at all times. When nodes become unnecessary for the fulfilment of the networks' goals, the whole system tends to reconfigure itself, deleting some and adding other nodes. Networks can be overlapping – global, national, local – and it is the "switches" that thus become most important: the nodes

[158] Ibid., p. Xxx

[159] Manuel Castells, *End of Millennium* (Malden: Wiley-Blackwell 2000), pp. 8-28

[160] Manuel Castells, *Communication Power* (New York: Oxford University Press 2009), pp. 18-20

that act as connecting points between various networks, allowing for new “programs” to alter the composition by entering a particular system from outside. Once again, this means that territories can become deeply divided as a network looks to add valuable nodes where it can find them, and can thus bypass localities and people that have little value for the performance of the whole system. Networks are not just there to communicate, but also to gain positions and out-communicate others.[161] What the aim of the network is, and where the power lays, was precisely in the nodes that act as programmers (setting the task of the whole system) and switches (connecting various networks).

Seen like this, the Bulgarian technical elite can be seen as one of the most connected nodes in the network of power in the country. As we have seen over previous chapters, they traded, exchanged, bought, stole, sold, and talked across the Iron Curtain, becoming part of an emerging transnational elite that constituted the post-1970s information economy. They held important positions within the state-level network of power, trying to defend their own interests, and introducing new ideas regarding cybernetic governance or production management. In the short-term, they were outmanoeuvred by another node in the network – the Soviet-connected party elite – which facilitated the fall of Zhivkov (yet another node) in 1989 and the transition of 1990. However, the technocratic elite was part of a financial and business network that allowed them to negotiate the 1990s and 2000s more successfully than most, while their discourse of reform and the mismanagement of Bulgarian scientific and production capabilities became an important tool of switching the whole network’s idea of governance. Bulgarian socialism had ran its course in its current format, and all power players sought a change to maximise their own power too. Robert Castle argues that the delayed transition, with the country electing the BSP frequently in the 1990s and operating under a still statist economy until the crisis of 1997, was down to a lack of consensus among

[161] Ibid., p. 26

the elite and people of the country. Decisions were delayed, legislature was weak, and the BSP had no real interest in deep reforms to the state, continuing the power of the old, party elite.[162]

During that same period the economic elite, including the highest electronic echelons, could gather power through their skillset and connections, allowing them to continue exerting an important role in politics, whether from abroad or at home. Whether legal or illegal (and we must remember that the global information age also gave rise to complicated and powerful international crime networks too), they managed to weather these years better than most other industrial sectors by utilising their global connections and skills. By the 2000s, they were ready to gain positions of power again. Meanwhile, tens of thousands of educated workers and scientists could make a start either abroad or domestically, again utilising overlapping networks – this time professional ones. Bulgarian companies set up domestically benefited from the engineers' global experience in terms of education and knowledge, in order to compete globally on the technological market.

With men like Plamen Vachkov talking about their experience in the Silicon Valley in the 1980s or Stoyan Markov's global personal story, it is easy to see how the territory of socialist Bulgaria was in a sense fractured. The CICT institute, situated around seven kilometres from the centre of Sofia, was closer in its discourse and ideas to similar institutions in Berlin and Moscow, but also the West coast of the USA or Japan, than it was to villages nestled in the foots of the Balkan mountains a few dozen kilometres away. Bulgaria was creating discs in the 1970s and robots in the 1980s, and these men were building new careers in the 1990s – while the last village in the country to get electricity only did so in

[162] Robert Castle, *Bulgaria's Delayed Transition: An Analysis of the Delays in Bulgaria's Political and Economic Transition from Socialism to Liberal Democracy* (PhD dissertation, City University of New York 2013)

2008![163] The village of Plochnik is only thirty five kilometres south of Plovdiv, the site of one of the biggest disc factories in this story. Yet it may as well have been on the other side of the world in terms of the technological and global narrative that has unfolded in these pages.

The majority of the workers who populated the factories of the Bulgarian computer industry were net losers after 1989, unlike the strata of their managers or scientific supervisors. Their skills were not as easily transferrable or in-demand abroad or at home. Putting together complex machines on a conveyor belt was not something that was absent in the global economy once the protectionist wall of COMECON collapsed, and Bulgarian workers found themselves facing the Asian tigers and a rising China. Some of the knowledge workers of this story did not see them as particularly educated either, fitting perfectly in Castells' divisions of labour in the new age. Vasil Sgurev talks of the poor discipline of many workers, with the factory rooms "smelling of peppers", a reference to the rural origin and habits of many of the labourers.[164] Ivan Popov had reprimanded workers for poor hygiene – key to the super-clean production of computers – as far back as the late 1960s, as we saw in chapter one. There was a clear and self-conscious division between the mass of workers and those who created the "informational" product. The hundreds of thousands of others who had access to computers through work or their implementation in everything from factories to agriculture often were not trained in their proper use, or had to contend with computers who were unreliable – especially those in the huge agricultural-industrial complexes, who received the poorest produce, as Botev and Tsonev recall.[165] The last socialist generation, trained in

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[163] "Elektrifitzirat selo Plochnik" in Plovdiv24.bg; https://www.plovdiv24.bg/novini/regionalni/Elektrificirat-selo-Plochnik-62488 (Last accessed: 6th March 2017)

[164] Interview with Vasil Sgurev, 7th July 2016

[165] Interview with Nedko Botev and Boyan Tsonev, 23rd June 2015

schools after the 1983 introduction of such classes, was much more part of the global network of the information age, making the transition better than millions of older workers.

In the end, the collapse of socialism cannot be explained just by the machinations of a small party cadre. Through the globalised electronic industry it had created, the Bulgarian state had also fostered an internationally connected cadre of people who were channels for new practices and ideas. Some of them amassed enough power to challenge the state in the area of economic reform, utilising discourses developed by other knowledge workers. They contributed to 1989, and transitioned into the 1990s and 2000s much more easily than the vast majority of Bulgarians. The computer industry had an afterlife in the country through the continuation of a vibrant if smaller software and IT sector, staffed and created by tens of thousands of people who had been knowledge workers or high school students in the last days of the regime. It also had an afterlife in the echelons of power through a number of well-placed, well-connected economic managers and trade representatives who were already businessmen before 1989 – and would continue to be businessmen in various guises and permutations after it. The regime may have fallen politically in 1989, and its remnants more decisively defeated in 1997, yet aspects of it and its cadres survive to this day. Having entered the information age in the 1970s, they helped in the transformation of power after 1989. Global links and domestic positions fostered economic power, which could eventually again be transformed into political power under the new, multi-party system. Networks of power persisted, bridging the gap between socialism and capitalism, enabled by the information age in which these actors operated and still operate.

<u>**Conclusions**</u>

In the centre of Sofia, right next to the National Theater and the city art gallery, and right in front of the imposing Telephone Palace, a curious monument stands. Solid bronze, it weighs over three tons and rises six metres above the ground. A stylised tree acts as a halo around the face of an older, distinguished man. Erected in 2003, it commemorated the 100th anniversary of the birth of John Vincent Atanasoff, an American physicist and inventor who is now credited as part of the team that built the first electronic digital computer. It would be a mere curiosity if there wasn’t a link to the small Balkan state. Despite being born in Hamilton, New York, Atanasoff’s father came to the New World as a Bulgarian teenager, as a trader of rose oil, and settled there to seek a new life. Virtually unknown before 1970, Atanasoff’s link to Bulgaria dates to the socialist period, when a few scientists in the nascent computer industry discovered him and lobbied the state to recognise him. By the time of his death in 1995, he had received a number of honours, including the United States National Medal of Technology, the highest honour in technological achievement in the country, bestowed to him by George H W Bush in 1990.

Pic. 1: John V Atanasoff as man and legend. (Source: Wikicommons)

John Atanasoff was a professor in mathematics and physics at Iowa State University during the 1930s. Tired of mechanical calculators, he started developing the Atanasoff-Berry Computer (ABC) together with his graduate student Clifford Berry in late 1939, completing it in 1942. It was the first electronic digital calculating device in the world, made up of vacuum tubes, with a mechanical rotating drum for memory usage. It lacked stored program capability, distinguishing it from the modern computer, yet it was an important step forward – even if, due to the war and its unique nature, it was quickly forgotten. It was during the war that Atanasoff, like so many other early computer pioneers, was drafted into service of the "Big Science" of the US military. While Wiener worked on anti-aircraft guns, Atanasoff worked in the naval laboratories, developing acoustic devices. During these years, he often met with John Mauchly, one of the creators of ENIAC, the first general purpose electronic computer in history, discussing his own ABC as well as general computing theory. By 1945, Atanasoff was put in charge of the naval program to create a large computer, personally picked by John von Neumann. By the time he could disentangle from his acoustic ordinance duties (which the Navy prioritised), the project was shut down, and ENIAC had beaten him to the punch.

Between 1954 and 1973, however, Atanasoff was embroiled in the legal proceedings of Hollywell Inc v Sperry Rand as a witness, as attempts were made to invalidate the patents given to the ENIAC team. By 1973, the judge proclaimed finding three of the case – "Eckert and Mauchly did not themselves invent the automatic electronic computer, but instead derived the subject matter from one Dr. John Vincent Atanasoff".[1] The debate still rages, especially in articles published in the Institute of Electrical and Electronics Engineers, who nevertheless honoured Atanasoff with a 1981 medal of their own. By then, however, he was a

[1] The story's details are taken from Blagovest Sendov, *John Atanasov: Elektronniyat Prometey* (Sofia: UI Sv Kliment Ohridski 2003). That is but the latest book to appear in Bulgaria regarding Atanasoff, who spawned a number of texts dating back to the socialist period, started by Nikolai Bonchev's *Bashtata na Kompyutura* in 1984.

cause celebre in Bulgaria. Blagovest Sendov had learnt of him during the late 1960s from colleagues in BAS, who probably learnt of him in professional publications in the West which followed the legal case. In 1970 he contacted Atanasoff, inviting him to visit his ancestral home, which he did in December that same year. In Bulgaria, he received a warm welcome, being an official guest of the Academy, and the visit was capped by the bestowment of the Order of St. Cyril and Methodius, First Class, Bulgaria's highest such honour. He visited the country again in 1985, giving a keynote speech at the Sendov-organised conference in Varna on children in the computer world. This was accompanied by another medal – the Order of the People's Republic of Bulgaria, First Class.

Atanasoff's "re-discovery" of his Bulgarian roots was helped by the state. He was a providential gift to a regime that was just setting up its computer industry. Here was proof that Bulgarians were uniquely gifted and perfectly placed to create the technology of the future. A man who had been there at the inception of computing, and had – in the narrative – set the whole thing in motion, was visiting Bulgaria and his father's home village in the Yambol district. The future was meeting the past. National prestige, which the rising computer industry had always been a part of, was well bolstered by Atanasoff's figure. The Bulgarian roots of computing could now be taken to their natural conclusion by the BCP as it built up the socialist information age.

Atanasoff was a well-placed figure to remind us of the nature of the Bulgarian computer industry too. He is perfect in representing the crossings of Western technology into the small state, an American professor and creator who drove through the Iron Curtain in a car hired in Germany in order to meet the Bulgarian scientists such as Sendov who invited him. He is a powerful symbol for the transnational story that meets local circumstances and needs, which this dissertation has highlighted. This history has been global, collapsing the Iron Curtain at will, following the threads and travel itineraries of Bulgarian experts and trade representatives across Europe, North and South America, Asia, and Africa. Even if geopolitically the country was part of an opposing camp, the world was becoming increasingly global, as connections thickened through meetings, exchanges, purchases.[2] Bulgaria participated in this global interchange, taking the most modern developments in the West and transforming it in its own institutes. It opened windows to the world beyond socialism, not just to capitalist countries but to the developing world. The Bulgarian computer and its expert became globetrotters, sharing a common language of the cybernetic paradigm, interacting in the literal and metaphorical trading zones of the science – in conferences and fairs, in personal correspondence and technical arguments.

But a global narrative can unduly elevate motion over place, chasing the paths that circle the globe and ignoring the peculiarities of the local conditions, and those who were not part of this world. The computer experts and the cyborg science did not exist in a vacuum, and were responsive to local conditions, and harnessed to local projects. Bulgarian interests shaped what computers were to do. They were, above all, to raise cash for the regime. They were also to modernise Bulgarian society and clear the bottlenecks in the slowing economy. Bulgarian experts were not allowed the relative freedom to go West and South in the spirit of intellectual exchange, but in order to hone their skills in the best laboratories and conferences in the world, in order to build up the industry at home. Without COMECON, this story would not have unfolded the way it did. And while the Iron Curtain was certainly porous intellectually, it was very real when creating an economically "closed world". Plamen Vachkov recalls a roundtable in Hannover in the mid-1980s, which he attended in his capacity as director of the Pravetz factories.[3] A journalist in the audience asked him what he had to say to accusations that the Bulgarian computers were reverse engineered Apple clones,

[2] The "thickening" of connections is a term employed by C.A. Bayly in *The Birth of the Modern World 1780-1914* (London: Wiley-Blackwell 2004)

[3] Interview with Plamen Vachkov, 30th June 2015

while their operating system was a direct copy of MS-DOS. Vachkov replied that if the journalist could tell him the licensing fees he owed, he would write them the cheque there and then. This was met with much laughter in the hall, including by Vachkov himself. It is doubtful though that they all understood the core of the joke he was making – that of course that cheque would be in non-convertible roubles, a currency that wouldn't do Apple or Microsoft any good. The economic realities of the Cold War created actual "closed worlds" in terms of markets, where the socialist bloc was hermetically sealed off from competition with the Western companies, creating the financial and market mechanisms that allowed for the Bulgarian computer industry to arise. Locale was important for the very birth of the sector. Insulated from competition with American or Japanese companies, Bulgarians could thrive as they started from scratch – as did their other allies in the closed world of COMECON. The Second World constituted itself as an alternative modernity.

The cracks in the Iron Curtain through which the motion of global history passed were controlled by the state and its actors, carefully chosen to serve particular interests. When Western companies were negotiated with, this was a choice. When Indian companies were sold to, this was a choice too. By situating the history within the commodity and the experts it enchanted, this work has been able to zoom between the transnational and local story, keeping the global connections hitched to the realities of power. Who needed computers and to what ends determined how Bulgaria interacted with the world. By anchoring these interactions in the local story, there is less risk of losing the grand picture of why and how this industry developed by chasing the myriad threads that emanated from Sofia out to Tokyo, the Silicon Valley, or New Delhi.

It is precisely these crossroads in Sofia (and the other physical sites of Bulgarian computing, such as the factories and institutes in Stara Zagora, Plovdiv, Silistra, and beyond) that show the multitude of dependencies of the actors and the commodity. Castells' theory has proven useful as a way to frame the crossings of Bulgarian experts, especially in the highest echelons, between West and East, between capitalism and socialism. Parts of Bulgarian society became closer to other, similar nodes of power in the global network. Institutes in Bulgaria could converse with Soviet, French, American counterparts. Indian scientists visiting Bulgaria could deal in the same computer jargon, but also the same financial language. Danish engineers and Bulgarian technicians could swap stories about the same machines and the same problems. This doesn't mean, however, that these were not institutions embedded in local power relations too. They were to serve the modernisation of Bulgarian society, a story that was long and arduous and, for lack of a better word, lumpy. The Bulgarian socialist state was one of uneven development. Bulgarian villages existed in a different world to the cyberneticians of this story. Even though many were at most a generation removed from the land, there was a certain level of contempt for the poor workers that the villages produced, the ones who "smelt of peppers" while they worked the conveyor belts. The discourses of Pravetz were conceptually, economically, physically far from many Bulgarians.

Some of these Bulgarians were also highly placed. They did not need to understand the intricacies of computing to know what power they could give them as a party. That same power, however, was also enabling the rise of a self-confident party strata of technocratic managers. These men were the ones conversing with the West, talking of business and marketing and industrial associations on the Japanese model. Other party members were part of other networks that crossed in Sofia. They were nodes of networked power that, above all, stretched to Moscow. Their interests were different, their position increasingly threatened by computer managers who wanted reform. Ultimately, they won the short-term game of overthrowing Zhivkov. But as we have seen, the computer strata could negotiate the transition better, through expertise and financial links forged through their long-term interaction with the information economy.

Global history is imperfectly global. Just like colonisation met with resistance but also left blank spots on the map, with European power ending a few miles away from certain forts or railways, so did the internal colonisation of modern societies not always encompass society perfectly. The BCP was creating social databases of its population by the 1970s, but some Bulgarians were beyond the reach even of the electrical grid. The age of Edison was beyond them, let alone the information age. A few dozen kilometres away, IZOT specialists were working in super-clean rooms to create the next generation of profitable discs, while their trade representatives were showing American representatives of CDC around the factories. The cybernetic science and computer paradigm were a powerful dream in the later twentieth century, and are with us to stay. Automation did enter Bulgaria, so did computerisation. But for whom it entered, and to what extent, is the crux of any global history. The interconnections beloved of global history are messy, and the light that motions and crossings shines on hitherto unexplored areas, leaves others deeper in the dark.

The story of the Bulgarian computer industry is one of the expansion of horizons for hundreds of thousands of people, who were enabled by this to gallop ahead of many of their compatriots. They were part of the rising information age, and they were configuring it for socialist ends. Some wanted reform, others Marxism, third called for democratisation by the end. But the state's failure to create the bright future that was hoped for through computers did leave vast swathes of society out of the information age. Integration went hand in hand with disintegration, as elements of the Bulgarian financial and political elite drew closer to global networks of exchange and information economics, while many others were left behind. The success and failure of this story go hand-in-hand – it is akin to posing the question of "is what good for Apple good for the USA?" Power is a relation, and interests can shape what directions power flows. Integrating into the global network of the new economy meant the need to disengage from the state socialist-centred network of local power, speeding its disintegration.

The success remains in the realm of human capital. Tens of thousands of Bulgarian intellectual workers became part of the knowledge economy, and many could traverse the 1990s and 2000s better than their compatriots. The last generation of Bulgarian schoolchildren under socialism were particular beneficiaries of this, poised on the cusp of the true information age that came with the rise of the internet and the linking of Bulgaria to the true global network. Sendov, the man who invited Atanasoff to Bulgaria, also has a hand to play here. In 1989 Pravetz hosted the world's first International Olympiad of Informatics, which became the second largest Olympiad after the mathematics one. For three days in May, children from thirteen countries as far away as Cuba, Vietnam, and Zimbabwe, butted heads against a series of algorithmic problems, armed with Bulgarian PCs. In the end, two Bulgarian students, one Soviet, one Czech, one Hungarian, and one West German, received gold prizes.[4] This was the culmination of a Sendov proposal to UNESCO dating back to 1987, the natural progression to his new educational method tried out in Bulgarian schools and his international conference on children and computing in 1985. The IOI would become an annual event, with 84 countries represented in 2015 and 2016. Bulgaria might not have originated the computer, but it did birth an international "trading zone" where the next generation of computer experts would labour and create under the computer paradigm that is even more a part of our life today.

In 2008, the Voroshilov factory was dynamited to make way for new office buildings. The first incubator of engineering thought that would blossom into the Bulgarian computer

[4] Information on the Olympiad in Pravetz can be found in the "Proceedings of the International Olympiad in Informatics, Pravetz, May 16-19, 1989" by the Union of Mathematicians in Bulgaria; http://www.ioinformatics.org/locations/ioi89/International_Olimpiad_in_Informatics.pdf (Last accessed: 18th March 2017)

industry was brought to a dramatic end. Other factories, such as the huge plant in Stara Zagora, are not producing computers any more, turning to small scale electric appliances or electronic manufacture which consists of putting together parts shipped in from Asia. IZOT's central home, consisting of the institute building and the ZIT factory, today house over 200 small firms that continue to be active in the electronic industry, almost all created by ex-IZOT engineers and scientists. Koytcho Dragostinov's firm puts together devices for a French company, using parts from China.[5] Bulgarian computing continues to exist also in the IT sector, with a myriad of software specialists.

Pic. 2: The demolition of the Voroshilov factory. (Source: Milena Dimitrova, Zlatnite Desiteletiya)

The afterlife of the industry continues to be felt in politics, economics, and popular memory. The image of a socialist Silicon Valley is folded into a nostalgia for a time when Bulgaria was growing and industrialising, when its goods were exported to the vast Russian markets, and life was simpler. This narrative does not pay close attention to the realities of the guaranteed markets that made such progress possible. For many people, the Bulgarian Pravetz and Atanasoff are symbols of Bulgarian technical ability and a time when the

[5] Interview with Koytcho Dragostinov, 6th April 2015

country’s name was associated with the new age. Today, vastly more Bulgarians have computers than did during socialism, and through them they truly be a part of the information age, a click away. Yet this information age has a pre-history in the country, a local configuration of global developments. The Bulgarian case showed how different an information age can look, and that computers do not thrive and develop just democracies, open-access contacts, freedom and creative commons. They can be tools to foster a creative worker, to achieve utopia by eliminating menial labour, and to discipline labour through surveillance and recording. They can also serve particular interests, as the party found out. Just because it is input into a computer did not make data objective fact.

The journeys that the Bulgarian computer took its experts on were geographically and intellectually stimulating. They enabled the forging of contacts that are often obscured by the Cold War logics that supposedly blanketed every decision during the period. They gave power to particular interests, showing the imperfect penetration of any modernising project in the world. The global information economy created familiar languages and concrete links between sites tens of thousands of kilometres away, leading to the possibility of severing links to the immediate hinterland. The computer was vested with meaning and importance by its users. It created a common language and horizon for Bulgarian experts to converse and trade with Soviets, Japanese, Indians. It also created tools to discipline, modernise, automate, and sell. Ultimately, the Bulgarian computer allowed for applications akin to the famed “black box” of computer science, its internal workings hidden and not readily understood. The input of computers into society or trade did not always produce the same output everywhere in the world, or even within the same locale. It was the “black box” of the intermediate stage, where experts and actors negotiated between the transnational language of information and particular local and personal interests, where history was made.

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