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Plan Calcul: France's National Information Technology Ambition and Instrument of National Independence

The history of Plan Calcul—France's first information technology program, launched by de Gaulle's government in 1966—has been well described in the literature; however, few studies investigate the arsenal system of the program in depth. Drawing from Plan Calcul's archives, this article is the first to demonstrate that, in the context of de Gaulle's Cold War foreign policy, the French government, initially aiming to avoid an arsenal system, still became the program's funding supplier, entrepreneur, and client. Plan Calcul aimed to establish an industrial-type operation but was ultimately reduced to a state information technology arsenal program.

Keywords: Plan Calcul, France's information technology industry, arsenal strategy, 1960s

Established in 1966, Plan Calcul was a large high-tech industrial program in France promoted by de Gaulle's government. This was an adventure: the French government was taking the initiative to create an indigenous computer industry through state efforts by associating with private enterprises. According to the government, this large information program originated with an awareness among state policymakers that the rapidly growing computer industry not only would become the motor of the French electronics industry but even represented the key to the future growth of the country's economy.¹ In addition, France's information technology industry and market had almost

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¹"Rapport sur l'industrie des calculateurs électroniques," Dec. 1965, no. 65.87/COPEP, 5AG1/2606, Archives Nationales, France (hereafter, AN); "L'allocation des ressources

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fallen into the hands of American multinationals, and IBM's domination of the European market had alerted the French government that it needed to take action quickly in this key industry.² Notably, Bull, which could have been a French national champion in that industry, was acquired by General Electric (GE) in 1964 (referred to as the "Bull affair"). After losing France's leading punch card machine manufacturer, and in light of other factors such as the announcement of the IBM 360 series and Washington's refusal to deliver the supercomputer in 1966, the French government became more determined to establish an autonomous computer industry to reduce its dependence on the United States.³

After the early 1960s, the penetration by American multinationals into French industry with massive amounts of capital and advanced technology, the acquisition of French companies, and the domination of the French market had begun to provoke a certain degree of anxiety and hostility in French society.⁴ Jean-Jacques Servan-Schreiber's 1960s bestseller, *Le défi américain* (The American challenge), embodied French society's fear of the imagined colonization of Europe by U.S. multinationals.⁵ In terms of the information technology field, American multinationals had already been firmly installed in the European office equipment market as early as the 1950s, and they greatly expanded their activities in Europe following the creation of the European Economic Community (EEC) market.⁶ The United States held an overwhelming lead in terms of both the number of computers sold and manufacturing capacity.⁷ From 1965 to 1966, American enterprises dominated 90 percent of global information technology equipment and programming markets.⁸ Among American computer manufacturers,

consacrées à la recherche intéressant l'industrie (Rapport Saint-Geours)," 1 Oct. 1965, B-0070010, Centre des Archives Economiques et Financières, France (hereafter, CAEF).

² "Rapport à fin de décision sur la comptabilité administrative du Ministère du Développement Industriel et Scientifique (Rapport Lagaillarde)," 5 Apr. 1973, no. 72-955, 20160541/92, AN; "Rapport sur les industries de pointe," confidential report, Mar. 1969, 19890575/98, AN.

³ Pierre-Éric Mounier-Kuhn, "Le Plan Calcul, Bull et l'industrie des composants," *Revue Historique* 591 (1994): 123-26; "Note à Monsieur le Ministre pour son entrevue avec M. Boiteux," n.d., 5AG1/2627, AN; Rapport Saint-Geours, B-0070010, CAEF; "Plan Calcul Becomes Operative," Paris Embassy to State Department, 11 Oct. 1966, no. A-573, box 1070, RG 59, U.S. National Archives and Records Administration, Washington, DC (NARA).

⁴ Richard F. Kuisel, *Le miroir américain* (Paris, 1996), 255-58.

⁵ Jean-Jacques Servan-Schreiber, *Le défi américain* (Paris, 1967).

⁶ Elisabetta Mori, "Coping with the 'American Giants,'" *IEEE Annals of the History of Computing* 41, (2019): 85.

⁷ "La situation de l'industrie électronique française (Rapport de Bernard Kuhn de Chizelle)," Apr. 1966, 640AP/96, AN; "Une nouvelle politique économique ou les aspects industriels du Plan Calcul," Aug./Sept. 1969, 19810642/8, AN; *Le Figaro*, 16 Mar. 1966.

⁸ "Participation de l'Etat au développement des secteurs de pointe. Cas de l'informatique," confidential document, no. 69/25/COPEP, 19 Feb. 1969, 19890575/98, AN.

IBM, which occupied a leading role, held 65 percent of the global computer market and 64 percent of the European market in 1964–1965.⁹ IBM's French subsidiary, IBM-France, occupied 70 percent of the French market in 1966; the market share of the second-largest computer manufacturer, GE-Bull, was only 15 percent.¹⁰

The American computer manufacturers were able to dominate worldwide computer markets because of their leading technology. Owing to high military demand during the Cold War, Washington continued to provide extensive financial support and public procurements to the domestic computer technology industry, which laid the essential foundations that allowed U.S. multinationals to subsequently dominate global markets.¹¹ Moreover, the United States established a comprehensive and solid economic and industrial infrastructure in the field early. Apart from providing better price performance and reliable hardware backed by structurally robust and advanced components and peripheral industries and easy-to-use software tools, the American information technology industry also had a vast international commercial network and a strong after-sales service system. The United States had extensive public and private laboratories, strong university-industry links, and abundant information technology specialists. A huge number of office appliances were installed in American enterprises very early, and a large class of knowledge workers became an essential component of the economy; this base of experience provided vast fertile ground for the subsequent development of the computer industry.¹²

European governments and their domestic manufacturers were highly concerned about the predominance of American multinationals, particularly IBM, on the European computer market. Since that time, to compete with the “American Giants,” there have been a number of mergers between domestic firms as well as agreements to form European consortiums.¹³ As early as the 1950s, the British government had already

⁹ *Entreprise*, 2 June 1966; *Entreprise*, 16 June 1966; *Le Figaro*, 16 Mar. 1966.

¹⁰ “Développement de la Compagnie Internationale pour l'Informatique dans le cadre du Plan Calcul,” confidential report, 12 Jan. 1967, no. P.17.254, 19930277/228, AN.

¹¹ James W. Cortada, *The Digital Hand*, vol. 3 (New York, 2008), 49, 52, 54–57; Cortada, “Progenitors of the Information Age,” in *A Nation Transformed by Information*, ed. Alfred D. Chandler Jr. and James W. Cortada (Oxford, 2003), 189–90, 213; Cortada, *The Computer in the United States* (New York, 2015), 67–74; Paul N. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, MA, 1996), 43–44, 60–65.

¹² William J. Baumol, Sue Anne Batey Blackman, and Edward N. Wolff, “Is the United States Becoming an Information Economy?,” in *Rise of the Knowledge Worker*, ed. James W. Cortada (Boston, 1998), 153–56; Cortada, “Progenitors of the Information Age,” 179–92, 196–200, 203–4; Stuart W. Leslie, *The Cold War and American Science* (New York, 1993), 14–43.

¹³ Martin Campbell-Kelly and Daniel D. Garcia-Swartz, *From Mainframes to Smartphones: A History of the International Computer Industry* (Cambridge, MA, 2015), 88–92; Mori, “Coping,” 83–96.

supported domestic firms with technology policies to address the challenges that the American computer industry presented. It encouraged British computer manufacturers to undertake mergers and acquisitions and to participate in international cooperation. Under this policy, in 1968 the three British computer manufacturers joined together to form a national champion of the British computer industry: International Computers Ltd. (ICL).¹⁴ The previous year, the German government had imitated France's Plan Calcul to launch its own Plan Calcul and sought to make a national champion of Siemens.¹⁵

France decided to create a French computer national champion in response to the huge challenge posed by American industry. Following the Report of the Commissaire Général du Plan (the Ortolí Report), the interministerial committees of the session of July 19, 1966, confirmed the establishment of Plan Calcul and outlined its policies.¹⁶ The total funding of the first phase of Plan Calcul (1967–1971) exceeded one billion francs; the state provided 460 million francs in subsidies in the form of research contracts, and the manufacturing firms took responsibility for the rest.¹⁷ In addition, the government offered the program various preferential loans and guarantees and offered public and para-public procurement. The Délégation à l'informatique (Delegation for information technology), an ad hoc government agency attached to the prime minister, was in charge of policymaking and coordinating plan activities. As with the large-scale national programs in other industries, the French government also created a national champion in the information technology field—Compagnie Internationale pour l'Informatique (CII)—to execute Plan Calcul and to assume the leading role in the industry. CII was a private enterprise formed by the merger of two French-owned computer companies, Compagnie Européenne d'Automatisme Électronique (CAE) and Société d'Électronique et d'Automatisme (SEA). Apart from the core company (CII), Plan Calcul also involved a peripherals manufacturer, a component manufacturer, and two research institutions: Institut national de Recherche en Informatique et en

¹⁴ Martin Campbell-Kelly, *ICL: A Business and Technical History* (Oxford, 2005), 201–63; Richard Coopey, "Empire and Technology: Information Technology Policy in Postwar Britain and France," in *Information Technology Policy*, ed. Richard Coopey (Oxford, 2014), 150; James W. Cortada, "Public Policies and the Development of National Computer Industries in Britain, France, and the Soviet Union, 1940–80," *Journal of Contemporary History* 44, no. 3 (2009), 498–502.

¹⁵ James W. Cortada, *The Digital Flood* (Oxford, 2012), 126–32; Campbell-Kelly and García-Swartz, *From Mainframes to Smartphones*, 91–92; "Suite à la demande de M. le Directeur," 19 June 1968, 19910817/13, AN.

¹⁶ "Relevé des décisions du Conseil restreint du 19 juillet 1966 consacré au développement des secteurs de pointe," n.d., 19910817/12, AN; Rapport Lagaillarde, 20160541/92, AN.

¹⁷ "Convention," confidential document, n.d., 19930277/228, AN; Galley to Premier Ministre, 19 July 1967, no. 67.295/INFORM, 19820263/1, AN; *Le Monde*, 14 Apr. 1967.

Automatique (IRIA) and Laboratoire d'Électronique et de Technologie de l'Informatique (LÉTI).¹⁸

The French government believed that the only way to compete with the large U.S. computer multinationals was to cooperate with other European partners to build a pan-European consortium. Thus, following the designation of a French national champion and the early establishment of a solid French computer industry in the first phase of Plan Calcul, the second phase (1971–1975) was designed to immediately begin development of an international strategy.¹⁹ In 1972, France's national champion, CII, and Germany's national champion, Siemens, began to actively negotiate the creation of a European champion. Later, the Dutch company Philips joined the venture, and in 1973, Philips, CII, and Siemens formed a European joint venture, Unidata.²⁰

The government's pursuit of national independence led French electronics industry policy in the direction of a dirigiste economic regime throughout de Gaulle's presidency.²¹ France has a long tradition of dirigisme; the state has actively intervened in the economy since the Colbert era in the seventeenth century.²² Nevertheless, Plan Calcul's policymakers initially affirmed that this extensive information technology program had intended to avoid an arsenal pattern. Jean-Jacques Salomon, a French historian of science, coined the term "arsenal strategy" to describe the trend of France's post-World War II technology policy. In the arsenal strategy, the state plays the role of banker, entrepreneur, supervisor, and client. Simply put, the state took on the role of the nation's "industrial architect."²³ The advanced industrial practices adopted by the Soviet Union in the post-World War II era were based on an arsenal model, albeit a Soviet-style arsenal model, which differed

¹⁸ "La mise en oeuvre du 'Plan-Calcul,'" n.d., 19810642/9, AN; Rapport Lagailarde, 20160541/92, AN; Mounier-Kuhn, "Plan Calcul," 123; Alain Beltran and Pascal Griset, *Histoire d'un pionnier de l'informatique: 40 ans de recherche à l'INRIA* (Les Ulis, 2007), 33–36; *Entreprise*, 2 June 1966.

¹⁹ "La politique européenne de la C.I.I.," n.d., 19810642/9, AN; "Rapport sur l'industrie des calculateurs électroniques (Rapport Ortoli)," 13 July 1966, 19930277/228, AN.

²⁰ Jean-Michel Quatrepoint and Jacques Jublin, *French ordinateurs: de l'affaire Bull à l'assassinat du Plan Calcul* (Paris, 1976), 78–87, 93–95; Eda Kranakis, "Politics, Business, and European Information Technology Policy," in Coopey, *Information Technology Policy*, 234–35; Susanne Hilger, "The European Enterprise as a 'Fortress,'" in *The European Enterprise*, ed. Harm G. Schröter (Berlin, 2008), 141, 147–48.

²¹ Beltran and Griset, *Histoire*, 15; Pierre-Éric Mounier-Kuhn, *L'informatique en France: de la seconde guerre mondiale au Plan Calcul* (Paris, 2010), 16.

²² Elie Cohen, *Le Colbertisme "high tech"* (Paris, 1992), 108–11; Jean-Jacques Salomon, *Le gaulois, le cow-boy, et le samourai: la politique française de la technologie* (Paris, 1986), 13.

²³ Salomon, *Gaulois*, 13, 38, 117; Cohen, *Colbertisme*, 90, 176–77; Yves Bouvier, "La recherche, interface privilégiée entre la Compagnie Générale d'Électricité et l'État (années 1950–années 1990)," in *Entreprises de haute technologie, État et souveraineté depuis 1945*, ed. Patrick Fridenson and Pascal Griset (Paris, 2013), 65–69.

from that of the French in terms of power framework and intervention type. The USSR began to adopt an “administrative-command economy” in the 1930s. This type of closed system is separate from normal economic circuits and private markets, and all the factors of production are affected by the specific purposes of the state’s programs.²⁴ In such a system, the military technological innovations rarely spilled over into civilian sectors, and any reform would be hampered if it infringed on the existing power hierarchies or the Communist Party’s authority. One of the key factors of the failure of Soviet network ambitions was in the conflicts that arose among institutional and individual self-interests.²⁵

In the open “state-industry” system that emerged as a result of U.S. large-scale advanced technology programs, the government subcontracts the research and development (R&D) and production of large-scale defense and space programs to the private sector. Apart from meeting the needs of the state, the research results can be commercialized and transferred to civil markets. Thus, implementing such a program indirectly stimulates the development of industry and the growth of the general economy. Typical examples include such important projects as the U.S. Navy’s “Project Whirlwind,” which established real-time computing; the U.S. Air Force’s Semi-Automatic Ground Environment (SAGE) air defense program, which developed many key technological innovations for civilian computing; and the U.S. Department of Defense’s Advanced Research Projects Agency Network (ARPANET), the predecessor of the Internet. To a large extent, it was the military’s enormous and sustained investment in R&D and its technology transfers that laid the foundations for the development of the American computer industry. IBM was the primary beneficiary of the state-industry system in the computer field, which explains why IBM became the industry’s world leader.²⁶

Some important government reports, including the Boiteux Report and the Ortolini Report, indicated that Plan Calcul’s objectives were of

²⁴ Benjamin Peters, *How Not to Network a Nation: The Uneasy History of the Soviet Internet* (Cambridge, MA, 2016), 57–59, 72–73; Paul R. Gregory, *The Political Economy of Stalinism* (Cambridge, U.K., 2003), 1–2, 127, 156; Cohen, *Colbertisme*, 177; “Une nouvelle politique économique,” 19810642/8, AN.

²⁵ Peters, *How Not to Network*, 79, 81–105, 160–189; Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (Cambridge, Mass., 2002), 266–268.

²⁶ “Une nouvelle politique économique,” 19810642/8, AN; Arthur L. Norberg and Judy E. O’Neill, *Transforming Computer Technology: Information Processing for the Pentagon, 1962–1986* (Baltimore, 1999), 4–23, 69–74; 153–196; Edwards, *Closed World*, 43–65, 75–111, 353; Kent C. Redmond and Thomas M. Smith, *From Whirlwind to MITRE: The R&D Story of the SAGE Air Defense Computer* (Cambridge, Mass., 2000), 1–261; Cortada, *Digital Hand*, 52–55; Cortada, “Progenitors of the Information Age,” 205; James W. Cortada, *IBM* (Cambridge, Mass., 2019), 167–170; Alfred D. Chandler Jr., *Inventing the Electronic Century* (Cambridge, Mass., 2005), 82–94; Leslie, *Cold War*, 32–37.

an industrial nature; the aim of the program was to create a veritable industry instead of an arsenal destined to meet national requirements.²⁷ One of Plan Calcul's initiators and apologists, Pierre Audoin, pointed out that Plan Calcul was not designed to supply nuclear weapons and fulfill the needs of government agencies but rather to establish a nationally owned computer industry.²⁸ The president of the Permanent Electronics Commission of the Plan (COPEP), which was in charge of the development of the French electronics industry and played an important role in Plan Calcul, also emphasized that a core French information technology industry, as constituted by Plan Calcul, had to possess the ability to confront fierce competition from American companies and avoid becoming a protected, state-subsidized industry.²⁹ The French government expressed the expectation in the first aid agreement that CII could soon be independent from government subsidies, with its profitability and its industrial and commercial autonomy ensured. Obviously, by initially choosing the state-industry system of the United States, Plan Calcul avoided adopting the arsenal system of the Soviet Union.³⁰

Even though the protagonists of Plan Calcul and some reports emphasized that Plan Calcul aimed to establish a veritable industry instead of a state arsenal, an in-depth study in this article of the relevant documents indicates that the program's subsequent development ran counter to its initial purposes. Historian Richard Coopey even described the first phase of Plan Calcul as having "amounted to a Soviet-style 5-year plan."³¹ Such an inclination corresponds with Salomon's arsenal strategy thesis. Unfortunately, Salomon did not analyze Plan Calcul. This article uses Plan Calcul's archives, which were gradually made public but are not yet in common use, and shows that the program involved certain political considerations. However, such political considerations were comprehensible in the context of the pursuit of "national independence,"

²⁷ "Rapport intermédiaire de la Commission Calculateurs Développement (Rapport Boiteux)," confidential report, 1965, no. 1065 PD/VP, 5AG1/2627, AN; Rapport Ortol, 19930277/228, AN; "Rapport sur l'industrie des calculateurs électroniques," 5AG1/2606, AN; "Collaboration Franco-Britannique en matière de Calcul Electronique," secret document, 9 Aug. 1965, 5AG1/2627, AN.

²⁸ "Une nouvelle politique économique," 19810642/8, AN; "Philosophie du Plan Calcul," n.d., 19820263/1, AN. Pierre Audoin was secretary general of the Commission Permanente de l'Électronique du Plan (COPEP) and a member of the Délégation à l'Informatique. He was the principal author of the Ortol Report, which first introduced Plan Calcul. See Maurice Allègre, "La politique informatique française et son avenir," in *Le général de Gaulle et la recherche scientifique et technique*, ed. Fondation Charles de Gaulle (Paris, 2003), 91; and Quatrepoint and Jublin, *French ordinateurs*, 37.

²⁹ "Suite à la demande," 19910817/13, AN.

³⁰ "Convention," 19930277/228, AN; "Texte de convention," confidential document, 26 Sept. 1966, 19910817/12, AN; Salomon, *Gaulois*, 38; Alain Peyrefitte, "Un domaine réservé," in *De Gaulle et la technologie*, ed. Gilles Marchandon and Patrice Noailles (Paris, 1993), 237.

³¹ Coopey, "Empire and Technology," 161.

which was one of the principal objectives of de Gaulle's foreign policy in the Cold War. Because of both political considerations and the manufacturers' egoism, the plan objective shifted its primary focus of operations away from the business computer and private-sector markets and instead relied on the procurements of administrative agencies and state-owned enterprises. Plan Calcul, which should have been a national large-scale industrial information technology program, proved in fact to be an information technology arsenal program that only met the national requirements.

Strategies Influenced by Political Considerations

One of Plan Calcul's industrial objectives was to direct production toward the most promising market: business computers.³² In 1964, business computers accounted for 70 percent of all computers available in France, while scientific computers represented 28 percent and process control computers accounted for only 2 percent.³³ Government reports and ministerial documents of that time mentioned that within a few years, the largest market for computers would be business and the private sector. Plan Calcul needed to concentrate its main production activity on business computers and increase its commercial orientation toward civil markets; if the future target market was confined to government clients, Plan Calcul would be doomed to failure.³⁴ In France, the business computer market was dominated almost completely by U.S. firms. To prevent manufacturers from being overwhelmed by American enterprises while also having access to the highly profitable business computer market, the French government decided to confront IBM. However, despite the government's initial intentions, the subsequent development showed that political considerations often outweighed economic motives. These political considerations were one of the major factors that, counter to the program's initial objectives, gradually led Plan Calcul toward the arsenal pattern.

Such political considerations can first be observed in the specialties of the manufacturers participating in Plan Calcul. CAE was the common subsidiary of two French electronics manufacturers, La Compagnie Générale d'Électricité (CGE) and La Compagnie Générale de Télégraphie

³² Rapport Boiteux, 5AG1/2627, AN; "Développement de la Compagnie Internationale," 19930277/228, AN; "Propositions pour un Plan Calcul," n.d., 640AP/96, AN.

³³ "Rapport sur l'industrie des calculateurs électroniques," 5AG1/2606, AN.

³⁴ "Note sur les conditions du développement d'une industrie de calculateurs," strictly confidential document, 8 June 1965, no. 975/MT-V°P., 5AG1/2627, AN; "Rapport sur l'industrie des calculateurs électroniques," 5AG1/2606, AN; "Situation de l'informatique en France," strictly confidential document, 18 Mar. 1968, 19820263/1, AN; "Suite à la demande," 19910817/13, AN.

Sans Fil (CSF), both of which were among the “rescue team” formed by the French government to save Bull in the “Bull affair.”³⁵ CAE, which specialized in military applications and medium-sized scientific computers, mainly produced the process control computers required for nuclear power and contributed to the country’s strike force (*force de frappe*).³⁶ The other French-owned manufacturer, SEA, had experience in computer manufacturing and possessed its own technologies. SEA had long specialized in scientific applications, and most of its technical support came from the military.³⁷ All of them—CAE, SEA, and both parent companies—had largely insufficient experience in business computers. Aside from IBM-France, Bull was the only French computer manufacturer with the ability to offer a relatively complete range of computers, particularly business computers; it also possessed a solid international commercial network.³⁸ However, the French government excluded Bull from Plan Calcul and instead chose CAE and SEA, two small companies that had consistently played a role in the state’s “arsenal,” to merge into one firm: CII. The fact that the French government used teams specializing in scientific computers and automation to challenge the specialties of IBM and Bull in the business computer field led French historian of technology Pierre-Éric Mounier-Kuhn to criticize Plan Calcul as a technical and commercial program that was difficult to maintain.³⁹

Since Plan Calcul was targeted at the business computer market, why would Bull, whose specialty was the most appropriate for the plan, be excluded? Bull’s exclusion was, to a large extent, due to political considerations. One explanation is that CAE intended to continue to develop scientific computers, a domain where it held sufficient mastery. CAE was afraid that including Bull would focus CII’s main activity on business computers and provoke a power struggle.⁴⁰ Furthermore, since Bull concentrated its production on business computers,

³⁵ “Compte rendu du Comité interministériel,” secret document, 4 Feb. 1964, B-0023587, CAEF; “Compagnie des Machines Bull,” 31 Jan. 1964, B-0023585, CAEF.

³⁶ “CAE—Compagnie européenne d’Automatisme Électronique,” Feb. 1966, 640AP/96, AN; “Action Calcul: choix et bilan technique,” secret report, 1 July 1966, 19810642/8, AN; Pierre-Éric Mounier-Kuhn, “L’industrie informatique française de 1945 aux années soixante,” in *Informatique, politique industrielle, Europe: entre Plan calcul et Unidata*, ed. Pascal Griset (Paris, 1998), 16.

³⁷ “Société d’Électronique et d’Automatisme,” Feb. 1966, 640AP/96, AN; Pierre-Éric Mounier-Kuhn, “Product Policies in Two French Computer Firms: SEA and Bull (1948–64),” in *Information Acumen*, ed. Lisa Bud-Frierman (London, 1994), 113, 115.

³⁸ “Politique industrielle en matière de traitement et de transmission de l’information,” confidential report, 10 Feb. 1966, 19930277/234, AN; “Propositions de la SEA,” confidential document, 4 Feb. 1966, 19910817/12, AN; Jean-Pierre Brulé, *L’informatique, malade de l’Etat* (Paris, 1993), 120.

³⁹ Mounier-Kuhn, “L’industrie informatique française,” 19.

⁴⁰ Mounier-Kuhn, “Plan Calcul,” 146.

refused to develop military computers, and even interrupted its scientific computer operations in 1963, from the French government's perspective it was a backward, antiquated, punch card tabulating machine manufacturer that was completely inappropriate for the state's modern large-scale technology programs.⁴¹ Although Bull was acquired in 1964 by General Electric, which possessed advanced technologies, the French government believed that Bull had already lost its technical potential and would merely become one of GE's many factories worldwide. The French government also believed that, in circumstances where the world's computer markets were dominated by American firms, the eastern European markets represented one of the few opportunities for the expansion of the French electronics industry; however, the U.S. government restricted American companies (including GE-Bull) from exporting certain techniques and products to Soviet bloc countries.⁴²

However, these considerations were less important than the major concern of the French government: national independence. The report of the French Planning Commission explicitly declared the following:

The extent of the program of action to be selected raises a final question that is essential since it is related to the specific objectives that the state pursues by encouraging the creation of a computer industry. In fact, apart from the concern to establish, on the basis of sufficient independence, an industry that will be one of the most important industries in the last decades of the twentieth century, the state is concerned about having, without foreign veto, the materials needed to implement its military or scientific policy. The program, drawn up in agreement with French companies, takes, as we shall see, this legitimate requirement into account.⁴³

CAE and SEA, both French-owned companies that had long cooperated with the French government, were naturally the preferred choice. The French authorities understood the benefits Bull could bring to Plan Calcul; however, from the government's perspective, Bull, having been acquired by GE, was now an "American company." Its decision-making center, which was located outside mainland France, would definitely affect the independence and development of the French computer industry. The French government assumed that it would be difficult to ask Bull, given its current situation, to meet its requirements to operate

⁴¹ Pierre-Éric Mounier-Kuhn, "Calculateurs électroniques et nouveaux systèmes d'armes: Interactions armées/recherche/industrie, 1946–1959," in *La IV^e République face aux problèmes d'armement*, ed. Maurice Vaisse (Paris, 1998), 375, 404; Mounier-Kuhn, "Plan Calcul," 143–44; "Société d'Électronique et d'Automatisme," 640AP/96, AN.

⁴² Pierre Davous, "Naissance de la filière électronique," in Griset, *Informatique, politique industrielle, Europe*, 67; "Politique industrielle en matière de traitement," 19930277/234, AN.

⁴³ Rapport Ortoli, 19930277/228, AN.

under the Plan Calcul framework set by the government and to follow the policy outlines.⁴⁴

The shift of Plan Calcul's main objectives from the planned focus on the business computer and private-sector markets to the scientific, military computer, and public-sector markets was also related to the position adopted by the participating manufacturers. In fact, early in the planning stage of Plan Calcul, the parent companies of CII were already showing reluctance to concentrate the company's major activity on business computers. The manufacturers—considering the high risk involved in the business computer market and the critical situation in the French business computer market, which was largely dominated by IBM and GE-Bull—were unwilling to enter into this domain and compete with these two companies. CII was still in its infancy, and confronting American companies such as IBM and GE-Bull early on would doom the company to failure. Moreover, France's experience in the business computer field was three to four years behind that of the United States, and the precedent of Britain's unsuccessful entry in the business computer market further discouraged them. In addition, both CAE and SEA were too small in scale and had too little experience to engage in the business computer market, and they both lacked a vast trading network—which is the main explanation for the failure of the "SEA 3900" business computer in the early 1960s.⁴⁵

The manufacturers' proposals and the selection of CII's core products also revealed that, in fact, Plan Calcul had no intention of aiming at private markets; instead, its target was a noncompetitive market. The 1965 report of the French Planning Commission suggested that Plan Calcul should focus its efforts on developing the small-sized computers needed by the private sector, which would be the new market for the information technology industry.⁴⁶ However, Plan Calcul excluded Bull, which possessed the manufacturing capabilities for small-sized business computers, and instead chose the medium and large-sized computers needed by government agencies as the program's core product.⁴⁷ In the preparation stage of Plan Calcul, SEA proposed focusing its main activities on the fields of small-sized business

⁴⁴ "Pourquoi ne pas avoir choisi Bull-General-Electric comme maître d'œuvre du Plan Calcul?," n.d., 19820263/1, AN; "Les raisons pour B.GE d'une politique de collaboration avec le Plan Calcul, et les éléments de cette politique," n.d., 640AP/96, AN.

⁴⁵ "Propositions relatives au Plan Calcul," confidential report, 10 June 1966, 19810642/8, AN; "Données principales d'un Plan Calcul," secret document, 2 May 1966, 19930277/229, AN; "Action Calcul," 19810642/8, AN; "Suite à la demande," 19910817/13, AN; Rapport Ortolì, 19930277/228, AN; Mounier-Kuhn, "SEA and Bull," 115; *Entreprise*, 2 June 1966.

⁴⁶ "Rapport sur l'industrie des calculateurs électroniques," 5AG1/2606, AN.

⁴⁷ Mounier-Kuhn, "Plan Calcul," 148; "Développement de la Compagnie Internationale," 19930277/228, AN.

and scientific computers.⁴⁸ Compagnie Internationale des Techniques Électroniques de Contrôle (CITEC), which was in charge of overseeing the interests of CAE's two parent companies, offered a contrasting proposal to exclude small-sized business computers in the first phase and to develop CAE's specialty, medium-sized computers.⁴⁹ In the eyes of the French government, CITEC-CAE's proposal offered more advantages at a commercial level and could ensure the company's short- and medium-term financial stability.⁵⁰ The development of medium-sized computers could also avoid direct confrontation with IBM and GE-Bull in the fiercely competitive small-sized business computer and very large scientific computer markets.⁵¹ Furthermore, CITEC-CAE's proposal could also strike an ideal balance between civil and military needs. It completely met the expectations of the French Ministry of the Armed Forces and satisfied the state's important goal—to supply the large military computers needed by the French Atomic Energy Commission and the nuclear weapons strategic programs.⁵² The French government preferred CITEC-CAE's proposal from the beginning and eventually adopted this conservative proposal.⁵³ This decision allowed CITEC-CAE to dominate Plan Calcul's direction of development, and thus the program strayed from the business computer field and private markets and returned to the traditional scientific and military computer markets and the public-sector markets.⁵⁴

Information Technology and National Independence

France sought to establish an autonomous information technology industry that was closely related to its advanced industry policy; this advanced industry policy was a crucial part of the “national independence” objective of the de Gaulle government's foreign policy during the Cold War. After he returned to power, de Gaulle made every effort

⁴⁸ “Propositions de la SEA,” 19910817/12, AN; “Le problème calculateur: point de vue de la SEA,” 9 Feb. 1966, 5AG 1/2628, AN.

⁴⁹ “Action calcul: Proposition CITEC d'un plan progressif à creneaux cohérents,” 14 Mar. 1966, 5AG 1/2628, AN; “Action Calcul,” 19810642/8, AN.

⁵⁰ “Elements techniques,” confidential report, 1965, 5AG1/2627, AN; Rapport Boiteux, 5AG1/2627, AN; Rapport Ortol, 19930277/228, AN.

⁵¹ “Propositions pour un Plan Calcul,” 640AP/96, AN; “Données principales d'un Plan Calcul,” 19930277/229, AN; *Entreprise*, 16 June 1966; *Économie*, 20 Apr. 1967.

⁵² “Action calcul: Proposition CITEC d'un plan synchronisé répondant aux besoins civils et militaires,” confidential report, 2 June 1966, 640AP/96, AN; “Action calcul: Plan proposé par C.I.T.E.C.,” confidential note, 5 July 1966, SG/69/CLC, 640AP/96, AN.

⁵³ “Rapport sur les résultats des contrats de définition calculateurs,” secret report, 30 Sept. 1965, 640AP/96, AN; “Elements techniques,” 5AG1/2627, AN.

⁵⁴ Coopey, “Empire and Technology,” 160; Mounier-Kuhn, “Plan Calcul,” 146, 149; “Action calcul,” 2 June 1966, 640AP/96, AN.

to break the Cold War's bipolar system of confrontation between the Western and Eastern blocs to restore France's independence with regard to the United States and France's *grandeur* of the past. For de Gaulle, the two weapons used by the United States to "dominate" the Western bloc in the Cold War bipolar system were nuclear force and the economy. The only way to build a strong and independent country in a bipolar world and to get rid of the "protectorate" role of the United States was to possess independent and autonomous capabilities in both the economy and defense. One indispensable step toward economic autonomy was to resist the domination of American investment in French industries, particularly in key sectors. The necessary condition for an independent defense was to develop a nuclear weapon. One way to achieve these two aims was through the development of *grandes opérations* (large-scale national programs).⁵⁵ As defined by the Saint-Geours Report, the *grandes opérations* were highly concentrated in defense and high-technology industries such as nuclear energy, space exploration, supersonic transatlantic aircraft, and computers.⁵⁶ These advanced industries, particularly the nuclear weapons industry, were the most crucial part of the goal of attaining "national independence." In de Gaulle's view, France was unable to achieve military independence without developing independent advanced industries; in turn, an independent international policy would not be possible without an independent military. Thus, the government should invest in advanced R&D in close cooperation with the nation's arsenals.⁵⁷

The great importance attached to scientific and military computers was, to a certain extent, closely related to such advanced industry planning. Since information technology is the "neural system" of the modern great power and could provide France with an essential factor of independence, control of the information technology could lead to the overall control of nuclear power.⁵⁸ De Gaulle's persistence in

⁵⁵ Richard F. Kuisel, "The American Economic Challenge," in *De Gaulle and the United States*, ed. Robert O. Paxton and Nicholas Wahl (Oxford, 1994), 196–98; Kuisel, *Miroir américain*, 224–32, 258–62, 299; René Girault, Robert Frank, and Jacques Thobie, *La loi des géants, 1941–1964* (Paris, 2005), 141–42, 504–6; Maurice Vaisse, "L'indépendance nationale, d'une République à l'autre," in *Pierre Guillaumat, la passion des grands projets industriels*, ed. Georges-Henri Soutou and Alain Beltran (Paris, 1995), 36–38; Jean Doise and Maurice Vaisse, *Diplomatie et outil militaire: politique étrangère de la France, 1871–2015* (Paris, 2015), 595, 602, 607.

⁵⁶ Rapport Saint-Geours, B-0070010, CAEF.

⁵⁷ Frédéric Fogacci, ed., *De Gaulle et la défense de la France, d'hier à aujourd'hui* (Paris, 2017), 133–34; Peyrefitte, "Un domaine réservé," 234–38.

⁵⁸ Gabrielle Hecht and Paul N. Edwards, "Les techniques de la guerre froide dans une perspective mondiale: le nucléaire et l'informatique comme systèmes technopolitiques," in *Deux siècles d'histoire de l'armement en France*, ed. Dominique Pestre (Paris, 2005), 168; Mounier-Kuhn, "Interactions armées/recherche/industrie," 403.

achieving his goal of obtaining autonomous nuclear and computer industries was driven not only by his resistance to “American hegemony” and his response to the challenge of competing with U.S. multinationals but also by the United States’ refusal to offer aid to France in support of developing certain core technologies. Indeed, Washington’s refusal to deliver the supercomputer, Control Data’s CDC 6600, for French atomic bomb research in 1966 caused problems for the French Atomic Energy Commission.⁵⁹

In a letter to Prime Minister Pompidou, de Gaulle gave instructions for the quick implementation of a French electronics industry policy in the Fifth Plan context, noting that the electronics industry would be a necessary precondition for a powerful and independent French economy. He prioritized four electronics industries, including computers.⁶⁰ The second Délégué à l’informatique (Delegate for information technology), Maurice Allègre, emphasized that the objective of Plan Calcul was to build a genuine industry instead of a type of arsenal.⁶¹ However, the first Délégué à l’informatique, Robert Galley, declared that de Gaulle’s initial motivation in developing France’s computer industry was based on the need for nuclear weapons and national independence; it was not until Pompidou’s government that the fundamental idea truly obtained an industrial orientation.⁶² In a speech before de Gaulle and the nation’s ministers and officials, Galley made clear that in the near future, Plan Calcul’s objective would be the realization of a very large scientific computer destined for the development of the hydrogen bomb and computers designed to meet defense and administrative requirements.⁶³ The Nora Report of 1978 pointed out that France’s original aim in obtaining large-scale computers was driven by military independence considerations and the French government’s intention to design computers for the development of nuclear weapons.⁶⁴ A number of secret official documents also reveal that one of the main reasons France tried to establish a nationally owned computer industry

⁵⁹ “Position du C.E.A. sur le problème des calculateurs,” 26 Apr. 1966, 19820263/3, AN; “Calculatrices,” n.d., no. AG.D-66.34, 20110333/14, AN.

⁶⁰ Général de Gaulle to Premier Ministre, n.d., 5AG1/2448, AN.

⁶¹ Allègre, “Politique informatique française,” 96, 108. Maurice Allègre, a member of the prime minister’s cabinet who was one of the initiators of Plan Calcul, had also persuaded the prime minister to promote the development of France’s information technology industry. See Allègre, 91–92; and Quatrepoint and Jublin, *French ordinateurs*, 36–37.

⁶² Robert Galley, “Le duo de Gaulle-Pompidou,” in Marchandon and Noailles, *De Gaulle et la technologie*, 245. Robert Galley was a Gaullist who came from the Atomic Energy Commission. See Jean-Pierre Daviet, “Pierre Guillaumat et l’enrichissement de l’uranium 1952–1962,” in Soutou and Beltran, *Pierre Guillaumat*, 142; and Quatrepoint and Jublin, *French ordinateurs*, 31–33.

⁶³ “Les problèmes actuels de l’informatique (par Robert Galley),” 14 Feb. 1967, 19820263/3, AN.

⁶⁴ Simon Nora and Alain Minc, *L’informatisation de la société* (Paris, 1978), 13, 63.

was to meet military and space requirements and to avoid the risk of embargo stemming from a dependence on a few U.S. suppliers for essential defense devices.⁶⁵

The French Ministry of the Armed Forces was the first department to take concrete action in the computer field and became an important participant. Convinced that “political, military and economic independence requires having a nationally owned electronic computing industry,” the Ministerial Delegation for Armament and the General Delegation for Scientific and Technical Research (DGRST) launched France’s computer industry, engaging in basic and technical research from 1963 until the planning began for Plan Calcul.⁶⁶ In addition, to meet defense requirements, 64.5 million francs of the subsidies invested in Plan Calcul’s first phase came from the Ministry of the Armed Forces.⁶⁷ Examining the “Gamme I” computer range launched in the first phase of Plan Calcul, it is evident that scientific and military computers occupied a considerable proportion of the program. Gamme I contained a range of four medium-sized computers: the P0, P1, P2, and P3. Among the four models, the P0, P1, and P2 were universal, and the P0 and P2 both had an additional version for military purposes (PoM and P2M). PoM was destined for the army while P2M was the backbone of tactical and strategic data processing systems and was principally destined for the *grandes opérations* of national defense (naval corvettes and nuclear submarines). The P3 was a high-performance scientific model.⁶⁸ In the Gamme I family, CII originally intended to develop a very large scientific computer (the P4) destined for the Atomic Energy Commission, to fill the gap left by the embargo of the Control Data 6600 by the U.S. government; however, it was compelled to set the P4 aside owing to short deadlines, the high cost of operation, very restricted markets, insufficient technology, and the consideration that developing the P4 would hinder the production of medium- and small-sized computers.⁶⁹ Nevertheless,

⁶⁵ “Action calculateurs,” secret document, no. 107, 1 Apr. 1966, 19930277/229, AN; “Note sur l’action calculateurs considérée en fonction des programmes d’armement,” secret report, 23 Feb. 1966, no. 131/DMA/SCTI/SC, 640AP/96, AN; “Politique industrielle en électronique,” confidential document, n.d., 19820263/1, AN; “Le Plan Calcul et la D.R.M.E.,” restricted document, 30 Dec. 1968, no. 143/DRME/R.1/D.R., 19890575/98, AN.

⁶⁶ “Note sur l’action,” 640AP/96, AN; “Rapport sur les résultats,” 640AP/96, AN; “Fiche sur l’opération ‘Calculateurs-Développement,’” 28 Jan. 1966, 5AG1/2627, AN; “Propositions pour un Plan Calcul,” 640AP/96, AN.

⁶⁷ “Financement complémentaire pour le Plan Calcul Militaire,” 6 Mar. 1968, 19820263/1, AN; “Situation de l’informatique en France,” 19820263/1, AN.

⁶⁸ “Programme des ordinateurs C.I.I. du Plan Calcul,” confidential technical sheet, 29 July 1968, no. DER/GEP/68/249, 19810642/70, AN; “Texte de convention,” 19910817/12, AN.

⁶⁹ “Note sur le problème du ‘très grand calculateur,’” 2 May 1966, 19930277/229, AN; Rapport Ortoli, 19930277/228, AN; “Propositions pour un Plan Calcul,” 640AP/96, AN; Rapport Boiteux, 5AG1/2627, AN.

the French government had not given up on this idea; it still intended to develop the P4 model with subsidies and other resources from the Ministry of the Armed Forces and the Atomic Energy Commission.⁷⁰ According to secret information disclosed by Galley to the prime minister, in mid-1967, a team of specialists began pre-project planning for the development of a very large computer needed by the Atomic Energy Commission.⁷¹

L'État-entrepreneur (State as Entrepreneur), *L'État-client* (State as Client), and *L'État-banquier* (State as Banker)

Although the French government declared that Plan Calcul would adopt the “state-industry system,” in addition to production, state intervention was ubiquitous in CII management, marketing, and finance. In terms of management, the principal functions of the Délégué à l’Informatique were, in addition to policymaking, coordinating the state’s R&D policy and personnel training and controlling, rather than managing, the state’s equipment policy and Plan Calcul’s execution.⁷² However, after the program was launched, the manufacturers never ceased to complain about the intervention of the Délégué in CII’s management. From the perspective of the French authorities, since the state had granted 460 million francs and offered public procurement to CII, not only was it the government’s responsibility to manage the company but it was impossible for the state to refrain from such intervention.⁷³ Such an attitude led Georges Pébereau to complain that the state had paid the money and therefore regarded itself as boss.⁷⁴ Thomson, one of CII’s parent companies, criticized the government because it “preserved the appearance of liberal capitalism and, against this backdrop, there was a total authority of the state. The Délégation à l’Informatique intervened on all levels on a daily basis.”⁷⁵ Henri Boucher even described the Délégué as implementing an “authoritarian investment policy” and the “dirigisme” in the information technology sector as “pure folly.”⁷⁶ One of the reasons why

⁷⁰ “Compte rendu du Comité restreint du 19 mars 1968,” secret document, 29 Mar. 1968, 640AP/93, AN; “Ordinateur P4 du Plan Calcul,” confidential defense document, 8 Dec. 1967, 19820263/3, AN; CEA to Délégué à l’Informatique, restricted letter, 14 Dec. 1966, no. AG/D66-146, 19820263/3, AN.

⁷¹ Galley to Premier Ministre, 19820263/1, AN.

⁷² “Cas de l’informatique,” 19890575/98, AN; Rapport Ortoli, 19930277/228, AN; Rapport Lagaillarde, 20160541/92, AN.

⁷³ “Note à l’attention du Général de Gaulle sur le Plan Calcul,” 20 July 1967, 640AP/93, AN; “Plan proposé par C.I.T.E.C.,” 640AP/96, AN.

⁷⁴ Georges Pébereau and Pascal Griset, *L’Industrie, une passion française* (Paris, 2005), 57.

⁷⁵ Quatrepoint and Jublin, *French ordinateurs*, 57.

⁷⁶ Henri Boucher, “L’informatique dans la Défense,” in *Colloque sur l’histoire de l’informatique en France*, vol. 2, ed. Philippe Chatelin (Saint-Martin-d’Hères, 1988), 90–91. Henri

Robert Rémillon resigned as CII's president was that he was unable to accept the intervention of the Délégué in CII's management, which caused CII to lose its private-enterprise character.⁷⁷ Jean-Pierre Brulé criticized the Délégué as overstepping its authority in the CII—which was a private company. It actively intervened in the management of the CII; the company's executives not only had to go to the Délégation à l'Informatique to answer questions but were also required to obtain the approval of the Délégué for any decisions.⁷⁸

In fact, it was based on the aid agreement that CII executives had to report to the Délégué on the company's commercial and financial situation, the progress of the program, and its ongoing results.⁷⁹ In the tradition of arsenal culture, one of the reasons for the French government's intervention was to ensure that the “national champion” could meet the state's general industry policy.⁸⁰ One of de Gaulle's men, Pierre Lelong, noted that de Gaulle's government widely used various measures, especially financial intervention, to impose its will on private enterprises.⁸¹ In addition, the intervention of the Délégué in company management was, to a certain degree, due to disagreements between the CII's executives and between the parent companies. For example, there had been many sources of friction between CAE and SEA, the two rival companies, since the beginning of their merger that forced the Délégué to intervene in CII leadership.⁸² In addition, the Délégué had to intervene in response to the conflicts of interest between the parent companies and CII. The parent companies were reluctant to completely engage in Plan Calcul and scrambled for every opportunity to make money. In his briefing to de Gaulle, the technical advisor to the president, Jacques Narbonne, pointed out that “CII, instead of being the point of application of concerted efforts toward a common objective, is considered by many as a means of feeding, thanks to state subsidies, the participating manufacturers.”⁸³ When the parent

Boucher was director of the Centre de calcul scientifique de l'Armement. He was one of Plan Calcul's promoters and the one who introduced information technology to France's Ministry of Armies.

⁷⁷ “Note à l'attention du Général de Gaulle sur le Plan Calcul,” 640AP/93, AN.

⁷⁸ Brulé, *L'informatique*, 113.

⁷⁹ “Projet de Convention générale entre l'Etat et les groupes industriels privés chargés de réaliser le ‘Plan Calcul,’” n.d., 19910817/12, AN.

⁸⁰ Rapport Saint-Geours, annexe IV, 14 May 1965, B-0070010, CAEF; Coopey, “Empire and Technology,” 163.

⁸¹ Pierre Lelong, “Le général de Gaulle et les industries de pointe,” in *L'Entourage et de Gaulle*, ed. Gilbert Pilleul (Paris, 1979), 178.

⁸² “Situation d'ensemble des questions relevant du Plan Calcul,” 11 July 1967, no. 67.284/INFORM, 640AP/96, AN; “Développement de la Compagnie Internationale,” 19930277/228, AN.

⁸³ “Note à l'attention du Général de Gaulle sur le Plan Calcul,” 640AP/93, AN.

companies' own interests were in conflict with those of CII, they prioritized their own interests without any hesitation. For example, to reserve the exclusivity of production, which was of prime concern to them, the parent companies preferred to restrain CII activities.⁸⁴

In terms of marketing, CII was again unavoidably on track toward the national arsenal approach. Under the principle of the state-industry system, Plan Calcul initially aimed at both the public and private markets; the French government did not expect CII to be a national arsenal that only produced computers for public agencies and relied on the protected market.⁸⁵ Nevertheless, Plan Calcul's decision makers were well aware of the plight that CII would encounter in the desired market: IBM-France's turnover was two and a half times that of Bull and eleven times that of CITEC. In fact, IBM's annual research expenditure represented the equivalent of the annual total turnovers of the French electronics industry.⁸⁶ The competition with powerful rivals, market saturation and the inexperience of CII and its parent companies in producing a series of computers made it extremely difficult for CII, a fledgling company, to obtain market share in a short time. By initially depending only on the public market, CII could obtain the resources needed for self-financing and development.⁸⁷ Therefore, the French government promised to preferentially purchase CII's computers, and the public-sector market would be CII's principal outlet.⁸⁸

The reason CII subsequently became a type of national arsenal was not entirely due to the French government, which had sustained the company by offering public procurement. The major cause lies in its poor sales performance in the French private market, and the expected markets of eastern European and France's former colonies were equally fruitless; therefore, it could only depend increasingly on the public markets.⁸⁹ CII's marketing network in France and abroad was quite limited. The company also lacked a coherent and farsighted commercial strategy. "CII" was a new brand in the private market that remained unknown to customers and was completely unable to compete with IBM.⁹⁰ As observed by the president of SEA, François-

⁸⁴ Quatrepoint and Jublin, *French ordinateurs*, 41; "Problèmes de la C.I.I.," confidential document, 11 Dec. 1968, 19810642/9, AN; Galley to Premier Ministre, 19820263/1, AN.

⁸⁵ "Politique commerciale de la C.I.I.," n.d., 19810642/9, AN; "Suite à la demande," 19910817/13, AN.

⁸⁶ "Chiffres d'affaires annuels des grands constructeurs de calculateurs," Annexe V of Rapport Boiteux, 5AG1/2627, AN; *La Croix*, 26 Apr. 1967.

⁸⁷ "Philosophie du Plan Calcul," 19820263/1, AN; "Rapport sur l'industrie des calculateurs électroniques," 5AG1/2606, AN.

⁸⁸ "Convention," 19930277/228, AN; *Valeurs Actuelles*, 23 Feb. 1967.

⁸⁹ Coopey, "Empire and Technology," 160, 164; Rapport Lagailarde, 20160541/92, AN.

⁹⁰ "Politique commerciale de la C.I.I.," 19810642/9, AN.

Henri Raymond, the products of the Gamme I were very similar to those of IBM and lacked any original character.⁹¹ Moreover, CII production covered several families of different models, each resulting in high costs.⁹² CII's production strategy was, in fact, understandable: because the French market was too small, CII could not survive if it chose a niche market that IBM had abandoned.⁹³

However, the main disadvantage of CII was still its technological problems. A year after Plan Calcul began, the Délégué à l'Informatique pointed out that CII had encountered various technological difficulties that had disturbed the ordinary course of manufacturing and R&D.⁹⁴ The 1973 Rapport Lagailarde also revealed that the delay in most of the CII models was the result of technological difficulties.⁹⁵ The technology gap between France and the United States in the computer field was considerable when Plan Calcul first launched.⁹⁶ The French authorities observed that most computer manufacturers, whether American subsidiaries in Europe or local European manufacturers, simply used U.S. technology to produce computers.⁹⁷ In fact, other than SEA, the parent companies of CII used American licenses.⁹⁸ The fact that CII's parent companies depended largely on American licenses hampered the initiation of Plan Calcul.⁹⁹ French companies were satisfied with a narrow profit margin and increasingly relied on U.S. licenses, reluctantly agreeing to invest in R&D only when receiving limited state contracts from the French government.¹⁰⁰ Apart from competitiveness being weak when compared with the United States in terms of technology, the French government's R&D investments in the information technology industry were also not comparable to those of the United States. The R&D investment of the electronics industry in the United States in 1962 was twenty-three times higher than that in France.¹⁰¹ In addition, the information technology industry's R&D was extremely concentrated

⁹¹ "Politique d'INFI," confidential note, 30 Jan. 1967, 640AP/96, AN.

⁹² "Développement de la Compagnie Internationale," 19930277/228, AN.

⁹³ "Tendances de l'industrie américaine des calculateurs. Rapport de mission aux U.S.A. (4–22 Mai 1965)," confidential report, 1965, 19930277/228, AN.

⁹⁴ "Situation de l'informatique en France," 19820263/1, AN.

⁹⁵ Rapport Lagailarde, 20160541/92, AN.

⁹⁶ "Note sur les conditions du développement d'une industrie de calculateurs," 5AG1/2627, AN; "Industries de la matière grise," 8 Mar. 1968, Annexe V, 19820263/1, AN.

⁹⁷ "Rapport sur l'industrie des calculateurs électroniques," 5AG1/2606, AN; "Philosophie du Plan Calcul," 19820263/1, AN.

⁹⁸ "Note pour Monsieur le Directeur du Cabinet sur les problèmes concernant l'industrie des calculateurs électroniques," 28 Feb. 1966, no. 48330/D.C., 19910817/12, AN.

⁹⁹ Pierre-Éric Mounier-Kuhn, "Sur l'histoire de l'informatique en France," *Engineering Science and Education Journal* 4, no. 1 (1995): 39.

¹⁰⁰ "Compte rendu de l'entretien de Monsieur Galley avec le Général de Gaulle," 29 Nov. 1966, 19820263/1, AN; Lelong, "Général de Gaulle," 178.

¹⁰¹ "Rapport de Kuhn de Chizelle," 640AP/96, AN.

in the United States.¹⁰² A considerable number of French researchers were attracted to the United States, resulting in a “brain drain” that exacerbated both the problem of an insufficiency of available French information technology specialists and that of the technology gap between France and the United States in the field.¹⁰³

The consequences of the technology gap were directly reflected in sales. CII sales remained modest owing to the competition from more technologically advanced and less expensive American computers. Until 1970, CII’s market share in the domestic computer market remained at only 9.5 percent, far behind IBM’s 58 percent.¹⁰⁴ Worse yet, even CII’s principal clients—in both the public and para-public sectors—lacked interest in its computers. In 1971, only 16.5 percent of French government departments had installed CII computers. Most local governments rarely used CII equipment, and the great majority of French state-owned enterprises also did not choose CII.¹⁰⁵ Two computer procurement examples can fully explain why CII’s computers were unable to compete with those offered by IBM in the French public sector. The Ministère de l’Équipement (Ministry of Equipment) preferred IBM over CII in its computer procurement project in 1968 largely because of the technology gap between the two companies.¹⁰⁶ As to the computer procurement example of the “Civil Aviation” of the Ministère des Transports (Ministry of Transport), the Ministry believed that IBM was better than CII in both its financial and technical aspects. IBM’s proposal was “cheaper, more secure and more comfortable” than that of CII, and IBM had the ability to meet the ministry’s needs within the critical deadlines.¹⁰⁷

The government departments that chose CII equipment did so not for the quality of its products but simply to support state programs. In a conversation with the Minister of Research, Alain Peyrefitte, de Gaulle stated, “It cannot be avoided, at least initially, going through a period of dirigisme and protectionism. It is unacceptable for administrative agencies, universities, and state-owned enterprises to be free to purchase their computers abroad. The impetus of the state has to be

¹⁰² “Rapport sur l’industrie des calculateurs électroniques,” 5AG1/2606, AN.

¹⁰³ “Défense et illustration du secteur quaternaire,” Nov. 1967, 19820263/1, AN; “Note sur les problèmes soulevés par l’augmentation massive des investissements étrangers dans le secteur de l’Électronique,” 23 July 1965, 5AG1/2448, AN.

¹⁰⁴ Rapport Lagailarde, 20160541/92, AN.

¹⁰⁵ Rapport Lagailarde, 20160541/92, AN.

¹⁰⁶ “Choix de l’ordinateur du Ministère de l’Équipement,” 14 May 1968, no. 68/1022/INFORM, 19810642/28, AN; “Choix de l’ordinateur central. Rapport préliminaire,” Report of Ministère de l’Équipement, n.d., 19810642/28, AN.

¹⁰⁷ “Choix des calculateurs pour le Contrôle de la Circulation Aérienne,” 27 May 1968, 19910817/13, AN.

strong.”¹⁰⁸ When purchasing computer equipment, public agencies and state-owned enterprises were often under great pressure from the corridors of power.¹⁰⁹ Allègre revealed that CII typically had to depend on “amicable pressure” applied by the Délégation à l’Informatique to obtain the government orders.¹¹⁰ After the Ministère des Transports finally decided to adopt IBM’s proposal for technical consideration, the Délégué à l’Informatique notified the prime minister of the serious consequence for Plan Calcul if the ministry did not choose CII and asked him to make an “authoritarian decision” to overturn the ministry’s decision.¹¹¹

In fact, IBM had long occupied a large share of French public-sector markets. As noted above, before Plan Calcul, 85 percent of French government computer orders were supplied by U.S. enterprises, with only 15 percent supplied by French manufacturers.¹¹² Even after CII had launched its products on the market, and despite the government’s considerable influence over the public sector’s computer procurement, CII was still unable to compete with the highly competitive products and high-quality technical assistance of IBM; in addition, there was the costly problem of rewriting programming when converting to CII’s equipment. In addition to private markets, CII relied on an internal protective umbrella of the state, public-sector procurements, and an external protective umbrella: the markets in eastern Europe and in France’s former colonies. Not only did CII fail in the private markets, but the two umbrellas also proved to be out of action.

Poor sales performance consequentially affected CII’s financial condition. In fact, financial problems appeared soon after the creation of CII.¹¹³ The French government expected CII to become financially independent quickly; however, such expectations regularly came up against the refusal of the parent companies to increase their investment in Plan Calcul.¹¹⁴ From the perspective of the French authorities, Plan Calcul had been designed to allow France an autonomous, profitable, and genuine *private* computer industry. Private enterprises were the principal protagonists of the computer industry. However, for the

¹⁰⁸ Alain Peyrefitte, *C’était de Gaulle* (Paris, 2002), 1347.

¹⁰⁹ Rapport Lagayette, 20160541/92, AN.

¹¹⁰ Allègre, “Politique informatique française,” 101.

¹¹¹ Ministère des Transports to Délégué à l’Informatique, 11 July 1968, 19910817/13, AN; “Automatisation du contrôle de la circulation aérienne,” 2 Sept. 1968, no. 68-1583/INFORM., 19910817/13, AN.

¹¹² Peyrefitte to Secrétaire Général de la Présidence, 6 June 1966, 640AP/96, AN.

¹¹³ “Situation du Plan Calcul sur les plans technique et financier,” n.d., no. 68.404/INFORM, 19820263/1, AN; “Situation de l’informatique en France,” 19820263/1, AN.

¹¹⁴ André Danzin, “La situation de l’industrie informatique française,” in Griset, *Informatique, politique industrielle, Europe*, 34; “Révision de la Convention CII-Etat,” 7 Jan. 1969, 19810642/9, AN.

parent companies, Plan Calcul was the *state's* program, and the private enterprises were only executors at the service of the state. The state had to assume all the responsibilities and risks of the operation. Therefore, if the operation went wrong, the parent companies consoled themselves by saying that “the state will plug the holes.”¹¹⁵ In fact, throughout all phases of Plan Calcul, the parent companies never believed that the program could succeed, and as a consequence, none was willing to “risk [its] money.”¹¹⁶ To solve CII's endless problems, the French government had no choice but to continue engaging in Plan Calcul.¹¹⁷ The more the state engaged, the less responsibility the parent companies took.¹¹⁸ By the end of the first phase of Plan Calcul, CII was still in a financial plight with insufficient equity capital and a high proportion of long-term and short-term debt. Its computers were uncompetitive and were selling at a loss. CII relied heavily on the state's assistance for R&D, operations, and financing. In the subsequent stages of Plan Calcul, the French government increased its investment level to the point that the state financed most of the plans. Regardless, CII's performance remained unsatisfactory, and it continued to hobble along with the aid of the government's “cane.”¹¹⁹

Conclusion

France's industrial policy under Pompidou gradually distanced itself from de Gaulle's *grandeur* and state interventionism by shifting toward pragmatism and liberalization. Although Pompidou's efforts were intended to place military-style *grandes opérations* into the broader context of European cooperation and to integrate them into the world economy, the Franco-German-Dutch Unidata was still, as Allègre said, an “aborted attempt.”¹²⁰ Unidata encountered many difficulties, such as disagreement between partners, divergent interests, and dissonance in the policies of the European governments. Under the circumstance of the economic downturn caused by the oil crisis, and with the massive losses of Unidata, the succeeding government under Valéry

¹¹⁵ “Révision de la Convention CII-Etat,” 19810642/9, AN.

¹¹⁶ Allègre, “Politique informatique française,” 96–99, 102; “Compte-rendu de la journée du 2 mars,” 3 Mar. 1967, 19810642/9, AN.

¹¹⁷ “Compte rendu du Comité restreint du 19 mars 1968,” 640AP/93, AN.

¹¹⁸ Lelong, “Général de Gaulle,” 195; Quatrepoint and Jublin, *French ordinateurs*, 42.

¹¹⁹ Rapport Lagailarde, 20160541/92, AN; Salomon, *Gaulois*, 124–26; Quatrepoint and Jublin, *French ordinateurs*, 70–73, 110, 119; Brulé, *L'informatique*, 129–32; Campbell-Kelly and Garcia-Swartz, *From Mainframes to Smartphones*, 96, 138; Chandler, *Inventing the Electronic Century*, 183; *Le Monde*, 4 Aug. 1971; *Le Monde*, 26 June 1974.

¹²⁰ Pascal Griset, “Entre pragmatisme et ambition,” in *Georges Pompidou face à la mutation économique de l'Occident, 1969–1974*, ed. Éric Bussière (Paris, 2003), 284–88, 290–94; Allègre, “Politique informatique française,” 98.

Giscard d'Estaing was unwilling to allow the French national champion to be absorbed by European partners. Because of that, and owing to budgetary considerations in 1975, Giscard d'Estaing decided to withdraw from Unidata and instead to cooperate with an American conglomerate.¹²¹ The merger between CII and Honeywell-Bull, led by the French government, formed CII-Honeywell-Bull. Later, the French government paid a very high price to acquire control of the company from Honeywell, and it renamed the company CII-Bull. In the early 1980s, the Socialist government undertook the nationalization of France's major industrial groups. In 1982, CII-Bull was nationalized.¹²² Plan Calcul eventually became, as Georges Pébereau stated, "a veritable nationalization of French information technology."¹²³

Plan Calcul had been intended to be industrial in nature rather than a national arsenal. CII, established by Plan Calcul, was tasked with quickly developing an autonomous business and ensuring its profitability.¹²⁴ However, at every stage of its development Plan Calcul failed to meet most expectations. Until the 1990s, France's information technology industry continued to be dominated by U.S. multinationals. In 1970, IBM still occupied 60 percent of the French market, whereas CII occupied only 11 percent.¹²⁵ Moreover, CII accounted for only a negligible share (0.8 percent) of the world market.¹²⁶ CII-Bull has continued to suffer heavy losses since the early 1980s. After being nationalized, in only two years the national champion lost the total amount of money the state had invested over a period of ten years.¹²⁷ The company continued to rely on state subsidies and orders, and 90 percent of its expenditures were also charged by the state.¹²⁸ The outcome of France's first information technology venture, led by a small minority of young bureaucrats, was reflected in the lament of Maurice Allègre: "the state has never ceased to pay considerable amounts of money for very poor performance until today."¹²⁹ By the early 1990s, the French national

¹²¹ Jean-Michel Quatrepoint, "L'échec d'Unidata," in Griset, *Informatique, politique industrielle, Europe*, 119–21; Christian Stoffaës, "Trente ans de politique industrielle," in Griset, *Informatique, politique industrielle, Europe*, 10–12; Beltran and Griset, *Histoire*, 15, 66–67, 116–18; Hilger, "European Enterprise," 150–54.

¹²² Yves Bouvier, *Connexions électriques* (Brussels, 2014), 477–78; Stoffaës, "Trente ans," 11–12; Bernard Esambert, "Unidata, un grand projet vu de l'Élysée," in Griset, *Informatique, politique industrielle, Europe*, 116–17.

¹²³ Pébereau and Griset, *L'Industrie*, 55.

¹²⁴ "Convention," 19930277/228, AN; "Propositions relatives au Plan Calcul," 11 July 1966, 19810642/8, AN.

¹²⁵ Beltran and Griset, *Histoire*, 66.

¹²⁶ Mounier-Kuhn, "Plan Calcul," 152.

¹²⁷ Brulé, *L'informatique*, 207–12, 237–40, 250–55; Stoffaës, "Trente ans," 12.

¹²⁸ Quatrepoint and Jublin, *French ordinateurs*, 108–10.

¹²⁹ Allègre, "Politique informatique française," 101.

champion in the information technology field continued to suffer serious losses, and, in the end, the French computer ambitions of Plan Calcul proved futile.¹³⁰ In the broader context of the history of the European computer industry, Plan Calcul represents only one of several examples of the inability of European countries to respond to the fierce competition of American industry. Under competitive pressure from IBM, the British “national champion” ICL constantly changed its product strategy but still suffered heavy losses; it was acquired by the Japanese company Fujitsu in 1990.¹³¹ In Germany, although Siemens consolidated a start-up, Nixdorf, into a single company, it was still incapable of achieving economies of scale and preventing it from experiencing financial difficulties. Nixdorf eventually shared the same fate as ICL in the late 1990s by becoming part of Fujitsu.¹³² Despite being a pioneering personal computer producer, the major Italian computer manufacturer Olivetti failed to overcome U.S. dominance and ended up being acquired by an American consortium in 1996.¹³³

France has not reached global scale in the computer hardware industry; however, Plan Calcul left France with a strong information technology services industry, and its software industry was among the first in the world. Moreover, IRIA, which today is the well-known INRIA (Institut National de Recherche en Informatique et en Automatique), has continued to play an important role on the world stage.¹³⁴ Another complex factors that extend beyond the scope of this article may explain why Plan Calcul failed to meet expectations. However, the most crucial aspect of all may be the fact that the constitution of the information technology industry was, in essence, incompatible with a traditional arsenal system. The initial conception of Plan Calcul was to establish an industrial-type operation; nevertheless, it was difficult for the program to avoid the arsenal system under the context of de Gaulle’s foreign policy during the Cold War. In view of national independence, as Paul

¹³⁰ Salomon, *Gaulois*, 123–27; Brulé, *L’informatique*, 103–32; Coopey, “Empire and Technology,” 159–65; Cortada, *Digital Flood*, 115–19; Campbell-Kelly and Garcia-Swartz, *From Mainframes to Smartphones*, 138–39; Chandler, *Inventing the Electronic Century*, 183; Paul N. Edwards, “L’électronique rêvera pour vous,” in *Georges Pompidou et la modernité*, ed. Pascal Griset (Brussels, 2006), 159–65.

¹³¹ Campbell-Kelly, *ICL*, 255–63, 265–342; Campbell-Kelly and Garcia-Swartz, *From Mainframes to Smartphones*, 88–89, 97–98, 136–38; Chandler, *Inventing the Electronic Century*, 178–81.

¹³² Campbell-Kelly and Garcia-Swartz, *From Mainframes to Smartphones*, 91–92, 95–96, 139–40; Chandler, *Inventing the Electronic Century*, 186–89; Cortada, *Digital Flood*, 131–33.

¹³³ G. de Marco, G. Mainetto, S. Pisani, and P. Savino, “The Early Computers of Italy,” *IEEE Annals of the History of Computing* 21, no. 4 (1999): 34; Chandler, *Inventing the Electronic Century*, 183–85.

¹³⁴ Bernard Esambert, “Témoignage,” in Bussière, *Georges Pompidou*, 350; Allègre, “Politique informatique française,” 95, 103–4.

N. Edwards has said, Plan Calcul “was not a simple industrial strategy.”¹³⁵ To remove U.S. influence, the French authorities excluded the most suitable firm, Bull, from participating in Plan Calcul. French military demands, in addition to the manufacturers’ egoism and their relatively weak competitiveness in the business computer field, gradually shifted Plan Calcul away from its initial objective—to focus on the business computer field and private-sector market—toward the military, scientific computer, and public-sector markets; the major objectives in establishing a “national champion” were not to satisfy the market’s needs but to meet the state’s requirements. Based on the practice of traditional arsenal culture, and to resolve internal strife within the CII leadership team and various management problems, the French authorities were compelled to frequently and broadly intervene in the management of the company. Poor sales performance resulting from the technology gap forced Plan Calcul to continue to rely on public-sector markets. Because the manufacturers were reluctant to invest in Plan Calcul, the state had to “plug holes” everywhere by constantly infusing additional funds. Therefore, although it had initially intended to avoid the arsenal system, the French government ultimately became Plan Calcul’s funding supplier, entrepreneur, and client. As Plan Calcul progressed through each stage of its evolution, this inclination became more evident.

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¹³⁵ Edwards, “L’électronique rêvera pour vous,” 162.