

## **From Paperwork to “Mechanized Administration”: Designing the Bureaucracy of Self-Management in Postwar Yugoslavia**

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In June 1966, the clerks of Rade Končar, a Yugoslav manufacturer of electrical equipment and white goods, set about on a Sisyphean administrative task. They were to compile a complete inventory of the company’s capital goods (*osnovna sredstva*), such as its factory equipment, tooling, licenses, and building facilities. The exhaustive catalogue formed the first step in the process of “mechanizing the administration of capital goods,” so as to more effectively manage the factory’s production, monitoring gaps in assembly lines, and facilitating timely decision-making that would, ultimately, increase productivity.<sup>1</sup> This exercise in bureaucratic efficiency was performed on IBM’s tabulators, located in Končar’s aptly named Department of Business Machinery (Odjel poslovnih strojeva, OPS). Soon it became clear that mechanical tabulators had to be replaced by more efficient machines, such as IBM’s System 360 mainframe computer, which promised to deliver “daily balance sheets” and further facilitate “bookkeeping, tracking of expenses by location, type and bearer, carrying out pricing calculations for products, gathering analytical and statistical data to overview business flows.”<sup>2</sup> The introduction of this new system of electronic data management, approved by the factory’s workers’ council in 1967, was to “instigate a real little revolution” within Končar: the crawling paper trail of self-managed bureaucracy was to be replaced by real-time computer-aided management.<sup>3</sup>

This cybernetic intervention was presented as a necessity under the fragmented structure of workers’ self-management that underpinned the Yugoslav economy. Self-management was engineered following Josip Broz Tito’s break with Joseph Stalin in 1948 and Yugoslavia’s resultant split from the Soviet bloc. Seeking to carve their own path between the two Cold War superpowers and to mobilize the working class from below, Yugoslav political elites presented bureaucracy as the biggest enemy of “third way” socialism. Introduced in 1950, self-management was imagined as a system that would

sidestep both the “visible hand” of management and the centralized apparatus of the state by handing the decision-making power in the economy directly to workers.<sup>4</sup> The workers’ council, the elemental unit of self-management, was an idealized, yet hardly efficient, assembly of blue-collar managers. Councilmembers were elected, rather than appointed, by workers on the shop floor. In factories such as Končar, the workers’ council was tasked with overseeing factory operations, from the setting of production plans to deciding on investments. The slow, inaccurate, and overly complex reports upon which workers’ councils based their decisions were often decried as one of the main causes of inefficiency plaguing self-management. By churning out production plans, tracking sales, and distilling complex bookkeeping, computers were to close the feedback loop of workers’ self-management.

Founded in 1946 in Zagreb on the site of a former Siemens factory and named after a partisan hero, Rade Končar was one of the largest Yugoslav companies.<sup>5</sup> As with any other Yugoslav enterprise, it was socially owned.<sup>6</sup> According to company statistics, in 1969 Končar’s fourteen factories employed some 13,169 workers, and its output accounted for 29 percent of Yugoslavia’s electrical engineering production.<sup>7</sup> Both its name and its business—electrification—highlight Končar’s enormous symbolic capital with the regime, further magnified by its early embrace of workers’ self-management, the defining feature of Yugoslavia’s “third way” socialism. A photograph from the company’s first workers’ council meeting, dated August 15, 1950, less than two months after self-management was signed into law, shows rows of somber faces packed into a hall underneath a banner declaring, “We are enacting Karl Marx’s postulate ‘Factories to the workers!’”<sup>8</sup> In 1957, Vladimir Bakarić, the most powerful figure within the Croatian branch of the League of Communists of Yugoslavia, called Končar’s workers “the professors of self-management.” Those interested in understanding Yugoslav social, economic, and industrial organization, Bakarić suggested, should spend some time at the company.<sup>9</sup> At the International Labor Exhibition in Turin in 1961, Yugoslavia showcased its experiment in self-management in a dynamic, undulating pavilion designed by the neo-avant-garde architect Vjenceslav Richter. Nestled under the striking concrete pillars of Pier Luigi Nervi’s Palazzo del Lavoro, the pavilion told the story of

Rade Končar and its surrounding neighborhood, Trešnjevka, as an exemplary case study of self-management within factories and local communes.<sup>10</sup>

Its symbolic capital and reputation as a model self-managed factory make Končar's experiment with 'mechanized administration' all the more interesting. If self-management was introduced to prevent the country's "capitulation to bureaucracy and state capitalism," as the Yugoslav government claimed, what does the transition from paperwork to computers reveal about the everyday practice of self-management?<sup>11</sup> How did computers come to be seen as a 'solution' to the 'problem' of bureaucracy? While scholars of bureaucracy tell us about its role in the birth of the modern capitalist corporation—with the processes of organization, communication, and information, the key principles of the "science of management"—the story of Rade Končar suggests a socialist counterpoint to that narrative.<sup>12</sup> In this case, bureaucracy is not identified with the centralized state apparatus, like the much decried Soviet *nomenklatura*, but rather with processes of industrial management.<sup>13</sup> That is not because state bureaucracy did not exist in socialist Yugoslavia. Rather, it is because workers' councils within enterprises, in a country where the state was to "wither away," became key sites of the bureaucratic management of political, economic, and social life. In the present article, I am concerned with two shifts that occurred between the 1950s and 1970s: first, the way self-managed enterprises came to mediate everyday life under Yugoslav socialism; second, the way this mediation was facilitated by information technology.

Končar's "mechanized administration" suggests a further, technological evolution of the systematic management strategies first seen in the early twentieth century. A product of Cold War techno-utopianism, this was a vision that suggested that the feedback and control mechanisms of cybernetic systems and workers' councils were closely aligned. Computers could mediate the processes of workers' self-management. This view had a lot in common with approaches to operations research seen in Western Europe and the United States. While Western thinkers saw in systems thinking and digital technology the promise that "science could help them eliminate the use of intuition in decision making, standardize

routine decisions, render the future more predictable and controllable, improve planning, and integrate complex operations,” their Yugoslav counterparts put that scientific neutrality in the service of self-management.<sup>14</sup> They went as far as to claim that cybernetics and automation were inherently “socialist technologies.”

The introduction of systems thinking and computers in Končar’s administration happened alongside constitutional and economic reforms in the period from 1961 to 1965 and challenged the very understanding and practice of self-management. Questions of meaningful participation in decision-making for workers on the shop floor, together with decentralization and greater autonomy in the redistribution of profits, marked debates of the period. No more a foreign problem, in this period bureaucracy came to be identified with the cadre of industry managers and local officials whose hierarchical and technocratic control was stifling the development of true self-managing relations. As Branislav Jakovljević writes, the critique of self-managed bureaucracy erupted during the 1968 protests, with students explicitly attacking the “existence of strong bureaucratic tendencies in our society.”<sup>15</sup> Their slogans—“Down with the socialist barons,” “Down with the red bourgeoisie,” “Bureaucrats, stay away from the working class,” “Workers work—bureaucrats enjoy”—echoed the writing of Yugoslav dissident Milovan Đilas, who had exposed the “new class” of privileged party bureaucrats.<sup>16</sup> The protest slogans highlighted the clear disjunction between the egalitarian, decentralized framework of workers’ councils invoked in government rhetoric and the slow, mediating, centralized processes of managerial control that existed in practice. It was a tension between workers and directors, shop floors and tall office towers, participation and bureaucracy. If the plague of bureaucracy could not be fully eliminated, as party leaders had hoped in the early 1950s, then at least it had to be reformed.

This reform took a technological turn. While it never amounted to official government policy—unlike, for example, project Cybersyn in Chile—Yugoslavia’s experiment with cybernetics and automation was promoted by a group of technocrats and ideologues whose debates present a coherent set of ideas about the role of information technology under self-managing socialism.<sup>17</sup> True to decentralized structures of workers’ self-management, these

ideas were put to practice from below by forward-looking enterprises such as Končar. The company's Department of Business Machinery, with its efficient, rational, and objective computer systems, embodied this technological change. Paying attention to the materiality of Končar's mechanized bureaucracy—punch cards, flickering consoles, process diagrams, white control rooms, computer networks, and switchboards—and the discourse surrounding it, allows us to question whether this technology engendered a new or different experience of self-management; that is, to question the extent to which Končar's "mechanized administration," its reliance on machines and data as supposedly transparent, neutral, and trustworthy mediators of processes of self-management, was shaped by design.

### **Self-Management as a Rejection of Bureaucracy**

Bureaucracy was, notoriously, a "floating signifier" under Yugoslav socialism.<sup>18</sup> A 1981 dictionary of self-management observed that *bureaucracy* referred to "the class of professional managers," "the system of social and political relations in which the main role is played by the bureaucracy," as well as the "type of activity of the bureaucracy itself."<sup>19</sup> Over four decades, bureaucracy came to encompass a set of practices and ideological positions deemed subversive or, worse, "counterrevolutionary," such as *étatisme*, nationalism, liberalism, or techno-managerialism.<sup>20</sup> Such fluid understanding "ensured that the abstract specter of bureaucracy in opposition to self-managing socialism would be a frequent and legitimate trope of discussion in public life" that could be easily directed toward different political goals.<sup>21</sup> In this sense, the Yugoslav story is not unique. Reflecting on bureaucracy as critique, Sebastian Felten and Christine von Oertzen write that "Conservative reformers and revolutionary liberals, libertarians and Leninists, anarchists and nationalists, have all used the term to condemn structures that alienate governments from electorates, citizens from their nation, human being from human being, workers from their work, investors from their dividends."<sup>22</sup> Mapping the shifting meaning of bureaucracy, then, provides a valuable understanding of the social, political and cultural context that produced it.

In a moment of ideological uncertainty after the Tito-Stalin split, opposition to bureaucracy served to legitimize the introduction of workers' self-management.<sup>23</sup> Yugoslav political elites identified democratization, *de-étatization* and de-bureaucratization as three key pillars—the three Ds—of “third way” socialism. By mobilizing the working class from below, self-management proposed a clean break from the Eastern Bloc and a return to a supposedly “truer” version of Marxism-Leninism, one that rejected Stalinist “deviation.”<sup>24</sup> Yet, Yugoslav politicians were never dogmatic ideologues, and their policies were marked by pragmatism, which was also reflected in their openness toward Western markets.<sup>25</sup> In the early 1950s, therefore, the critique of bureaucracy became primarily a critique of Stalinism and of centralized state planning. As Boris Kidrič, a high-ranking politician, argued in 1950, “either the positions of true popular democracy in the management of state and economy are rising, and the positions of bureaucratism are declining, or, on the contrary, they are expanding” and those of self-management are dwindling.<sup>26</sup>

The first self-management law formally transferred the ownership of the means of production to the workers, who became “trustees of the share of this socially owned property committed to their hands in the form of machinery, buildings, etc.”<sup>27</sup> The workers exercised their power by electing representatives to workers' councils and management boards, with the director of the enterprise participating as a nonvoting member. As the historian Vladimir Unkovski-Korica shows, in its very inception, self-management was intended to sidestep bureaucracy, embodied in the figure of the company director. White-collar managers were denounced by party leaders as bourgeois bureaucrats—“a right gentleman”—for avoiding scrutiny and consultation with workers of the enterprise.<sup>28</sup> Edvard Kardelj, the main architect of workers' self-management, argued that “Bureaucratization is the last and most entrenched fort of the class system, and with it the most dangerous enemy of socialism.”<sup>29</sup> As a result, the historian Dušan Bilandžić would later write, a moral and political campaign took hold over the early 1950s to “eradicate bureaucratic conceptions and phenomena in all aspects of social life.”<sup>30</sup>

Still, from early on a clear split divided the utopian theory of self-management from the messiness of its everyday practice.<sup>31</sup> While the operational power of workers' councils appeared to be "extensive," in practice it remained "merely formal," limited to approving decisions usually already taken by the company director and management boards.<sup>32</sup> But to acknowledge any degree of struggle for power between shop-floor workers and management boards would have meant acknowledging that a "new class" existed in what was supposedly a classless self-managed society and that self-management had failed to truly empower the working class. The problem of bureaucracy, therefore, became a problem of paperwork. The sociologist Josip Županov, for example, attributed the failings of self-management to the workers' lack of motivation and knowledge in matters they were deliberating upon.<sup>33</sup> The newspaper *Vjesnik u srijedu (VUS)*, on the other hand, sided with workers. In 1960, it documented the conflict between directors and workers' councils, claiming that complex reports and paperwork were often used to obfuscate democratic decision-making. At hastily arranged meetings, *VUS* reported, "hundreds of facts and figures are presented, that are impossible to follow and compare if members of the council did not receive the analysis in writing beforehand."<sup>34</sup> And even if they were made available in advance, "In some companies such materials and analysis are written in such a technical way that they cannot be understood even by people with high technical and economic education. Those reports are probably incomprehensible even to those who put them together."<sup>35</sup>

With paperwork presented as a site of struggle, starting from the early 1960s companies like Končar attempted to alleviate the problem of meaningful worker participation through better business organization and a streamlined company bureaucracy. The 1961 economic reforms were a catalyst in this regard and formed the first step in Yugoslavia's transition to market socialism that would culminate in 1965. The reforms were meant to introduce a significant shift in self-management, giving workers' councils autonomy in the redistribution of profits.<sup>36</sup> Since the reform rewarded better-performing enterprises, which then got to decide how to reinvest or distribute their profits, factories were called on to

“improve their work organization, to run their business more rationally, to better use their resources.”<sup>37</sup> Končar’s “real little revolution” in reshaping the company bureaucracy through digital technology was thus less a matter of choice made by a forward-looking enterprise aiming to keep up with its Western counterparts and more a necessity under market-oriented conditions. Nominally empowered to decide what to do with surplus labor, the company’s workers needed to be more fully integrated within the factory’s decision-making machine. To this problem, Končar sought to propose a technological solution.

### **From Paperwork to Mechanized Administration and Cybernetics**

Končar’s first data center was created in 1959.<sup>38</sup> In company literature, computers and data management were set out as the basis of “a modern system of business and production with a consistent and functional organization of work.”<sup>39</sup> This effort to systematize business organization was formalized in 1961, when Končar created its Business Development Office (Služba za unapređenje poslovanja, SUPO).<sup>40</sup> The creation of SUPO coincided with a significant shift in Končar’s organization. After an initial, foundational phase in the company’s development from 1946 to 1953, the following decade marked Končar’s expansion across Yugoslav territory.<sup>41</sup> The period of rapid growth, which lasted until 1969, ran in parallel with an administrative and organizational reordering to enable greater decentralization, autonomy, and accountability of individual production units, in line with market reforms of the period. In 1961, “after multiple months of preparations and debate” the central workers’ council voted to reorganize the company so as to further “decentralize its management and extend workers’ self-management to every single company employee.”<sup>42</sup> As the factory grew, it seemed, so did the company’s commitment to self-management. This commitment was aided by the increasing informatization of its administrative functions.

SUPO was founded with the explicit purpose of facilitating “the process of reorganization and decentralization of workers’ self-management” within the company.<sup>43</sup> Its Analysis and Planning Division, for example, was responsible for “gathering and processing of analytical and statistical data, economic reports, setting up planning calculations, as well



as providing monthly reports and bulletins for management organs” across all company divisions.<sup>44</sup> This was “a delicate and comprehensive task, for all the decisions for further development and work of the company depended upon it.”<sup>45</sup> It was a task not to be left to clerks. Rather, mechanized administration was leveraged to ensure a more efficient running of the company while eliminating the drudgery of repetitive, slow, and alienating administrative work, mostly performed by women. Such processes of mechanization pose questions about the agency of technology and the value of labor. Historians of technology like Jon Agar, in his study of the mechanization of the British civil service, have documented how computers in administration came to be promoted as instruments of efficiency. On the one hand, computers could produce knowledge more quickly, expanding the government’s “capacity to administrate.”<sup>46</sup> Similarly, in the U.S. corporate context, operations research technologists sought to delineate a “scientific method of providing executive departments with a quantitative basis for decisions regarding the operations under their control.”<sup>47</sup> And yet, the mechanization of administration posed a threat to skilled clerks, who could be replaced by more efficient machines and cheaper, unskilled labor.<sup>48</sup>

Strikingly, such debates about labor found little room on the pages of Končar’s factory newspaper, *Končarevac*. Here, mechanized bureaucracy was portrayed as central to the successes of self-management, with computers seen as instruments of managerial transparency, accuracy, and objectivity. At Končar, all administrative computing was carried out at the Department of Business Machinery, whose “speed and precision in the processing of thousands and thousands of data” was essential in providing the “information necessary to manage the business policy of the company.”<sup>49</sup> By 1966, OPS had twenty-one IBM accounting machines and had become a “popular” and widely known department within the company.<sup>50</sup> By 1967, the IBM accounting machines were no longer sufficient to the task of carrying out the bookkeeping operations of such a complex organization, one whose production plants and individual workers’ councils were dislocated across Yugoslav territory. With the purchase of IBM’s System 360 computer in July 1967, whose full operation was planned for the second half of 1969, it was expected that the accounting system “would be

even more comprehensive,” forming an all-encompassing system for managing company records and informing the processes of self-management.<sup>51</sup> The electronic ““brain” will regulate and analyze all elements in the whole business of the company,” the factory newspaper reported.<sup>52</sup> The computer was presented as the ultimate solution not just to the company’s bureaucracy problem but to all of its problems, from planning and setting up of production programs to research and development.<sup>53</sup>

Končar’s introduction of computers to the administration of the company reflected the views of Yugoslav political elites, who considered automation and cybernetics to be both fully in line with socialist ideology and a pragmatic response to the need to increase manufacturing productivity. As Tito declared during his visit to the autumn edition of the Zagreb fair in 1960, “Automation has a massive impact, so conservative understandings, where they still exist, need to be eradicated. . . . Fast industrial development, ever faster production and accumulation of products will force our manufacturers to shift to automation.”<sup>54</sup> Dušan Čalić, a professor of political economy at the University of Zagreb and a member of the Federal Council of Yugoslavia, struck a more idealistic note.<sup>55</sup> An ardent advocate of automation and cybernetics in business organization, in 1962 he argued that these were inherently “socialist technologies” whose role was to “replace human beings in the processes of management, in setting up programs and control processes, and even in the lower sphere of thought.” For Čalić, behind the whirring sounds of electronic brains lay crucial questions of alienation, freedom, and control. In his view, the purpose of an automated, cybernetic system was not only to increase productivity and meet production plans. It was to “free man of direct work in the production process and to welcome him, as Marx argued, to the ‘realm of freedom.’”<sup>56</sup>

From 1967 to 1969, a flurry of articles appeared in *Končarevac* to introduce the company’s new electronic system to the workers.<sup>57</sup> The use of computers in company management and administration was presented less as a choice and more as an obvious, historic necessity: “there is practically no alternative” to an electronic system, the company paper reported, “as in today’s context the management of a business enterprise cannot be

based on analog technology of information processing and without the application of contemporary methods of management and administration.”<sup>58</sup> Workers were to be educated not only on how computers would operate within individual production units but also were to be asked to think about the company as an enclosed, self-regulating system: a cybernetic factory.

In April 1968, an article in *Končarevac* introduced the factory’s workers to the history of cybernetics and the writing of Norbert Wiener, already well-known to Yugoslav engineers and economists.<sup>59</sup> The goal was not only to apply cybernetics to everyday administrative tasks but to reach the higher level of “cybernetic thinking” so as to anticipate problems and identify possible solutions.<sup>60</sup> A month later, in May 1968, *Končarevac*’s authors linked cybernetic thinking to self-management. “While, for example, tools or workers on their own do not represent a system,” the article’s opening lines stated, “together, observed as a whole, they form a system. This workers-tools system is part of a bigger system, all the way to, in our case, the largest business system—the enterprise.”<sup>61</sup> Central to this integrated system was the flow of information. If the company was “not just a sum of parts, but first of all an integral unit,” then

one of the most essential conditions for managing such an integral unit, i.e. the business system, is the creation of such a communication system where all parts of the unit will participate in the exchange of information. The information flow within a business system is the basis of good and successful working of the company.<sup>62</sup>

Explaining the importance of integrated feedback loops in a cybernetic conception of the factory, the article suggested that the role of workers’ councils, of self-management, was not so much to engage in meaningful discussion and debate. Rather, it was to oversee the flow of information, regulating it and taking decisions to eliminate possible interruptions within the system. Complex processes of gathering, interpreting, and deliberating upon the information coming from individual production units, the central task of workers’ councils, were streamlined. Within the cybernetic factory, the intimate, subjective authority of divisional

managers and technocrats was substituted by data-driven analysis and planning, and no longer were workers required to engage with the minutiae of Končar's production and business management processes. In the name of accessibility and transparency, these could now be delegated to computers.

Process diagrams indicating the role of computers and data management within different divisions and production processes, published in the company newspaper and promotional materials, reinforced the image of Končar as a self-regulating organism while affirming its efficiency and modern business organization. According to Yugoslav theorists, a clear analogy could be drawn between the feedback and control mechanisms of cybernetic systems and the organs of self-management. As Borislav Bakić argued in 1975, "Self-managed decision-making constitutes, in essence, the establishment of an optimal regime for the functioning of all parts (subsystems) and all parts of parts (subsystems), in order for the whole system to achieve its established goals."<sup>63</sup> Workers' councils were individual subsystems, grouped to form the complex enterprise structure—the cybernetic system. Therefore, once the "optimal regime" of the enterprise was set by the workers' council, worker-managers became "executors" of such a regime, thus simplifying the cybernetic feedback loop. Further, Yugoslav theorists argued, if self-management was, in its essence, a system premised on "the gathering and processing of information" through the mechanism of the workers' council meeting, then cybernetics and self-management were closely aligned. Computer systems and workers' councils could both be described as management devices, technologies for processing information and regulating the factory workflow, thus minimizing bureaucracy.<sup>64</sup>

This understanding of cybernetics was aligned with the thinking of Stafford Beer in his work for the Chilean socialist government. Opposed to centralized control, Beer advocated for a horizontal model of lateral communication, which would achieve "its own dynamic self-regulation." As Eden Medina writes, "cybernetic management as described by Beer looked for ways to redesign the structure of a company or state enterprise so that it would naturally tend toward stability and the desired behavior."<sup>65</sup> Yet, this model as it was

conceived in Yugoslavia harbored a clear paradox. The cybernetic factory suggested a shift in the very understanding of self-management: it proposed digital technologies as a solution to deeper structural issues affecting self-management. Questions of worker participation in decision-making and bureaucratic control were now displaced onto technology. The central problem of self-management was cast as a technological one.

### **Cybernetics as a Design Idea**

Končar's embrace of techno-utopianism offered an alluring way to think about reforming self-management, one that intensified in the 1970s.<sup>66</sup> As an economist wrote in 1975, "socialism = self-management plus cybernetics."<sup>67</sup> The formula was an adaptation of Henri Lefebvre's postulate, first jotted down, less concisely, during his stay on the Yugoslav coast for the annual Praxis school of philosophy. Published in *Praxis* magazine in the spring of 1965, Lefebvre's essay both welcomed and warned against the use of technology in government.<sup>68</sup> Adapting Vladimir Lenin's catchphrase for the 1960s electronic age, Lefebvre came up with a laborious "new formula to define socialism: 'democracy through a complex network of basic organisms—electronic devices and the treatment of information as programmatic givens.'" Still, Lefebvre had reservations about the role of these new cybernetic systems. If modern democracy relied on "modern machines," those same machines could equally be co-opted by "technocrats and state-powers." "Machines and the elaboration of received information are necessary for the construction of plans and programs," he wrote. And yet, "they provide a dangerous power for those who manage and operate them. This means they carry the danger of serving the caste of technocrats and political dictators. They are necessary means and dangerous instruments."<sup>69</sup>

Despite such critical voices, the 1960s and early 1970s were largely a period of optimistic techno-utopianism. Writing in the early 1970s, Teofanija Trivunac suggested that "social deviations"—namely, bureaucracy—could be cured with better technology, "the creation of a unique Yugoslav system of information processing on all levels—from companies and local communes, to counties, republics and the federation."<sup>70</sup> This totalizing

system was to be coupled with a “decision-making theory,” the “principles, methods and techniques of self-management . . . based on cybernetics as a science for the management of complex systems.”<sup>71</sup> The view that technology could be used to solve deeper social, political, and cultural conflicts was not confined to Yugoslavia but emerged with different intensities in various contexts across the East-West divide. Scholars like Fred Turner, for example, have documented the complex links between 1960s counterculture and cybernetics in the United States, where the digital world was imagined as a (libertarian) realm of freedom. The networked society, Turner writes, was “an ideal society: decentralized, egalitarian, harmonious, and free.”<sup>72</sup> Yugoslav thinkers used the same language to describe self-management, further affirming what many scholars of socialism have long argued: that capitalism and state socialism during the Cold War appeared awfully alike.<sup>73</sup> Still, the history of cybernetics in the Soviet Union complicates the story. There the transfer of technology from one ideological, political, and economic system to another presented fundamental questions about the nature of science and technology under socialism, as Slava Gerovitch documents in his extensive study of Soviet cybernetics.<sup>74</sup> Like Taylorism in the 1920s, cybernetics needed to be purged of counterrevolutionary, capitalist connotations before being absorbed within the Soviet system.<sup>75</sup> While, in the 1950s, cybernetics was criticized for its “inhumanity, striving to transform workers into an extension of the machine, into a tool of production,” by the early 1960s, as the USSR sought to keep up with the West, “the popular press began heralding computers as ‘machines of Communism.’”<sup>76</sup>

If the adoption of cybernetics within state socialism posed challenges, then how did it fit so seamlessly within the Yugoslav system? Here design played a meaningful role. Debates about cybernetics in Yugoslavia first emerged in artistic, architectural, and design circles around the New Tendencies movement. Their ideas were central in shaping Yugoslav design practice in the 1960s and 1970s.<sup>77</sup> The magazine *Arhitektura*, for example, dedicated an issue to cybernetics and digital technology in 1969. In it, the design critic Fedor Kritovac argued that computers were not just a practical tool for automating design processes within

architectural practice but rather shifted the very understanding of architecture and design. In his words,

A “classic” understanding of architecture and urbanism where the object is understood to be the spatial-plastic reality determined by given functional constraints as well as “classic” visual-plastic principles, will have to give way to a conception that is being developed independently: the concept of ENVIRONMENT, i.e. AN INTEGRATED DYNAMIC SYSTEM OF A COMMUNICATIVE-OBJECTIVE MILIEU.<sup>78</sup>

At Končar, this cybernetic conception of design had deep roots. With cybernetics set as a central organizational principle of the company, each part of the cybernetic process of feedback and control was scrutinized and approached as a problem of design.

Unsurprisingly, the design of Končar’s cybernetic bureaucracy started from the materiality of paperwork itself. A standardized internal mail envelope was introduced in 1964 with the first wave of organizational reforms. Featuring a simple grid on its front, where addresses were to be listed, the envelope became a kind of process diagram of Končar’s bureaucracy, tracing the flow of paperwork between the departments of the company.<sup>79</sup> It made bureaucracy visible, demystifying its workings. This was a visual language of transparency and accountability, a technology intended to eradicate a perception of bureaucracy as an instrument of a privileged class of bureaucrats. In the same way, the company newspaper was launched as a weekly broadsheet in November 1964 with the purpose of facilitating participation in self-management and making operational decisions more accessible.<sup>80</sup> Standardized internal documents were also an integral part of this new, more efficient process, both within production units and administrative departments.<sup>81</sup> The standardization was seen as a “precondition for the development of an information system and computer system for the management of production.”<sup>82</sup> Like the envelope, the standardized documents and forms used to compile data from individual production units to be fed to the central computer were a material expression of the new, streamlined bureaucratic efficiency and formed an essential part of Končar’s corporate identity. For Noe Maričić, one of Končar’s

in-house designers, a systematic corporate identity, visualized through internal communication systems imposed by a “central authority,” was instrumental for Končar’s operation as an integrated, interconnected, yet distributed cybernetic factory.<sup>83</sup>

Končar’s centralized bureaucratic control, spearheaded by its data processing center, SUPO, was reinforced in spatial terms as well. Factories and production units were decentralized across the company’s many sites, while administrative functions were to be grouped together within a single center, an office complex whose plans were first laid out in 1952.<sup>84</sup> When the building project was announced following a public competition, it was described as “a functionally well-studied building,” designed so as to allow “company management, the collegium and management board to meet in the shortest possible time to carry out exceptionally urgent decisions.”<sup>85</sup> The proposed complex, with a low office block, meeting hall, and office tower, was designed to highlight Končar’s symbolic capital: “The whole building is very impressive and interesting, and urbanistically it will give emphasis, not just to the factory but also to the whole of West Zagreb, just like Rade Končar company represents an obvious highlight in the whole of our industry, and especially in the electrification of Yugoslavia.”<sup>86</sup> Even though the building was not realized as originally intended, administrative spaces occupied a central place in the company’s development, both spatially and symbolically. While the workers’ councils were to be made more autonomous, their autonomy was based on information distributed from the company’s bureaucratic center.<sup>87</sup>

In the early 1970s, the cybernetic conception of Končar was further systematized through the work of its in-house design office. The design office was founded in 1970 and headed by Vladimir Robotić, who joined the company in 1969 from the fledgling Center for Industrial Design (Centar za industrijsko oblikovanje, CIO), an organization founded with the aim of coordinating design practice within industrial manufacturing.<sup>88</sup> At CIO, Robotić had absorbed the teachings of Tomás Maldonado of the Ulm School of Design, emphasizing a scientific method of design. At Končar, Robotić sought to organize design practice into precise steps of data gathering, analysis, synthesis, and verification.<sup>89</sup> He wrote in the



company newspaper, “The basic principles of design methodology are founded on the approximation of the mode of action of highly organized machines and therefore are rooted in cybernetics.”<sup>90</sup> Končar’s adoption of “scientific operationalism” was part of a wider shift in Yugoslav design practice to align itself with the technocratic imperatives of rationalization within the industry.

Končar’s design office was created as a subdivision of the Electrotechnical Institute, its research and development department and technocratic center, which had been established in 1961. Here, design was best placed to intervene in the company’s production plans and product development. A structured design methodology became crucial in efforts to institute a clear design style for Končar’s wide-ranging production lines, which included objects and systems of varying complexity and scale, from small domestic appliances to large infrastructure projects for power plants. Končar’s administrative reordering and production systems dovetailed nicely with the latter, large-scale projects: cybernetic bureaucracy and distributed infrastructure systems followed the same logic of networked organization. Končar became a factory of factories and, with it, a factory of bureaucracy.

In a brochure from the 1970s, Končar emphasized this line of business. It described the enterprise as “industry that develops itself by building other industries.”<sup>91</sup> By building large industrial projects, Končar manufactured the infrastructure necessary to regulate the Yugoslav economy—the cybernetic infrastructure of self-management. In developing such large industrial projects, Končar’s design team seemed particularly concerned with creating human-machine systems that ensured a rational, scientific, and careful management of factory workflows. Consoles operated by blue-collar workers, situated in control rooms of vast industrial plants or energy suppliers, signaled the possibility of controlling environmental systems from a single administrative unit, connecting the periphery to the center, pulling dispersed production units and self-management bodies into an interconnected whole. Thus, Končar did not just seek to reorder its own bureaucracy and management systems by following cybernetic principles but extended this strategy across the Yugoslav industry. This was the ultimate expression of Yugoslav techno-utopianism, embodied in the shape of

computer terminals situated within self-contained control rooms of individual production units that suggested that the processes of self-management could be automated and frictionless, regulated by intelligent machines.

But, by the mid-1970s, in line with the new constitutional arrangements ratified in 1974, industrial organization had become atomized, split into ever smaller units of management. The Law on Associated Labor, finalized in November 1976, set out the reorganization of workers' councils into Basic Organizations of Associated Labor (Osnovna organizacija udruženog rada, OOUR). In a cybernetic analogy, these smaller management units, set up according to function or location, were then linked into Complex Organizations of Associated Labor (Složena organizacija udruženog rada, SOUR), representing the overall structure of the enterprise. While BOALs were hailed as a further step in the devolution of decision-making within enterprises, in practice they fragmented the structure and processes of self-management.<sup>92</sup> At Končar, the issue of atomization within self-management was, once again, approached as a problem of design. Končar developed infrastructure systems to support this administrative reordering. Computer terminals, located in individual units—or BOALs—were merged together into the complex organizational structure of the enterprise, or COAL, through a networked system. Dispersed across the Yugoslav territory, such terminals and control rooms represented sites of “networked power,” as David Crowley writes in his discussion of Cold War consoles, where “one environment could be controlled from another” and “the scale of an environment could be understood . . . in terms of the integrating power of networked systems.”<sup>93</sup>

In their effort to harmonize this networked technology with self-management, Končar's designers relied on the “new scientific discipline” of ergonomics.<sup>94</sup> The magazine *Industrijsko oblikovanje*, first published in 1970, became the key vehicle for introducing the principles of ergonomics in Yugoslav design. In the inaugural issue of the magazine, Mihaela Zamolo wrote,

the most important task of ergonomics has become to overcome the fragmentation of work, within which the individual is getting lost as an insignificant and useless

element of the system. The machinery should be designed so that the operator can “become one” with it, so as to understand the basic principles of its functioning and performance. The machine or device must not, therefore, become a “black box” to the operator . . . he needs to be able to overview the work process and structural complexity of the machine, as much as the functioning of the technological process as a whole. . . . the designer must allow the operator to observe the continuity of the process, i.e. to observe the causes and effects of his actions.<sup>95</sup>

By invoking the need to overcome the alienation and fragmentation of work, Zamolo inscribed ergonomics within the rhetoric of self-management. The article suggested that growing technocratic control could be ameliorated through design that would make technological processes more comprehensible and transparent, demystifying the “black box” of machine technology.

During the 1970s, an emphasis on ergonomics became an important element of Končar’s design strategy. A drawing of one of Končar’s control rooms highlights this approach. It shows an aerial view of two operators at their consoles. They look at two screens in front of them. An additional screen is placed in the left-hand corner of the room and a large panel is on the wall in front of them. This technical drawing shows the precise measurements and directions of the operators’ movement, indicating exactly how the consoles should be used and how the operators should behave. As much a technical drawing for Končar’s engineers, such forms of diagrammatic representation also sought to demystify the environments of networked power, opening up the black box of the machine by giving precise instructions for its use. Another control room designed by Končar reinforces this visual rhetoric. In a space that closely mirrors that of the drawing, two blue-collar workers sit at a sleek white console with two screens in front of them. But the main element in the control room is the process diagram on the wall, giving the operators an overview of the system in the service of frictionless control.

In addition to the rhetoric of visibility and transparency, Končar's designers also adopted flexibility and interchangeability as two fundamental principles in the design of consoles and control rooms.<sup>96</sup> A technical drawing of a workstation, designed by Marija Jeličić-Plavec, published in the catalogue for the Zagreb *Salon* in 1983, highlights this approach. The project indicates a modular workstation where each element is flexible: a desk to which the central computer unit could be attached, modular filing cabinets and drawers, output units on wheels that can be moved around to adapt to the individual operator's needs. A representation of cybernetic bureaucratic efficiency, the drawing also placed individual operators in control of their own environment. In 1980, Jeličić-Plavec described the work environment as an element in a larger organizational system:

The problems of man at work can be successfully resolved only if we consider both man and all elements of his working station, as well as the wider working environment, within the overall structure of an operating system. To make this unique system work well, it is important during the design process to adapt, as best as possible, labor to people and to harmonize technology, technics, ergonomics and the organization of work.<sup>97</sup>

And yet, this process of harmonization could hardly be divorced from a system of centralized control. Sitting in nondescript rooms across individual production units, such flexible, modular, decentralized cybernetic environments were simply plugged-in, tethered to a centralized computer network. Read within this context, the smooth, effortless control rooms and consoles designed by Končar's in-house design office not only had the task of structuring efficient and functional cybernetic systems that would rationalize and democratize the decision-making processes within workers' councils; they were also designed to produce rational, committed, and efficient self-managers.

### **What Was Self-Managed Cybernetics?**

The increasing emphasis on designing harmonious human-machine systems within Končar can be seen as a response to wider debates about the role of technology under self-managed socialism that emerged in the 1970s. These debates were not just about technocracy as another iteration of previous anti-bureaucratic campaigns. Rather, they called into question the very nature and scope of worker self-management in the Information Age.

Writing in 1971 the Praxis philosopher Rudi Supek discussed computer networks as the “infrastructure of society.” He argued,

The scientific and technological revolution along with the development of cybernetics, automation, and modern means of communication makes possible far more decentralization than was the case in undeveloped systems. At the same time, technology is becoming the “infrastructure of society,” freeing it from its technological determinism and providing greater possibilities for the organization of society in accordance with man’s real needs.<sup>98</sup>

However, lurking beneath the supposedly liberatory potential of networked man-machine systems was also an infrastructure of technocratic control. Supek himself wrote in 1965 about automation in production and the hierarchical management of factories. He argued, “automation in administration, just like in production, leads to the greater integration and interconnection of management . . . that, naturally, demands . . . greater discipline and subordination of the work of certain employees.”<sup>99</sup> This critique was also put forward by his colleague Danilo Pejović. In 1962, he anticipated the widespread use of automation and compared it to the centralized state apparatus:

technology is gradually overtaking all spheres of life. . . . It’s not a coincidence that we speak of the “state apparatus” or “state machine”. The goal of state apparatus is to function all the more automatically, rationally, practically, to execute from one center at the highest level all that has been predicted beforehand.<sup>100</sup>

What do these critiques tell us? Perhaps not that technology was antithetical to self-management or that technocracy and bureaucracy could not be “cured” with better, ever faster technological development—though these lessons may still resonate today. Rather, these critiques suggest that self-management was itself a kind of bureaucratic technology. Small, atomized, workers’ councils became particular organizational tools: they served to map out the enterprise workforce and to analyze its productivity. Through their meetings and reports, workers’ councils processed complex enterprise information by breaking it down into small, more manageable units. In his analysis of the filing cabinet, in an entirely different historical and political context to the one under review here, Craig Robertson describes the concept of “granular certainty.” In his view, the modern management of information in the pursuit of efficiency required that things be broken down to a granular level “to make [them] easier to apprehend, understand, and control; to create something small was to guarantee certainty.”<sup>101</sup> As the key pillar of Yugoslav postwar modernity, self-management was, ultimately, one such information technology.

As mechanical tabulators were replaced by mainframe computers and consoles and paperwork turned into mechanized administration and then into cybernetics, workers themselves got sorted into ever smaller units of management. While the number of Končar’s workers’ councils multiplied in the mid-1970s, the centralized apparatus of the factory did not disappear. Instead it dissolved into networked, interconnected environments—the infrastructure of society. The materiality of Končar’s machines simply reinforced the efficiency and pervasiveness of that process under the banner of objectivity and transparency. Feeding orders, material supplies, incomes, and production output figures into computer terminals, the workers were not so much replaced by machines as they themselves became a kind of machine, an ever more efficient, frictionless, and interchangeable cybernetic organism.

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<sup>1</sup> Unless otherwise noted, all translations are my own. Mirano Ružić, “Mehanizirana administracija osnovnih sredstava,” *Končarevac*, no. 74 (27 June 1966): 2.

<sup>2</sup> V.P., “Potpisan ugovor za elektronički sistem IBM,” *Končarevac*, no. 119 (13 July 1967): 4.

<sup>3</sup> V.P., “Potpisan ugovor,” 4.

<sup>4</sup> Dušan Bilandžić, *Historija Socijalističke Federativne Republike Jugoslavije, Glavni procesi 1919–1985* (Zagreb: Školska Knjiga, 1985), 171.

<sup>5</sup> The company was founded in 1945 as part of Croatian Electrical Industry, an industrial organization set up in the immediate aftermath of World War II. It became an independent factory called Rade Končar Works in 1946. In 1961, it was renamed Rade Končar Electrical Industries and Engineering. When the company was privatized, in the early 1990s, its name was shortened to Končar—Electrical Industry. I use “Rade Končar” and “Končar” interchangeably in this article to refer to the company. See *Rade Končar, Electrical Industries and Engineering* (Zagreb: n.pub., 1964).

<sup>6</sup> Even though social ownership may be considered similar to state ownership, it was meant to further differentiate Yugoslavia from other socialist states by decentralizing ownership rights. See Saul Estrin, “Yugoslavia: The Case of Self-Managing Market Socialism,” *Journal of Economic Perspectives* 5, no. 4 (1991): 189.

<sup>7</sup> *Rade Končar: Danas i sutra* (Belgrade: Ekonomska politika, 1969), 2.

<sup>8</sup> The photograph was widely published in Končar’s company brochures, such as *Rade Končar: Electrical Industries and Engineering*, 6.

<sup>9</sup> “Od 1945. do danas,” *Končarevac*, no. 22 (10 May 1965): 8.

<sup>10</sup> “Od 1945. do danas,” 8–9.

<sup>11</sup> Edvard Kardelj, “O socijalizmu i demokratiji,” *Problemi naše socijalističke izgradnje*, vol. 1 (Belgrade: Kultura, 1954), 196, in Bilandžić, 171.

<sup>12</sup> JoAnne Yates, *Control through Communication: The Rise of System in American Management*, (Baltimore: Johns Hopkins University Press, 1989), 7–8. See also Judith A. Merkle, *Management and Ideology: The Legacy of the International Scientific Movement* (Berkeley and Los Angeles: University of California Press, 1980); Alfred D. Chandler, Jr., *The Visible Hand: The Managerial Revolution in American Business*, (Cambridge, MA: Harvard University Press, 1977); and Sanford M. Jacoby, *Employing Bureaucracy: Managers, Unions, and the Transformation of Work in the 20th Century*, rev. ed. (Mahwah, NJ: Lawrence Erlbaum Associates, 2004).

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<sup>13</sup> See Moshe Lewin, "Rebuilding the Soviet Nomenklatura 1945–1948," *Cahiers du monde russe* 44, nos. 2–3 (2003): 219–252; and Jerry F. Hough, "The Bureaucratic Model and the Nature of the Soviet System," in *The Soviet Union and Social Science Theory* (Cambridge, MA: Harvard University Press, 2013), 49–70.

<sup>14</sup> Stephen P. Waring, *Taylorism Transformed: Scientific Management Theory since 1945* (Chapel Hill: University of North Carolina Press, 1991).

<sup>15</sup> Živojin Pavlović, *Ispijuvak pun krvi* (Belgrade: Dereta, 1990), 44, cited in Branislav Jakovljević, "Human Resources: June 1968, *Hair*, and the Beginning of Yugoslavia's End," *Grey Room*, no. 24 (2006): 42.

<sup>16</sup> Jakovljević, 43; and Milovan Đilas, *The New Class: An Analysis of the Communist System* (New York: Frederick A. Praeger, 1957).

<sup>17</sup> Eden Medina, *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile* (Cambridge: MIT Press, 2011), 62.

<sup>18</sup> Marko Grdešić, "Serbia's Anti-bureaucratic Revolution as Manipulation? A Cultural Alternative to the Elite-Centric Approach," *Comparative Studies in Society and History* 58, no. 3 (2016): 774–803.

<sup>19</sup> Petar Sorić, *Rječnik samoupravljanja* (Zagreb: Informator, 1981), 21, cited in Rory Archer, "'Antibureaucratism' as a Yugoslav Phenomenon: The View from Northwest Croatia," *Nationalities Papers* 47, no. 4 (2019): 565.

<sup>20</sup> Archer, 565.

<sup>21</sup> Archer, 564. The nationalist protests that brought Slobodan Milošević to power in the late 1980s, ultimately leading to the Yugoslav wars, were called an "anti-bureaucratic revolution" because they were directed toward government bureaucrats in the independent provinces of Vojvodina and Kosovo.

<sup>22</sup> Sebastian Felten and Christine von Oertzen, "Bureaucracy as Knowledge," *Journal for the History of Knowledge* 1 (2020): 1–16.

<sup>23</sup> John Lampe, *Yugoslavia as History: Twice There Was a Country* (Cambridge, UK: Cambridge University Press, 2000), 245–254; and Dennison Rusinow, *The Yugoslav Experiment, 1948–1974* (London: C. Hurst, 1977), 22–31.

<sup>24</sup> The description of the Soviet system as a deviation is Milovan Đilas's. See Rusinow, 54.

<sup>25</sup> On pragmatism versus idealism, see Carol S. Lilly, *Power and Persuasion: Ideology and Rhetoric in Communist Yugoslavia, 1944–1953* (Boulder, CO: Westview Press, 2001).



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<sup>26</sup> Boris Kidrič, *Socijalizam i ekonomija* (Zagreb: Globus, 1979), 60, in Darko Suvin, "Diskurs o birokraciji i državnoj vlasti u post-revolucionarnoj Jugoslaviji 1945–1974. (I)," *Politička misao* 49, no. 3 (2012): 135–159.

<sup>27</sup> Rusinow, 58.

<sup>28</sup> Vladimir Unkovski-Korica, "Workers' Councils in the Service of the Market: New Archival Evidence on the Origins of Self-Management in Yugoslavia 1948–1950," *Europe-Asia Studies* 66, no. 1 (2014): 117. Darko Suvin has analyzed the conception of bureaucracy under Yugoslav socialism from the points of view of high-ranking party cadres and key intellectual figures. See Suvin, "Diskurs o birokraciji I," 135–159; and Darko Suvin, "Diskurs o birokraciji i državnoj vlasti u post-revolucionarnoj Jugoslaviji 1945–1974. (II)," *Politička misao* 49, no. 4 (2012): 228–247.

<sup>29</sup> Edvard Kardelj, *Problemi naše socijalističke izgradnje*, vol. 1 (Belgrade: Kultura, 1954), 103, in Suvin, "Diskurs o birokraciji I," 142.

<sup>30</sup> Bilandžić, 175.

<sup>31</sup> See Sharon Zukin, *Beyond Marx and Tito: Theory and Practice in Yugoslav Socialism* (Cambridge, UK: Cambridge University Press, 1975).

<sup>32</sup> Rusinow, 58–59. For a summary of key debates from the period on the conflict between managers and workers, see Igor Stanić, "Što pokazuje praksa? Primjer funkcioniranja samoupravljanja u brodogradilištu Uljanik 1961.–1968. godine," *Časopis za suvremenu povijest* 46, no. 3 (2014): 453–474.

<sup>33</sup> Josip Županov, *Poslije potopa* (Zagreb: Nakladni zavod Globus, 1995), 20–21, in Stanić, "Što pokazuje praksa," 458.

<sup>34</sup> Miodrag Ašanin, "Zaobilazni putovi," *VUS*, 17 February 1960, 4.

<sup>35</sup> Ašanin, 4.

<sup>36</sup> Rather than having to contribute to federal investment funds, which supported regional development, individual enterprises were nominally free after the reforms to decide how to distribute their surpluses. Bilandžić, 250. For Lampe, this drive to *de-étatization* "sounded the death knell for jugoslovenstvo." Lampe, *Yugoslavia as History*, 286–87.

<sup>37</sup> Bilandžić, 250.

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<sup>38</sup> Đorđe Burić, ed., *Rade Končar, 1946–1986* (Zagreb: Rade Končar, 1986), 65. Končar was one of the first companies in Yugoslavia to own a computer, purchased in 1957. *Rade Končar: Danas i sutra*, 3.

<sup>39</sup> Burić, 64.

<sup>40</sup> *Unapređenje* has been translated here as “development,” but its meaning is perhaps closer to “improvement” in Serbo-Croatian. Equally, *poslovanje* has been translated as “business,” but it can be understood as “operations.”

<sup>41</sup> *Rade Končar, Electrical Industries and Engineering*, 11–17.

<sup>42</sup> “SUPO—Služba za unapređenje poslovanja,” *Končarevac*, no. 28 (21 June 1965): 4.

<sup>43</sup> “SUPO,” 4.

<sup>44</sup> “SUPO,” 4.

<sup>45</sup> “SUPO,” 4.

<sup>46</sup> Jon Agar, *The Government Machine: A Revolutionary History of the Computer* (Cambridge: MIT Press, 2003), 308.

<sup>47</sup> Stephen P. Waring, “Cold Calculus: The Cold War and Operations Research,” *Radical History Review*, no. 63 (1995): 33. See also William Thomas, *Rational Action: The Sciences of Policy in Britain and America, 1940–1960* (Cambridge: MIT Press, 2015).

<sup>48</sup> Agar, 329.

<sup>49</sup> “SUPO,” 4–5.

<sup>50</sup> This popularity was mainly because it managed payroll. “SUPO,” 4–5.

<sup>51</sup> Končar purchased an IBM 360, model 2040, in 1967. Končar’s adoption of IBM signals the complex history of computer technology in Eastern Europe. Soviet computers from the 1970s were clones of IBM’s System 360. See Benjamin Peters, “Normalising Soviet Cybernetics,” *Information and Culture: A Journal of History* 47, no.2 (2012): 145–175.

<sup>52</sup> V.P., “Potpisan ugovor,” 4.

<sup>53</sup> V.P., “Potpisan ugovor,” 4.

<sup>54</sup> I.K., “Automati traže zaposlenje,” *VUS*, 12 October 1960, 6. *Automation and cybernetics* were often used interchangeably and discussed as part of the same process of technological development in the industry. See, for example, Teofanija Trivunac, *Automatizacija i kibernetika* (Belgrade: Savremena Administracija, 1974).

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<sup>55</sup> Čalić published a series of books on automation. See Dušan Čalić, *Automatizacija u tehničkom napretku i privrednom razvitku Jugoslavije* (Zagreb: HAZU, 1962); and Dušan Čalić, *Neki aspekti integracije i automatizacije* (Beograd: Privredni pregled, 1963). In *Produktivnost rada i privredni razvoj SFRJ*, published in 1966, Čalić explored the “application of mechanographical tools” in business organization, basing his analysis on Rade Končar and Prvomajska (another prominent Yugoslav company).

<sup>56</sup> “Tribina 15 Dana: Suvremeni čovjek i tehnizacija,” *15 Dana* 5, no. 18 (15 June 1962): 6.

<sup>57</sup> In 1969, a series of articles appeared under the heading “Uvođenje savremene organizacije rada” (Introduction of contemporary business organization). See *Končarevac* issues nos. 201–222, published from May to November 1969. On cybernetics and electronic data management at Končar, see also I.V., “Materijalno poslovanje uz pomoć elektronike,” *Končarevac*, no. 127 (12 October 1967): 2; “Informacije i rukovođenje,” *Končarevac*, no. 155 (16 May 1968): 7; “Kretanje informacija u sistemu mrežnog planiranja i upravljanja,” *Končarevac*, no. 160 (20 June 1968): 7; Mirano Ružić, “Elektronska obrada podataka,” *Končarevac*, no. 172 (24 October 1968): 2; “Kvalitetna promjena u izgradnji moderne organizacije poduzeća,” *Končarevac*, no. 202 (5 June 1969): 1, 4; “I podaci o kadrovima putem elektroničkog sistema,” *Končarevac*, no. 207 (10 July 1969): 7; and “Projekt organizacije upravljanja proizvodnjom,” *Končarevac*, no. 204 (19 June 1969): 2.

<sup>58</sup> “Nauka i elektronsko računalo,” *Končarevac*, no. 153 (25 April 1968): 7.

<sup>59</sup> Some of cybernetics titles published by Yugoslav technologists in this period include Zlatko Kekić, *Kibernetika* (Zagreb: Privreda, 1962); Miloš Sindić, “Informacija i samoupravljanje—kibernetiski aspekti,” *Industrijska istraživanja* 2 (1964); Slavko Marjanović, *Primjena kibernetike u rukovođenju radnom organizacijom* (Zagreb: Informator, 1967); Borislav Bakić and Franjo Kranjčević, *Automatizacija poslovanja poduzeća* (Zagreb: Informator, 1967); Jovan Petrić, *Mrežno planiranje i upravljanje* (Zagreb: Informator, 1967); Mirko Marković, *Kibernetika i sistemi* (Belgrade: Institut za sisteme planiranja i upravljanja, 1970); and Mirko Marković, *Prilaz kibernetici* (Belgrade: Savremena administracija, 1972).

<sup>60</sup> “Nauka i elektronsko računalo,” 7.

<sup>61</sup> “Informacije i rukovođenje,” 7.

<sup>62</sup> “Informacije i rukovođenje,” 7.

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<sup>63</sup> Borislav Bakić, *Kibernetika i samoupravljanje* (Belgrade: Zavod za ekonomske ekspertize, 1975), 21.

<sup>64</sup> Bakić, 18–19.

<sup>65</sup> Medina, 28–29.

<sup>66</sup> There were two strands of cybernetic thinking in Yugoslavia in the 1960s and 1970s. The first emerged within New Tendencies, which brought a group of international thinkers, artists, and information technologists to Yugoslavia. The second strand was developed within technocratic circles of economists, engineers, and politicians. Within New Tendencies, however, a shift occurred in the late 1960s. The shift signaled a clear split between an earlier, radical phase of New Tendencies that sought to rethink the alienating impact of automation and its later development, which became enchanted by digital technology for its own sake: a “rationalistic technophilia,” as Armin Medosch writes. The rationalistic, instrumental view of cybernetics was embraced by Yugoslav technocrats as they sought to “reform” self-management. For more on New Tendencies, see Armin Medosch, *New Tendencies: Art at the Threshold of the Information Revolution* (Cambridge: MIT Press, 2016).

<sup>67</sup> Bakić, 23.

<sup>68</sup> Henri Lefebvre, “Sur quelques critères du développement social et du socialisme,” *Praxis International*, no. 2–3 (1965): 156–167; available in English translation as Henri Lefebvre, “Everyday Life, Socialism, Electronic Machines and Organization: Segments from ‘On some Criteria of Social Development and Socialism’ (1964),” translated by Uroš Pajović, *Communique*, no. 1 (2018), <https://readcommunique.co/one/everyday-life-socialism-electronic-machines-and-organization/>.

<sup>69</sup> Lefebvre, “Everyday Life, Socialism.”

<sup>70</sup> Trivunac, 83.

<sup>71</sup> Trivunac, 83.

<sup>72</sup> Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago: University of Chicago Press, 2006), 1.

<sup>73</sup> See, for example, David Crowley and Jane Pavitt, *Cold War Modern: Design 1945–1970* (London: V&A Publishing, 2008).

<sup>74</sup> Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (Cambridge: MIT Press, 2002).

<sup>75</sup> Zenovia A. Sochor, “Soviet Taylorism Revisited,” *Soviet Studies* 33, no. 2 (1981): 246–264.

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<sup>76</sup> Peters, 150, 165.

<sup>77</sup> In this context, the Ulm school and the writings of Tomás Maldonado had a central role.

Maldonado's conception of design practice as "scientific operationalism" entered Yugoslav discourse through international exchanges facilitated by New Tendencies and writing published in *BIT* magazine. See Tomás Maldonado, "How to Fight Complacency in Design Education?," *Bit International*, no. 4 (1969): 19–28; and Paul Betts, "Science, Semiotics and Society: The Ulm Hochschule für Gestaltung in Retrospect," *Design Issues* 14, no. 2 (1998): 67–82

<sup>78</sup> Fedor Kritovac, "Arhitektura i kompjuter," *Arhitektura*, no. 102–103 (1969): 16; emphasis in original.

<sup>79</sup> V.P., "Vrijedna interna kuverta," *Končarevac*, no. 101 (23 February 1967): 5.

<sup>80</sup> *Končarevac*, no. 1 (9 November 1964): 1. On factory newspapers as vehicles of labor politics in Yugoslavia, see Sven Cvek, "Class Culture and Yugoslav Factory Newspapers," in *The Cultural Life of Capitalism in Yugoslavia: (Post)Socialism and Its Other*, ed. Dijana Jelača, Maša Kolanović, and Danijela Lugarić (Cham, Switzerland: Palgrave Macmillan, 2017), 101–119.

<sup>81</sup> V.P., "Može li papirni put biti kraći?," *Končarevac*, no. 186 (6 February 1969): 2.

<sup>82</sup> Mladen Pavličić, ed., *Rade Končar, 1946–1976* (Zagreb: Biblioteka monografije, 1976), 82.

<sup>83</sup> Noe Maričić, "Što znači 'lik firme'?", *Končarevac*, no. 176 (21 November 1968): 5.

<sup>84</sup> Tomo Bosanac, et.al., *Rade Končar 1946–1956*, (Zagreb: Rade Končar, 1956), 25. See also "Remontna radiona i alatnica električnih strojeva 'Rade Končar' u Zagrebu," *Arhitektura* 9, no. 1–2 (1955): 24–25.

<sup>85</sup> Bosanac, 25.

<sup>86</sup> Bosanac, 25.

<sup>87</sup> By 1973 the data center was situated in the central management building at Končar's main production site in West Zagreb. I. Panjkota, "Računski centar preselio u nove prostorije," *Končarevac*, no. 396 (18 October 1973): 4–5.

<sup>88</sup> Jasenka Mihelčić, "Razgovor s Vladimirom Robotićem," *Život umjetnosti*, no. 54–55 (1993–1994): 16–23.

<sup>89</sup> Goroslav Keller, "Organizacija dizajna u Rade Končaru" *Industrijsko oblikovanje*, no. 7 (1971): 32–34. While working at CIO, Robotić also produced a report on organizing and managing a design office within industrial enterprises. See Vladimir Robotić, Fedor Kritovac, and Davorin Savnik, *Upravljanje industrijskim dizajnom / organizacija dizajn biroa* (Zagreb: CIO, 1970).

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<sup>90</sup> V. Robotić, "Kako radi dizajner—kako nastaje dizajn," *Končarevac*, no. 478 (17 July 1975): 6.

<sup>91</sup> *Industrija koja gradi industriju* (Zagreb: Rade Končar, 1977), 3.

<sup>92</sup> BOALs were now invited to take decisions that would benefit their own, small production unit rather than the overall enterprise or class interests. Bruce McFarlane, *Yugoslavia: Politics, Economics and Society* (London: Pinter Publishers, 1988), 210.

<sup>93</sup> David Crowley, "The Choreography of the Console: Electronic Environments and Their Operators," in *Re-scaling the Environment: New Landscapes of Design, 1960–1980*, ed. Ákos Moravánszky and Karl R. Kegler (Berlin: Birkhäuser, 2016), 42.

<sup>94</sup> D. Radulović, "Ergonomija i zaštita na radu," *Končarevac*, no. 583 (8 December 1977): 8.

<sup>95</sup> Mihaela Zamolo, "Ergonomija i industrijsko oblikovanje," *Industrijsko oblikovanje*, no. 1 (May–June, 1970): 61.

<sup>96</sup> On interchangeability as a key design principle in data management, see Zeynep Çelik Alexander, "The Larkin's Technologies of Trust," *Journal of the Society of Architectural Historians* 77, no. 3 (2018): 300–318.

<sup>97</sup> Marija Jeličić-Plavec, "Dizajn radne okoline nadzorno upravljačkim centrima", *Končar-Stručne informacije*, no.4 (1981): 53-58.

<sup>98</sup> Rudi Supek, "Protivurječnosti i nedorečenosti jugoslavenskog samoupravnog socijalizma," *Praxis*, 3–4 (1971): 349–350.

<sup>99</sup> Rudi Supek, *Automatizacija i radnička klasa* (Zagreb: Centar Božidar Adžija, 1965), 87–88.

<sup>100</sup> "Suvremeni čovjek i tehnizacija," 5.

<sup>101</sup> Craig Robertson, *The Filing Cabinet: A Vertical History of Information* (Minneapolis: University of Minnesota Press, 2021), 17.