Big Blue Gets Beaten: The Technological and Political Controversy of the First Large Swedish Computerization Project in a Rhetoric of Technology Perspective

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This article analyzes the rhetoric used in the Datasaab–IBM controversy when the first computerized national register and taxation system was created in the early 1960s. The aim is to understand how Datasaab could establish a new technological frame and at the same time grow into what became Sweden's first big computer manufacturer.

Introduction

One of the first big schemes for introducing Electronic Data Processing (EDP; in Swedish, "Automatisk Databehandling" or ADB) in the Swedish state administration was the so-called county computer project, which was initiated in the mid 1950s and ran through the 1960s. The objective was to rationalize the national register and taxation systems by using computers. Two committees were appointed to investigate this process. The first report to the Swedish Parliament in 1960 stated that a big computer center placed in Stockholm, the capital of Sweden, would be the best solution in terms of economic efficiency and coordination of redundant capacity. But the project almost immediately got in conflict with regional interests, and a centralization–decentralization debate soon arose, as well as a discussion of national industrial and technology policy.

The technological controversy described in this article concerns which system design and which computer vendor to choose for the central civic registration and tax collection project (Centrala Folkbokförings- och Uppbördsregistret, the National Board of Civic Registration and Tax Collection or CFU). Almost from the outset, traditional punched card machinery was rejected, and in 1959, in the first phase of the project, the technical solution was given to the commissioners: a centralized system with one very big IBM computer placed in Stockholm for processing the whole national database, supported by smaller satellite computers that would register and report to the central computer. But as the debate rolled back and forth, competitors had shown up, and the drafting committees had to let more vendors compete for the tender (in late 1961). By this time, Svenska Aeroplan Aktiebolaget (the Saab Aircraft Company) had announced its new D21 medium-sized mainframe system, which was a good contestant, not least since the centralized solution had been voted down. Instead, the CFU system was to be built with some 20 regional but coordinated computer centers administered and run by the county administrative boards (Länsstyrelserna).

The second phase of the controversy has to do with technology choice: On what grounds and by which criteria should one vendor be preferred? The recommendation from the Committee on National Taxation Organization (Uppbördsorganisationskommitten, UOK) was IBM, but after strong criticism from outside actors and a redraft of the organizational plans, this phase of the county computer project was closed by Minister of Finance Gunnar Sträng (who was the top politician responsible) to set up two test sites: one equipped with an IBM 1401 (in Stockholm) and one with a Datasaab D21 (in Linköping). The test sites opened in August 1964 and ran until February 1965.[1] The tests showed that D21 was better, and a compromise was reached—nine IBM 1401 and five D21 systems were ordered. While this procedure continued, IBM launched its new System/360, which replaced the older 1401. In April 1965, Parliament decided that 12 IBM 360/30 and eight D21-P systems should be ordered and installed before March 1967.[2,3]

The third phase derives from an assessment of the county computer centers that the Parliament auditors made in 1967.[4] By this time, all 20 systems had been installed and put into operation. The Parliament auditors' evaluation showed, again, that on all measured parameters—primarily reliability and efficiency—the Datasaab D21 computer was better and subsequently advised that all IBM computers should be replaced. But the auditors also concluded that the county computer centers were underutilized and that their number might have to be reduced. CFU considered the auditors' criticism, and a suggestion for a reorganization of the CFU system was presented in Government Bill 1969:81.[5] This reorganization should be effected by 1970. Parliament accepted the recommendation and made the orders; by 31 August 1970, all systems were replaced and the new ones were running. "Big Blue" (as IBM was known) had been beaten.

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This big, state-driven computerization project contributed to placing Sweden on the computing map. We had had an early start, thanks to the work on the BARK and BESK computers. And as we can see from Table 1, in January 1963 some 120 computers would be installed in the country by public and private bodies. Today, new reports say that Sweden, mainly because of state subsidies for private computer consumption, is about to become the most computer dense country in the world, if measured per capita. In Table 1 from SOU 1962:32, we can see how fast the technology transfer took place. In 1953, there was only one computer in use in Sweden. By 1963, there were some 120 systems installed. The state was first to procure computers, but after only a few years, private trade and industry passed the state.

In this article, I will put the artifacts—the Saab D21 and IBM 1401/360 computers—in focus, surrounded by some administrative bodies, a few corporations, and documents representing the computer rhetoric of the 1960s to make an actor-based history of technology.[54,55] My point of departure is the assumption, from science and technology studies, that the technical and the social interact to form our reality.[6,7,54] As discussed in my thesis,[54] the easiest to get hold of representations of the rhetoric of technology are in written form in official documents, especially if we want to study processes that lie many years in the past. But this leaves out a vast number of possible sources for the computing discourse we intend to follow. Therefore, we shall also look at other "texts" produced by members of relevant social groups, e.g.:

- internal memos,
- IBM's and Saab's advertisements and other public relations materials,
- photos,
- newspaper and magazine cuttings, and
- interviews.

Phase 1: Automation—A Revolution in Office Administration

DBK and UOK—Commissioned to Investigate Computerization

In May 1962, a public debate arose concerning what computers the county administrative boards should have: IBM, Datasaab, or others? Should this rationalization of state administration with the help of computers be organized on a national, regional, or county basis? The debate, as we shall see, in many ways originated in two opposing technical *and* organizational paradigms:

1) centralized computer power and
2) hierarchy versus decentralized computers and distributed power.

The latter paradigm was in many ways inscribed in the design of new computer systems, such as the IBM 1401 or Saab D21, while the older and bigger mainframes more or less demanded a centralized system design.

The controversy originated in the opposing opinions of the two royal commissions that had been appointed to investigate:

1) if computers could be used to make the state administration more efficient and
2) a new organization of taxation and national registration.

These opinions were presented in reports to Parliament in 1961 and 1962. It is noteworthy that the Committee on Machine Methods of Computation (Databehandlingskommittén, DBK) and UOK had very different ideas about how the system should be designed. DBK advocated a centralist solution, while UOK was for a decentralized county or regional system. But before the report was presented, DBK had beaten the other committee's members for the national system.

TABLE 1
COMPUTER USAGE IN SWEDEN

Tabell 1. Datamaskinanläggningar inom landet

Innehavarekategori	1/1 1956	1/1 1957	1/1 1958	1/1 1959	1/1 1960	1/1 1961	1/1 1962	1/1 1963
	Antal anläggningar							
Statsförvaltningen	1	3	5	7	9	10	28	26
Kommunala myndigheter	—	—	—	—	1	1	1	3
Industri	—	—	—	4	5	6	17	40
Handel	—	—	—	—	—	3	8	15
Bank- o. försäkr.-väsende	—	2	2	4	6	9	13	18
Servicebyråer (ej statliga)	—	—	4	5	5	6	8	12
Övrigt	—	—	—	1	1	1	3	6
Totalt	1	5	11	19	25	35	78	120
	Anläggningarnas värde, miljoner kr.							
Statsförvaltningen	1,0	3,0	3,9	4,9	7,7	8,3	32,4	46,3
Kommunala myndigheter	—	—	—	—	1,5	1,5	1,9	3,7
Industri	—	—	—	6,4	8,9	10,5	26,3	52,6
Handel	—	—	—	—	—	3,0	9,1	17,4
Bank- o. försäkr.-väsende	—	1,9	1,9	7,0	7,7	10,2	23,1	33,6
Servicebyråer (ej statliga)	—	—	4,1	3,6	3,6	9,1	13,5	18,6
Övrigt	—	—	—	1,1	1,1	1,1	3,2	8,6
Totalt	1,0	3,9	8,9	23,0	30,5	43,7	109,5	179,3

Anm. Uppgifterna avseende 1/1 1962 och 1/1 1963 är beräknade på grundval av beställningar intill den 1 februari 1961. Senare beställningar torde inte ha kunnat påverka de redovisade värdena mera märkbart beroende på de långa leveranstiderna för flertalet maskiner.

Source: SOU 1962:32, p 176.

The first suggestion from UOK in 1959 presented a system equipped with an IBM 7070 (see Fig. 1) or 7074 transistorized mainframe and IBM 1401 satellites (see Fig. 2). In its 1961 report, the UOK committee gave two alternative solutions to the centralized or national system for organizing this EDP task: Either a regional system of, say, nine computer centers could be set up to serve three or more county taxation authorities each or each county (19 of 24) could be equipped with its own computer center—of course with smaller machines, for example, the 1401. Five counties were regarded as too small to have their own computers.[8]

In UOK's first suggestion, the choice of computer machinery was not especially controversial, and thus few referral bodies had any objection to the IBM 7070/1401 solution (see Fig. 1 and Fig. 2). It was the centralized national solution that was criticized. But UOK's choice of computer manufacturer was not accepted right away. There were objections from the Swedish electronics industry, for example, Saab and Åtvidabergs Industrier (Facit). Since the national system solution was rejected, UOK had to redraft its county system based on a smaller EDP machine like the IBM 1401. On 15 September 1961, the government commissioned the committee to prepare a plan for the national registration and taxation system in accordance with the county alternative, to be submitted by January 1962. A new tender was invited, and five companies presented offers. The revised plan, together with the choice of computer, was submitted seven months later (SOU 1962:18). Tenders were presented by:

- L.M. Ericssons Driftkontrollaktiebolag (ICT 1301);
- International Business Machines Svenska AB (IBM 1401);
- RCA Sweden AB (RCA 301);

- Svenska Bull Maskin AB (Bull Gamma 30); and
- Saab and Facit Electronics AB (Saab/Facit D21-P).[9]

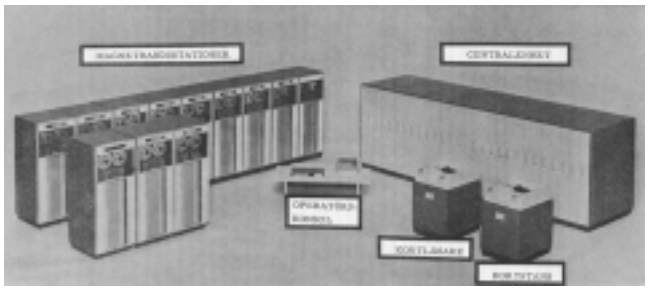


Fig. 1. The IBM 7070 mainframe computer was a system designed for heavy computing. Model of the computer, not the real machine.

(Source SOU 1961:4, p. 198)

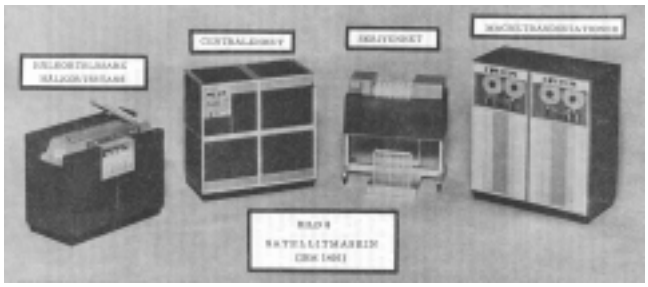


Fig. 2. The IBM 1400 system, despite its smaller CPU power, had a wide range of use, but it was especially well-fitted for EDP. Model of the computer, not the real machine.

(Source SOU 1961:4, p. 201)

Technological Shift

The first UOK suggestion was based on a technological frame of the 1950s, in which the only possible solution for large EDP systems was a big mainframe. The smaller, punched card systems did not have enough capacity for data retrieval of this volume. But the technical conditions changed quickly in these years. The transistorized IBM 1401, Saab D21, and the subsequent third-generation computers like the IBM System/360 introduced in 1964, which used magnetic tape or disk store for input/output (I/O) and mass storage, gave new preconditions for a regional system.

The IBM 1401, which was announced in October 1959 and shipped in quantity in 1960, represented a leap in technological development, with its new possibilities for data processing using punched cards, magnetic tape storage, and fast printouts.[10] It was not especially fast with respect to internal processing, but it was specialized for converting data from punched cards to magnetic tape to printed text. With its comparatively fast chain printer, a 1401 could replace four conventional tabulators.[11] The IBM 1401 was a second-generation, transistorized small/medium-sized computer that could be connected to a large-scale computer (like an IBM 7070/7090) for top-speed computing tasks. It used magnetic tape and had random access storage. Maybe magnetic tape was the biggest novelty, since it was a much better data carrier than punched cards or paper tapes.[12] In other words, the 1401 represented a new technological frame.

The second UOK report, presented in April 1962, was somewhat different from the first one (SOU 1961:4). By now, it was clear that nobody was opposed to computer technology being used for administrative tasks, and the main objective for the committee thus became to present a good solution for the organization of the CFU project.

In the committee's argument for its suggested plan, very little was said about the technological details of the project. This is striking, not least since the public debate, as we shall see, became almost totally occupied with the choice of computer vendor and technical specifications and said very little on the new organization of the central population registration and tax collection system.

Since the machine configurations suggested for the national system were no longer valid, the committee had to invite tenders for new, smaller systems suitable for the county system. In the new report, the committee presented the different systems offered and a suggestion as to which computer to choose. It was also remarked that part of the explanation concerning which system the committee had chosen had been reported to the Minister of Finance in a nonpublic memorandum.

The classified part of the UOK evaluation contained comparisons of technical specifications for the five computer systems offered by the tenderers.[13] No hands-on tests were made. UOK had set up a specification list for a "normal solution" with which the systems should comply. The systems were compared on 11 factors (on a 1–5 scale, where 1 is best). See Table 2.

TABLE 2
THE 11 FACTORS THAT WERE COMPARED AND WEIGHTED IN THE SECRET MEMO

Comparison factors	BULL G 30	IBM 1401	LME ICT 1301	RCA 301	SAAB D21-P
1. Capacity to perform tasks	1	1	1	1	1
2. Appropriateness	1	1	4	1	4
3. Running expenses	2	3	4	1	5
4. Comparison of capacity in technical respect	3	5	2	3	1
5. Expandability	2	2	5	2	1
6. Capacity utilization	3	3	2	3	1
7. Operating qualities:					
a) reliability regarding processing failures	3	1	2	3	5
b) reliability regarding operating failures	..	1	–	(2)	–
8. Programming technique	2	1	4	2	5
9. Technical service and spare parts supplies	2	1	2	2	5
10. System resources	3	1	3	2	5
11. Data exchange	2	1	2	2	2

Source: "Tabell 15. Maskinsystemens inbördes placering med beaktande av vissa faktorer" in UOK "Promemoria angående utvärdering av ADB-utrustning i länssystem avgiven av Uppbördsorganisationskommittén (del 1." Mimeo of 16 Apr. 1962, p. 55; author's translation.

In eight out of 11 evaluated parameters, the IBM 1401 was found to be the best choice. Saab D21 was, UOK admitted, the best computer system when technical qualifications and stated performance were compared. But the 1401 was found to be the most reliable (some 19 systems were installed in Sweden by 15 March 1962), and IBM's service and support were, the committee judged, far better than the others'.

Support and service became a central argument against Saab. In IBM's advertising, it pointed out its extensive service organization as a major benefit. Saab had no such organization and could only give assurances that it would be able to support its customers in due time when the computers were delivered. In the early 1960s, a central part of the support was training/education.

In those early days, the only schools for computer operators and programmers were courses given by vendors or on site in computer centers. Both IBM and Saab trained many of the first-generation computer experts in Sweden, long before the universities started to give courses. Ever since that time, support has been an important—but intangible—extra value for vendors when selling their products.

Long discussions were held about the difficulties involved in comparing computer systems. This was partly because there were no standard procedures for evaluations and partly because of the considerable proportions of this procurement, UOK said. Since the machines would be used in a system of great social importance and the costs of malfunctions would be consequential, the reliability of the computers had to be extremely high. Therefore, the committee had used "every possible opportunity to win better clarity in the evaluations." These high requirements regarding the chosen system spoke against the D21 computer.

In its concluding paragraphs, the committee discussed whether or not the availability for testing of the chosen computer systems could be the determining factor in a procurement process. The answer in this case was yes. This standpoint was supported by quoting a memorandum from May 1960, in which the prerequisite was issued that the vendor must give a full guarantee that the system in question was available and in use to even be considered for the CFU project. This could, of course, seem a very rigorous demand, UOK admitted, and could be seen as discriminating against those vendors/manufacturers in the process of developing new computer systems, but it was nevertheless necessary when dealing with systems of high social importance. Had, for example, the choice fallen on Bull G 60 or Facit EDB, which had been suggested for the first evaluation in 1959, the whole project would have been threatened. These were both examples of systems that never became available even though the manufacturers had advertised them; one was never produced, and the other was taken out of production before the first UOK testings started. Saab was put among these, since it could not guarantee serial production delivery before 1963/1964.

Neither had the question of whether or not to choose computers of Swedish construction been neglected, the committee remarked. But, argued the committee, in the Saab system, some units were produced in Sweden and others abroad, especially in the United States. The IBM 1401 system consisted of units produced mostly in Europe and one in Sweden (the printer). The output value of the D21 units made in Sweden was higher than that of the 1401 unit made in Sweden, but on the other hand, the latter was exported in rather big quantities. The argument used was coupled to heterogeneity and reliability: Saab's system was heterogeneous and therefore less reliable, while IBM's system was homogeneous and thus more reliable. The validity of this argument can, of course, be debated, but it nevertheless served to defuse the national-industry support issue.

The major line of argument of this report was that the consequence for the whole county computer project, if the choice fell on a computer system other than the IBM 1401, would be a delay of one or more years, especially since a final decision could not be made until the D21-P (or other system) had been thoroughly tested in a real-life situation. Rhetorically, this "secret report" was of higher value as an item of debate, rather than in its own right. The tone in the text was restrained, but with a clear support for the IBM computer, while Saab's alternative was mentioned as "the worst," "the least reliable," and "the most untried."

This UOK report caused much commotion, not least since the results of the testing were classified. The centralization/decentralization debate had barely been settled after the first report (SOU 1961:4). Now it was UOK's choice of computer system that was questioned. Should a big state procurement like this be decided only in terms of "the cheapest possible solution" and on the basis of the "only available" argument? These were arguments the press raised. Secret investigations trying to invalidate the UOK results were made by the Swedish Board for Computing Machinery (Matematikmaskinnämnden, MMN) and by Saab, which showed that the D21 system could outperform the IBM 1401.

Both UOK and DBK turned in their final reports in June 1962. From then on, the somewhat indecisive Swedish computer policy was moved to the political level. In November, the Ministry of Finance declared that no decisions regarding UOK's suggestions would be made until the next year. During the autumn, the Saab alternative came up once again, through different lobbyists demanding that the state should buy a Swedish computer system. One such lobbying group included Östergötland County and its county governor, Per Eckerberg, who strongly supported Saab, whose main production facilities were located in the Östergötland town of Linköping.[14] A government bill (Bill 1963:32) was presented in February 1963 based on UOK's second report.

Bill 1963:32—The Minister of Finance Settles the Controversy Temporarily: "Let's Run Two Test Sites"

The Minister of Finance declared that on grounds of principle, it was questionable to let economic and/or industrial policy aspects decide the choice of computer system, but that on the other hand, there were strong reasons for not letting one company dominate the market.[2,15,3] But UOK had not been instructed to consider aspects pertaining to economic policy. To settle the controversy, Minister of Finance Sträng decided that the order should be split between Datasaab and IBM.

On 1 February 1963, the Ministry of Finance presented Bill 1963:32, in which both of UOK's reports (SOU 1961:4 and 1962:18) and the responses from outside actors (mostly referral bodies) had been brought together for a solution for the county computer project that could be accepted by most actor categories. A temporal closure was reached through the suggestion of a "double solution." In the proposition, it was suggested that machinery for automatic data processing should be introduced to support the national registration and in the work with taxation and accounting of direct taxes. A new body would be formed to handle the central administration and supervision of the organization. This would be called the CFU and commence its work in July 1964. The new organization was to be effected by the turn of the year 1966/1967. Before this, certain tests were to be carried out.

In the bill, the technological frame of EDP in the early 1960s was summarized: What uses, what problems, and what benefits formed the computing discourse of this time? According to this document, computers could be used for:

- rationalization of office work,
- inventory control,
- financial accounting,

- customer registration,
- payroll, and
- personnel records.

Computer technology was especially well-suited for rationalization of office work thanks to its ability to execute long chains of processes, including:

1) arithmetical operation,
2) tabulation,
3) sorting,
4) retrieval of requested data and index posts, and
5) printout of results.

Typical characteristics of this technology were that it was fast and safe and involved no more than insignificant risk of miscalculation or other error. Office automation through computerization considerably reduced the need for office staff.

Many actors in this controversy used the arguments listed above. But in Bill 1963:32, a new argument for computerization was presented—the *human factor*. The argument was that by using automation, many sources of errors could be reduced, and tedious tasks moved from humans to machines. The Minister of Finance settled the controversy temporarily by calling for a mixed system. Sträng's compromise satisfied most parties, and in the press, this was reported as the Minister of Finance acting as a mediator in the computer war between Saab and IBM.

The Computer Bill (Government Bill 1963:85)

In a following government bill to Parliament from the Ministry of Finance, the so-called Computer Bill, the state policy of computer implementation was declared.[16] This bill had been in preparation for eight years by the committee on machine methods of computation (DBK), which was appointed in 1955. One of the bill's major items was that state administration should be rationalized with the aid of computers. The argument was that the only way the national, regional, and local authorities could manage the rapidly growing administration was by rationalization through the use of modern technology—i.e., computers or EDP. This was not to get rid of staff, since the administration was growing all the time, but to cope with the increasing demand for administrative work connected to the buildup of the welfare system.[17,18] The Computer Bill and subsequent decisions in Parliament constituted the start of a new Swedish state policy on computing in administration. It was a policy that made Sweden one of the most computerized countries in the first years of the 1970s.

Even though UOK/DBK had proposed a centralized solution, the government, in Bill 1963:85, approved the county system. A centralized system would be better in economic terms, but the decentralized system was preferred in terms of military preparedness, because of problems with transportation of material to a central computer and because there was a widespread unwillingness toward centralization of already decentralized activities. It was proposed that there should be a coordination of the state computing activities, regarding both hardware and software, as well as programming, coding, and media. The bill also suggested how computer research and development should be conducted.

The bottom line of the bill was that EDP presented many possibilities for rationalization and increased efficiency within the state apparatus, which, as it seemed, it had become the Minister of Finance's task to introduce.

Remarks on Phase 1

In the discussion of the first phase of the CFU project, the technological frame of the committees was at first self-evident, but then was challenged by other actors. A centralize–decentralize debate arose in connection with the national–regional–county system design suggestions; there was also debates on the choice of vendor/manufacturer for the county computers and on domestic-industry protection considerations.

UOK presented IBM as its main choice. At first, this was accepted, but when Saab D21 proved to be "better" in technical respects, the criticism of UOK's choice became harsh. Also, industrial policy arguments and arguments of trust appeared in the press, which took an active part in the "war." UOK defended its choice by repeating that the time factor was crucial—D21 was nonexistent at the time of decision and could therefore not be evaluated, while the IBM 1401 had been proven both useful and reliable in practice. Also, the size of the companies gave the advantage to IBM—the bigger company could be expected to give better service and support than Saab, and this was a major factor in UOK's evaluation.

Sträng presented a rhetorical closure mechanism when he killed the debate by ordering a "double solution" for the tests (and giving good reasons for it, too). After the introductory phase, the interpretative flexibility of the CFU project was reduced: Closure was reached on a decentralized system design and on what computers should be tested for the project.

We can also see that the actors did not pursue a primarily political argument in the sense of party politics, but rather in the sense of a general endeavor to modernize society. There was a consensus that this must be done and that computers were one (or for some actors *the*) means to achieve it. Computerization was good for everybody, while industrial policy/protectionism divided the actors in two ideological groups: those who put internationalization first and those who put strong industrial policy making through state procurements first. The technological argument differed between actors: While the committees and many referral bodies argued on a conceptual level (computerization or not, organizational solutions, delays, etc.), MMN, Saab, and the defenders of the D21 went more into technical details, using arguments about speed, redundant capacity, and flexibility. Maybe this is a typically Swedish way of managing social change: broad consensus on the central issue, but hard debate on the details.

Phase 2: The Contestants—IBM 1401, System/360, and Saab D21

The second phase of the computerization process starts with the 1963 decision to set up two test sites with IBM and Saab computers. This settled the controversy for the moment: Through the splitting of the orders, all parties would be satisfied, and the loss of face was reduced. But the advocates of the IBM 1401 system found themselves fighting for an outmoded system once the IBM System/360 was announced in April 1964, while the national industrial policy advocates were pleased that Saab's computer showed better results and beat IBM in cost/performance comparisons. Even though the tests showed that Saab's computer was better, the final orders were split between Saab and IBM. By mid 1967, all CFU systems had been delivered. But the main question

remained: On what grounds and in accordance with what criteria should one vendor or system be preferred?

In the following section, we will take a closer look at the contestants in the CFU controversy: on the one hand, the computers IBM 1401 and System/360 model 30 and IBM Svenska AB and, on the other, the Saab D21 and Svenska Aeroplan Aktiebolaget. Through analyzing brochures used to sell the 1401 and D21 computers—and seeing how these were "packaged" for presentation to prospective customers—the intention is to study another type of "text" rather than the official statements representing the computing discourse in Sweden around 1963. We will also look at the first practical trial of the IBM and Saab computers.

Big Blue in Sweden

IBM Svenska AB was established in 1928 and was a pioneer in the punched card and computing business in Sweden. International Business Machines Corporation, with its roots in the U.S. office appliance industry of the early 20th century, had by 1962 become one of the world's largest companies, with some 120,000 employees and a turnover of nearly 10 billion Swedish krone.[19,15,12,20] IBM Svenska AB, in 1961, had some 1,200 employees and a turnover of 153 million Swedish krone, of which 50 million Swedish krone were accounted for by export. IBM had approximately 70 percent of the Swedish computer market, and the international market share was about the same. IBM's share of the U.S. market exceeded 70 percent.[21,22,23,24] The Swedish subsidiary grew fast in the 1940s and 1950s. In 1945, the company had 94 employees and a 1.3 million Swedish krone turnover; in 1955, it had 400 employees and a 13.3 million Swedish krone turnover. By 1965, the company had 1,700 employees and a turnover of 195.5 million Swedish krone.[24]

In Sweden, the first IBM (C-T-R) punched card machinery had been installed in 1913 at Brandoch Lifförsäkrings AB Svea in Gothenburg. Other early users were Svenska Kullagerfabriken (SKF) in Gothenburg (1918) and the National Bureau of Statistics (SCB, Stockholm, 1921). Early products sold in Sweden apart from punched card machinery were:

- scales,
- time recorders,
- electric clocks, and
- electric typewriters (starting in 1936).

IBM set up a service bureau for computation in Stockholm in 1932. As we can see, the company was well-established as a provider of office equipment in Sweden long before the computer business started. IBM's early computing products were introduced as follows:

- IBM 405 alphanumeric tabulator in 1934,
- IBM 416 tabulator in 1945,
- IBM 604 electronic valve calculator in 1948,
- magnetic tape as a storage medium introduced in 1949 (in Sweden in 1956), and
- IBM 650, the first electronic computer system in midprice segment, in 1954 (the first Swedish order was by Statens Järnvägar in 1957).

IBM introduced its 1401 in 1959, and some 40 orders for it were placed in Sweden the first year. Exchangeable magnetic disk storage was introduced in 1961. In 1964, the IBM System/360 computer family was introduced worldwide.

In the 1960s and 1970s, IBM was criticized for being "hegemonic," not only in the Swedish market but all over the world.[25,15,26,20] For many people, IBM was synonymous with computers, just like Rank Xerox for a long time was the "only" photocopier vendor ("to Xerox"). The parallels are many to today's claims against Microsoft.

IBM Machines Competing for the CFU System

The IBM 1401 Data Processing System quickly became one of the most important and successful products IBM had ever announced. A small configuration, without tape drives and with the minimum memory capacity of 1,400 characters, was available for just under $2,500 per month—a much lower rental for much higher performance than a "big" accounting machine configuration. It has been remarked in a history of IBM's early computers that it would be no exaggeration to say that the IBM 1401 opened the world of electronic data processing for the first time to a broad range of small and medium-sized users of IBM's punched card systems and also gave IBM its first realistic glimpse of the size and importance of the computer market that was unfolding.[27]

IBM had a well-established sales organization long before the CFU project arose; it was capable of transferring customer needs to research and development departments but designed first and foremost to persuade the world that IBM provided the most versatile computing resources. In a Swedish sales brochure (see Fig. 3) for the 1400 series, the fact that IBM was big—both in Sweden and in the rest of the world—was used to stress that the 1400 Data Processing System was big as well.[28]

Fig. 3. This brochure was published by IBM Svenska AB's information department in 1963. The map showed the places in Sweden where IBM had an office.

(Source: IBM Svenska AB IBM 1400 IBM Inf.-avd., Stockholm, 1963; courtesy National Museum of Science and Technology, Stockholm)

The best-selling IBM 1401 was replaced by a new computer family in 1964. On 7 April 1964, the IBM System/360 (see Fig. 4) was announced, and it somewhat changed the technical preconditions for the CFU project.[29,25] The System/360 compatible range of computers consisted of six distinct processors/CPUs and 40 peripherals, which were intended to replace all IBM's current computers (except the smallest and the largest). This was the first massive announcement of a whole range of compatible computers built on interchangeability and a standard interface, and it is said to have taken the industry more or less by surprise.[11]

Fig. 4. The IBM System/360 range of computers introduced in April 1964 set a new standard for computing. It also changed the preconditions for the CFU project in many ways. This was yet another untried computer system that the UOK/CFU committee had to consider. But IBM considered that it was not different, only better, and thus no testing was needed.

(Source: IBM Svenska AB *IBM Nytt Extra* April 1964)

System/360 was a fully transistorized computer built on integrated solid logic technology circuitry with magnetic core store. It was designed in modules with compatible standard units, which made many different configurations possible. At the introduction, there were six models, of which the smallest (IBM 360/30) could perform 33,000 additions per second, while the biggest could perform 2.5 million per second. The modular principle introduced with System/360 was applied on both hardware and software. The machine, or rather the system, was a so-called third-generation computer that had most of the characteristics of a "modern" computer: a powerful operating system, multitasking, and full compatibility. Full compatibility meant that the user of one machine could run the same program without recompilation on any machine in the series—from the smallest to the biggest. It also had a standard I/O bus for peripheral equipment. (This was sometimes referred to as "IBM environment," and it opened the door to the *plug-compatible* industry.) This was a strong technical argument, since the inconveniences and costs for the user to convert programs for a new computer were high.[29]

In June 1964, almost exactly one year after Parliament had decided on the county computers, CFU on its own initiative had written to IBM Svenska AB and "asked IBM to preliminarily reserve one [IBM 360] computer system model 30 for delivery" to replace the 1401 at the Stockholm test site.[15] In November 1964, both CFU and Statskontoret (Swedish Agency for Administrative Development) agreed that the 1963 contract for delivery of nine IBM 1401 computers should be changed, so that IBM could supply the new System/360 Model 30.[15,30]

Saab Electronics Ltd

In the spring of 1962, some engineers from the electronics department of Svenska Aeroplan Aktiebolaget (Saab; Saab Aircraft Company) made the first installation of a D21 computer at Skandinaviska Elverk, an electricity power supplier in Stockholm. This untried machine—not a single D21 computer existed before this installation—was built more or less on site in Stockholm. Saab took a prototype D2 (the first fully transistorized computer built in Sweden), added some external units, and continued with construction, learning the hard way (see Fig. 5). A center of competence for the development of applications was formed around this machine, and many new and untried fields of computing were explored, both in the scientific/engineering field and for EDP uses. In a few years, the D21 system (see Fig. 6) and the following D22 model were established as competent and versatile "mathematical machines" or general-purpose mainframes that could compete well with computers from international vendors, such as IBM, RCA, Control Data, and Remington Rand.[31,32,33,34]

Fig. 5. The D2 prototype had a very small CPU module. It weighed some 200 kilos and needed only a 250-watt power supply. The emblem in the lower right corner was changed, depending on to whom it was shown: D2 for potential civilian customers and SANK (Saab's Numeriska Kalkylator) for potential military ones.

(Source: Datasaab archive)

Fig. 6. The D21 in the first installation at Skandinaviska Elverk, Stockholm.

(Source: Datasaab archive)

Saab's calculation department—led since 1949 by Börje Langefors, who later became Sweden's first professor in informa-

tion processing—was a frequent user of the BESK computer when it was ready in 1953.[12,36,37] Starting in 1953, the department also used two IBM 604 "Electronic Calculating Punches" and one IBM CPC (Card Programmed Calculator) for its massive calculations in connection with aircraft design. Numerical analysis (finite-element method) had become a major tool in aircraft construction, and this demanded heavy computing resources. After having used the BESK for a couple of years, Saab decided to build its own copy of the machine instead of trying to buy an advanced computer from abroad.[32]

Saab's copy of the BESK, called SARA ("Saabs Räkne-Automat"/Saab's automatic calculating machine), which was up and running in 1957, was expanded with an in-house-built magnetic tape store in 1958 and used for construction and design work in connection with Saab's aircraft production. SARA was dismantled in 1967.

Saab's economic department used an IBM 604 (since 1956) and an IBM 650 (since 1958) for administrative routines. In 1963, this became a source of conflict when the company wanted to replace the IBM machines with a D21.

The D2 was first tested in August 1960.[31] It was transistorized, had magnetic core store, used very little power, and was compact—it weighed only some 200 kilograms (about 500 pounds). The purpose of this prototype was mainly to gain knowledge about how to build a small computer, which could be used as an on-board computer on Saab's new combat aircraft, the AJ37 "Viggen." Although it was "commercially accessible," the D2 was not built primarily to be launched on the market, but was offered to a few potential military and industrial customers.

The D2 concept was presented publicly for the first time in connection with the international Instruments and Measurements Conference held at Ostermans Marmorhallar in Stockholm in September 1960.[37,54] Until then, the computer had been a primarily military project, but from then on, Saab tried to sell it commercially under the name D2. The first order for a D21 system was placed by the power supplier Skandinaviska Elverk AB in December 1960. This pioneering installation was ready in May 1962.[38]

For the CFU project, Saab in cooperation with Facit Electronics, Åtvidaberg, offered the D21-P system, equipped with magnetic tape mass storage, punched card and paper tape I/O units, and printers. The D21 had a longer word length, a combined memory for instructions and data, and a considerably enlarged instruction list. It had a simple logical design and high internal speed. Its high speed gave it better possibilities of communicating with terminal units (I/O), often eliminating special buffers.[39]

D21 Brochures

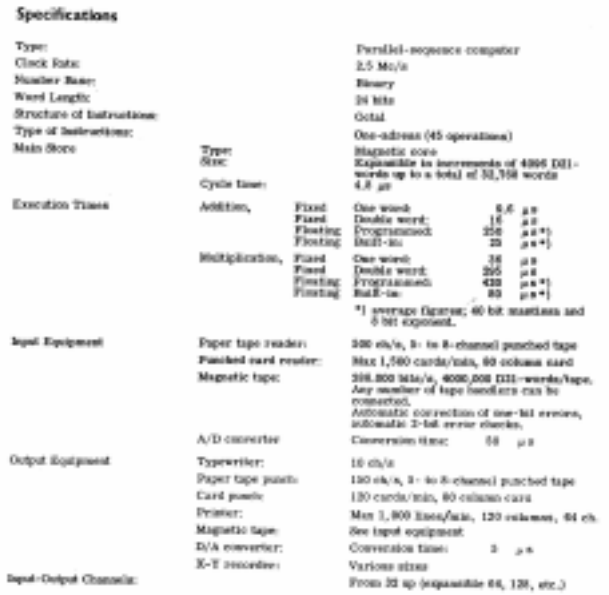
In the publicity material Saab produced to sell the D21 system, we can find some interesting aspects of the rhetoric of technology. In an early, very simple brochure[40] presenting the "synopsis" of the not yet ready "D21 Data Processing and Computer System," the new computer was presented as a "very fast digital computer system with a high data-handling capacity and exceptional facilities for adaptation to suit varying requirements." This sentence carried much of the "engineering" attitude toward the product that characterized Saab's early presentations of its new computer. It was truly a machine, a by-product of Saab's highly skilled aircraft production, and was not intended as a commodity.

"Flexibility" was the "pitch" of the text: flexibility stemming from fast internal logic, high transfer rate to and from the CPU, and a well-planned modular construction. The message was that this rendered the D21 useful for the most widely varied applications, both for administrative and technical-scientific data processing as well as for process control (see Table 3). The most "desirable" technical properties of the computer system were given as (and this is really a technological rhetoric):

- The size of both the core store and the external memory can be matched to requirements.
- Virtually all terminal units (magnetic tape, line printers, punched card equipment, etc.) can readily be connected.
- The system can easily be optimized for a given application.
- The system lends itself to modification to meet changing requirements.
- Servicing is easy.

Also, the reliability of the system—thanks to "meticulous testing of components and good circuit design"—was pointed out.

TABLE 3
SPECIFICATIONS OF THE D21 PRESENTED IN AN EARLY PROSPECTUS



Specifications

Type:			Parallel-sequence computer
Clock Rate:			2.5 Mc/s
Number Base:			Binary
Word Length:			24 bits
Structure of Instructions:			Octal
Type of Instructions:			One-address (45 operations)
Main Store	Type:		Magnetic core
	Size:		Expansible in increments of 4096 DII-words up to a total of 32,768 words
	Cycle time:		4.8 μs
Execution Times	Addition,	Fixed	One word: 9.6 μs
		Fixed	Double word: 14 μs
		Floating	Programmed: 256 μs *)
		Floating	Built-in: 28 μs *)
	Multiplication,	Fixed	One word: 24 μs
		Fixed	Double word: 295 μs
		Floating	Programmed: 432 μs *)
		Floating	Built-in: 80 μs *)
			*) average figures; 40 bit mantissa and 8 bit exponent.
Input Equipment	Paper tape reader:		200 ch/s, 5- to 8-channel punched tape
	Punched card reader:		Max 1,500 cards/min, 80 column card
	Magnetic tape:		208,000 bits/s, 4096,000 DII-words/tape. Any number of tape handlers can be connected. Automatic correction of one-bit errors, automatic 2-bit error checks.
	A/D converter		Conversion time: 50 μs
Output Equipment	Typewriter:		10 ch/s
	Paper tape punch:		150 ch/s, 5- to 8-channel punched tape
	Card punch:		120 cards/min, 80 column card
	Printer:		Max 1,800 lines/min, 120 columns, 64 ch.
	Magnetic tape:		See input equipment
	D/A converter:		Conversion time: 3 μs
	X-Y recorder:		Various sizes
Input-Output Channels:			From 32 up (expansible 64, 128, etc.)

Source: Svenska Aeroplan Aktiebolaget D21 Data Processing and Computer System (1962).

Throughout the text, a low profile was kept: The inherent (technical) features of the computer should speak for themselves. Key words were "fast," "high capacity," "flexibility," and "reliability," which all had to do with technical properties of the computer. A long description of programming languages conveyed a double message: On the one hand, it showed that the D21 system had a "full" range of programming resources, while on the other hand, phrases such as "the program library is dynamic and undergoes constant development," "intensive work is at present in progress on several aspects," and "the D21 system is just as well equipped in this respect as it is on the hardware side" had an undertone of not being ready yet, that Saab was promising a little more than what could be delivered at the moment. (This was, of

course, nothing unique for Saab; vaporware is still a well-known phenomenon.) The "meticulous testing of components and good circuit design" argument was coupled to Saab's aircraft production—the message being "if we can build aircraft with high demands on quality, we can build reliable computers."

In another sales brochure, from 1963, the packaging was more elaborate. The message was maintained that the D21 system was fast and flexible, but now the brand name "Saab" and the fact that it was a Swedish computer were more emphasized.[41] "D21 the Swedish computer" and "the 1960s computer for all data processing" were the main messages. If the brochure described earlier was very simplistic, almost "un-selling," this second brochure was sober and spacey, white with black and gold printing, not very conspicuous in the layout, but clearly persuasive in its form (see Fig. 7 and Fig. 8).

Fig. 7. "D21—The Swedish Computer" was the choice of the 1960s according to Saab. The brochure tells a tale of quality, flexibility, and reliability.

(Source: Svenska Aeroplan Aktiebolaget, *D21—den svenska datamaskinen,* Saab, Elektronikavdelningen, 1963)

size	– expandability
performance	– speed
quality	– reliability (safety)
system	– adaptability
economy	– versatility
service	

Fig. 8. Like paper tape spurting out from a punch, the arguments as to why a D21 was the choice of the 1960s cut a picture from the SEV computer center into strips. Each pair built on an argument changing from technical details to more general "values."

(Source: Svenska Aeroplan Aktiebolaget, *D21—den svenska datamaskinen,* Saab, Elektronikavdelningen, 1963)

Inside, two lines ran across the whole spread. Here, piled on the picture of the computer setup at Skandinaviska Elverk, the main features of the system were presented in pairs that built on the same bottom line as the earlier brochure, but with a much more explicit rhetorical touch to the copy. The characteristics especially pointed out as the D21's advantages were:

The main characteristics of the D21 system, given as pairs of keywords (excluding the service line), were elaborated in the text accompanying each pair. The arguments used together formed a set of catch phrases that described details (technical features) but most of all the "values" that the D21 offered. The pulse of the text was high, almost staccato-like.

Arguments listed were (my translation):

- a broad spectrum of sizes, depending on needs (modular construction allows easy expansion; D21 has the right size);
- adds 100,000 24-bit words per second, transfers almost 300,000 bits/sec to and from magnetic tapes (D21 lets the external units work simultaneously and makes use of the high pulse of the central unit, 2.5 million beats/sec; lightning fast arithmetic; binary representation; simultaneous operations; and large high-speed memory);
- D21 is built with the high-grade technology and quality that mark the aircraft manufacturer Saab (every part of D21 is carefully designed and produced by Saab, after testing chosen by Saab to guarantee faultless operation with the highest security);
- D21 is the computer of many possibilities (richly equipped for easy programming of all kinds of EDP tasks; the flexibility of the D21 system allows for far-reaching adaptability);
- the D21 offers good EDP economy (a fast machine gives better margins, and expandability gives a longer economic lifetime; for many companies, D21 offers an extra economic advantage through its versatility).

An interesting imagery was used to describe these "values." The high pulse—D21's good and strong heart (bodily metaphor)—and "lightning fast arithmetic"—the speed of light, it had energy like a flash of lightning (physical metaphor)—were metaphors taken from the natural sciences. By associating the D21 with Saab, the image of advanced technology and quality connected to the aircraft production was transferred to computers (symbolic value of brand name). Saab also guaranteed faultless operation and high security—which of course is absolutely necessary in an aircraft (the pitch being: "computing is like flying"). D21 offered many possibilities—instead of there being one area where the D21 was best, the idea was that it could be adapted and expanded to fit *any* purpose (a chameleon). And of course technology, economy, and versatility go hand in hand in a society that is changing, therefore fast storage and fast computers offered a better position for those who wanted to march in step with this progress (the computer was a good companion to the land of the future).

Saab also offered its D21 customers good service in the following forms:

1) system assistance,
2) expert consultants,
3) lectures and discussions,
4) standard programs,
5) programming systems,

6) programming courses,
7) documentation,
8) training in service and repair,
9) qualified technical support, and
10) spare parts.

Indeed, the company promised to take care of almost anything.

The text on the back of the brochure told a story of fast development. In only a couple of years (1960–1963), Saab had managed to design and build "one of the world's fastest and most efficient computer systems" already in full operation at three places in Sweden. In 1964, this system would be used in the following industries:

- engineering,
- shipbuilding,
- power plants,
- insurance,
- meteorology,
- aircraft research,
- university research,
- food industry,
- road and water-main construction, and
- national register.

This is a truly impressive list of uses. This was a rhetoric of mass effects, but at the same time, it was vague. The D21 *would* be in use, but there was no testimony that it worked in all these applications.

The inside spread of the brochure, with its sliced-up picture resembling strips of punched paper tape, tells a similar story. On the basis of the D21's technical qualities and Saab's well-documented engineering skills, the readers were assured that innovative (though untried) technology was the best choice if they wanted to secure their EDP investment for the future. This can be compared to the IBM rhetoric of "safe bets" and "worldwide organization" in its 1400 series brochure.

Test Sites With IBM 1401 and Saab D21 Set Up—UOK Becomes CFU

Minister of Finance Sträng had solved the problem of what computer system should be tried for the CFU project by deciding that two test sites should be set up: one equipped with IBM 1401 (in Stockholm) and one with Datasaab D21 (in Linköping). The test sites opened in August 1964 and ran for some six months.[1] During the test period, IBM started to market its new System/360 family, which replaced the older 1400 series. Since the System/360 was totally new, the UOK evaluation was now in many ways invalid.

The CFU was commissioned on 1 July 1964. It was to continue UOK's work as the official body leading the buildup of the county computer centers. In April 1965, CFU suggested to the government that the preliminary contracts with IBM and Saab for renting computers should be made definite. At the same time, the CFU suggested that all machines needed in the future should be the IBM System/360 model 30.[42] In support of that suggestion, the CFU board adduced the results from the tests in Linköping and Stockholm.

After the testing had been completed in April 1965, Parliament decided that the order of six computers that would fill the procurement was to be divided between Saab and IBM. All computers should be ordered and installed before March 1967.[2,43,44,3,45] In the years 1966–1967, installations were made at the 19 county administrative boards: 12 IBM System/360 model 30s and eight Datasaab D21-P machines. The last system was installed in Kalmar in August 1967.[46]

The tests for the CFU project were performed between August 1964 and February 1965. The CFU overtly preferred the IBM System/360 model 30, but Saab managed to defend its position. This was mostly because the D21 was a much faster computer than the IBM 1401, which had been the first suggestion for the whole county computer center system, but also the argument to support domestic industry was decisive.

In Phase 2 of the controversy, CFU used a somewhat odd way of arguing for its choice of computer: The tests were made on an IBM 1401 and a rather small D21 configuration—and subsequently the D21 did not present results that were markedly better than those of the 1401, even though D21 proved better on many points. At the same time, the technical specifications of the (not yet delivered) System/360 model 30 system were compared with the specifications of a small D21 configuration.

Saab showed its competitiveness by offering better components for the CFU computers at about the same price. This made the D21 competitive with the System/360 model 30. The CFU's major criticism of the D21 was based on Saab's inferior service and support as compared to IBM's. It is not improbable that CFU believed IBM to be more sustainable in its undertakings, not least since the company was so much bigger.

We can see how the positions got reversed. In Phase 1, the D21 was untried and therefore rejected by UOK and DBK. In the second phase of the CFU controversy, it was the IBM computer that was untried. Still, CFU persisted in arguing against the D21. Saab could now show that the D21 system had been tried in more than 10 installations, and it proved to be very reliable. Therefore, according to Saab, the D21 was the natural choice for the county computer centers. The government relied on a clause in the contracts with Saab and IBM saying that improvements that were to the advantage of the CFU project were a responsibility of the vendors—and so it was up to Saab to compete with IBM once it had been allowed into the procurement process. Major themes in the arguments of the test phase of this controversy were:

- tried versus untried technology,
- flexibility,
- reliability,
- technical properties,
- service, and
- support.

We have followed how Saab went from just saying "Look, we have a computer" to a full advertising campaign of a new computer system. The D21 computer was associated with features of Saab's aircraft manufacturing for quality and reliability. Its versatility or general-purpose capacity would connect the user with the new world of lightning fast computing.

Phase 3: New Trial 1967–1970

Stabilization and Redefinition—and a New Controversy Let Loose

The third phase of this controversy begins with an independent survey of the 20 newly installed CFU computers that was conducted after about one year of operation. In their report for 1967, the Parliament auditors concluded that the Saab computers had

shorter processing times and thus higher capacity than the IBM System/360 model 30 computers and that the county computer centers were underutilized as a whole.[4] The auditors requested that the centers should be given more tasks in order to fill their capacity, e.g., by changing machines between counties or taking on service bureau jobs. If this could not be done, the number of counties with fully equipped computer centers should be reduced. In light of this request, the CFU suggested that the number of computer centers should be reduced and that only Saab computers should be used, in order to get a homogeneous system. This idea was presented to the government in 1968.

The Minister of Finance—on CFU's suggestion—called for a reduction of the number of computers. The government also took this position in Bill 1969:81.[5] Several referral bodies involved with this bill—most of them representing county interests—wanted to keep the same number of computer centers as before. The question of which computer type to choose was, on the other hand, rather uncontroversial this time. CFU suggested D21 as the most economic system, and most referral bodies had no objections to this, but counties equipped with IBM machines protested that they would lose service jobs. This was a big shift from the first phase of the controversy, when the choice of computer vendor was one of the key issues in the debate.

During the spring and summer of 1970, the new Saab computers were installed, changing the previous system of using two different computer manufacturers. After 12 long years of investigations, bad speculations, doubtful acquisitions, and expensive experiments, one of the biggest state computer procurements was ended. This phase of the CFU project can be seen as a stabilization, in that the dispute regarding which computer brand the county computer centers should use, as well as regarding vendor and regarding how many centers should be set up, was finally settled. But less than a year after the start, strong actors proposed a redefinition of the whole system.

An Unbiased Evaluation

The Parliament auditors' evaluation was the third trial of the Saab D21 computer in the CFU project and the first unbiased one, in the sense that the Parliament auditors had no interest invested in either computer system or organizational solution (as far as we can know). The primary objective of this investigation was to recommend ways to bring down the state's costs for the CFU system. This being said, it is necessary to try to analyze the technological discourse of Parliament's auditors.

The evaluation was based on operating times reported by the different county computer centers between January and September 1967. It was a rather short time during which some computers were still being put into operation. Nevertheless, the critique was rather harsh. The way of using reported operating statistics can, of course, be questioned. First, some computer centers had been operational for only a few months when the report was made. Second, only Stockholm and Östergötland were used for testing CFU routines and programming of new routines, apart from the daily work. Nevertheless, these records were used to draw quite strong conclusions for the future of the CFU project.

There is always a considerable degree of arbitrariness in how a test is set up, and this one, as well as the other two trials described in this case, could be criticized for proving only what it was intended to prove. Parliament's auditors' argument was very technical in the sense that the audit was based on the operating time for the computers, pointing out one computer as better than the other. But at the same time, the recommended changes were only partly a question of technological features. To redistribute the computers was a drastic suggestion based on the inherent technical features, but the effect of it was mostly organizational. Parliament's auditors could have suggested other technical solutions, e.g., expansion of computer capacity and reprogramming. Instead, they suggested taking on more jobs to fill existing capacity. Good economy, as an effect of high utilization of investments that were already made, was the most important point.

CFU Suggests "One Computer" Solution on Economic Grounds

The CFU presented its response to the auditors' criticism in a report to the government in October 1968.[47] CFU's main argument as to why the county computer system should be reorganized was the great inconvenience the double solution presented. To run two parallel systems was expensive and led to extra costs for systems engineering, programming, etc. of approximately 700,000 Swedish krone. To convert magnetic tapes to and from IBM (1/2 inch) and Saab (1 inch) standard had also become a growing problem, the committee stated. This called for changes. When considering the maximum capacity and the low total utilization of the computers, CFU found that a reduction could be made to two or three counties per center (≈450,000 residents/center). This, however, was without considering external jobs. Even though there was an increasing demand from outside for the data the county computer centers had stored, there was still a problem of low utilization. CFU therefore suggested a reduction of the number of county computer centers.

The double solution had now been tested, and certain conclusions could be drawn, CFU stated. The major objective for the double solution—to compare two different computer systems for the CFU project—had been fulfilled, and now only the inconveniences remained. Indeed, they had even increased. Running two systems also had bad effects on other national EDP tasks administered by the county computer centers, which resulted in raised costs for personnel administration and works management.

As the report was written, the main reason for CFU to reconsider the organization seems to have been that the renting contracts on the IBM computers were due, and thus it had become time to renegotiate them and to take precautions if the systems should be replaced. The CFU committee's main suggestion was a reduced system of 13 centers (using 14 computers) equipped with only Saab D21 computers. The reason for this choice was mainly economic. Renting 14 D21s would be cheaper; the total reduction of costs came to 5.1 million Swedish krone.[47] Also, Statskontoret supported CFU's suggestion of a reduced CFU system equipped with only Saab computers.[48]

The CFU's recommendation of Saab D21 as the only computer for the CFU system seems to have been based on two points. First, evaluations showed a much better performance (about double) of the D21 systems over the IBM System/360 model 30. This would lead to lower production costs for the national population registration and tax collection system thanks to higher capacity. But equally important (and maybe a way out of the IBM lockup) was that the Saab and IBM contracts were different. By skipping IBM and waiting for renewal of the Saab contracts, the state would

save more than 2 million Swedish krone, according to CFU's estimations.[46] If the number of computers was reduced to 14, the total savings would be 5.1 million Swedish krone, under the precondition that the machines were rented. Again, economy had become more important than technical features for the outcome of the CFU controversy.

This might have been the decisive argument, since indications were becoming stronger and stronger that the CFU system with county computer centers in 19 (reduced to 13) counties might become obsolete. To meet this, a reduced and rented system would give better flexibility for future changes. Plans were being made for a national register based on the new social security system that was under development.[48,49,18] This would present yet another technological frame: centralized registers and computer power distributed by means of networks.

Unified, Reduced, Rented—New Order for the County Computer Centers Presented by the Minister of Finance

On 28 March 1969, the Minister of Finance presented his new plans for the CFU project. In Bill 1969:81, we can find a reflection of the criticism from the Parliament auditors and of CFU's and Statskontoret's views on how the future would be at the county computer centers.

In this bill, a new organization for the national register and taxation system and for the county computer centers was suggested. The bottom line of the proposition to Parliament was that a unified (homogeneous) system with only one type of computer, which would be rented, and a reduction from 20 computers at 19 counties to only 14 computers at 13 counties should be effected by the end of the first quarter of 1970. CFU's argument that the experiences from running two parallel systems had now been gained—and that now only the inconveniences from the double solution remained—was repeated. Also, Sträng's own arguments about competition between vendors, about experience for future procurements, and about data exchange between different systems were repeated and dismissed as no longer relevant.

The new system should be reduced by six computers. One argument for this was that the counties without their own computer centers had reported fewer problems than expected. The reduced organization would be based on the number of inhabitants in each county.

All county administrative boards had been asked to react to the CFU suggestions. The majority were for a homogeneous system. Not unexpectedly, counties that would lose their computer center were against the new organization. Another objection from IBM-equipped counties was that they would lose service bureau jobs if they lost their IBM computers. Others thought they would get jobs from the county councils (Landstingen), which were about to procure Saab computers. But, and perhaps most interesting, a new centralization–decentralization debate was opened up, based on the central computer network connection system design.

Another "hard" technological argument was referred to in Bill 1969:81 as to why the county computer centers would lose or had lost their importance. The technological development had to a certain degree made the old CFU computers unable to compete with newer equipment: They had no direct access storage. Removable disk packs had, by the end of the 1960s, become a prerequisite for many EDP tasks. The CFU system was more or less batch-operated (magnetic tape was in this sense similar to punched cards, since the tapes were processed sequentially and the result was new tapes), while newer integrated systems made use of continuous random access. And the total number of computers available in the country—both public and privately owned—made the technology diffusion argument less valuable. Because of this, the county computer centers in their existing form were doomed.

The Next CFU Computer Generation—D22/220

The new plans for the CFU system that had been decided by the government meant that all IBM computers would be removed by 1 April 1970. After August 1970, the 13 remaining county computer centers would be using only Datasaab computers models D21, D220, and D22.[50] In April 1969, seven new computers were ordered from Saab. Saab had offered to replace the computer in Stockholm with a D22, its new model launched in 1966, which was a much faster machine than the D21 (see Fig. 9).

Fig. 9. The geometrical figures floating around in the top rectangle symbolized the connection between entities that Datasaab's computers could provide. The D22 system was a true third-generation computer. Like the System/360, it had magnetic core memory and disk storage. Integrated circuitry (LSI) in logic and memory were not used until the next generation IBM System/370 introduced in 1970 and Datasaab D23 in 1973.

(Source: Saab *Datasaab D22. Expansion with Data in the Center,* Saab Aktiebolag, Computer division, 1967)

"Expansion with data in the center" was Saab's new slogan for the late 1960s. It was also the headline of a new sales promotion brochure produced in 1967. The brochure was made in two very similar versions, a green one for the D21 and a blue one for the D22.[52] The cover had a simple two-color printing with a special geometrical figure as the only image. This figure, consisting of two overlapping squares of different size, was used as a logotype in many Saab advertisements together with a specially cut typeface. The whole publication was much more self-conscious than the previous ones—clearly Saab/Datasaab had become a market-focused computer vendor—and the language was much more

influenced by the "computer world." Many code words of mainframe computerese can be found in the text.[53,54] This can of course be due to the fact that the whole computer industry had taken large steps toward a more developed language—or established its own jargon—from the beginning of the 1960s to the end of the decade.

The D22 was a considerably more powerful computer system than the D21, with a much more developed software intended for use in, for example, data banks and terminal systems. It was introduced in 1966. Typical characteristics were:

1) true multiprocessing,
2) Cobol,
3) decimal arithmetic, and
4) disk storage.

Saab still claimed that its computer was well-fitted for both scientific/technical and business data processing, and maybe the development of all computing was going this way. IBM's System/360 was also sold to both communities, albeit with different arguments.

The eight-page brochure contained two types of text. One was a quite factual description of central technical features of the new computer and the peripherals that could be connected to it. Also, the programming systems were described in a certain amount of detail. The most important CPU features that Saab put forward were memory capacity and processing speed. In the technical specifications, the memory size was given for maximum and minimum configurations in both bytes and words (maximum memory was 786,432 bytes or 262,144 words; this can be compared with the D21 that allowed a maximum memory of 98,304 bytes or 24,576 words). External units were paper tape and punched card, magnetic tape, and disk storage. Supported programming languages for easy coding were Algol, Algol-Genius, Cobol, and Fortran. The machine-oriented language for standard routines was DAC 3 (D20 Auto Code). By now, Saab could declare that its own "problem-oriented" software Algol-Genius had been "successfully applied" by many D21 customers. If disk storage was one major novelty, the other was intelligent terminals or "inquiry stations" that allowed network solutions. All in all, these features made the D22 "a computer system with virtually unlimited possibilities."

Even more interesting was the second message in this short text. The electronic computer was given a central role in the development of our whole present society. As one of the major inventions of the 20th century, it was the electronic computer that made both atomic energy and spaceflight possible, we are told. In a rapidly developing society, the constantly growing need for fast information had made automatic data processing crucial. To meet this need, Datasaab had introduced the new D22 computer system. This was the bottom line of Saab's argument.

The only photograph in this brochure showed a woman operating a computer. Over her shoulder, we can see the console where large digits and push buttons light up. In the background, a pair of tape drives spin. What was she doing there in her angora jumper? Where was the man in the white coat?

Many of the jargon or key words of computing used in this text had been used in earlier documents we have studied, e.g., "fast," "efficient," "economic," "speed," "flexibility," "unlimited possibilities," "system," "high-level languages," "scientific," and "business." New values attributed to the computer here were "problem oriented," "application," "terminals," and "inquiry stations." Also new was the connection of computer technology to a deeper social change: "Commerce, industry, research and other vital aspects of present-day society" owed their rapid development to the computer, according to this text. Society was expanding, all right, though not only with *data in the center*, but also *thanks to* computers. This argument, building on the interaction of technology and society, was one expression of the technological discourse we have been following. In the 1960s, to allude only to the transforming power of technology was a way of giving positive "charge" to Saab's bottom-line argument to buy its computer. In the next decade, the Swedish debate pointed out the computer as a negative force in society: threatening personal integrity, employment, and the working environment. At the same time, the number of computers and registers increased dramatically.

Remarks on Phase 3

I have characterized this third phase of the CFU project as a stabilization of the controversy and a redefinition of the national population registration and tax collection system. There was a stabilization in the sense that the disputes regarding which computer make the county computer centers should use, which vendor should be chosen, and how many centers should be set up were finally settled. There was a redefinition because the whole CFU organization was questioned in the late 1960s, about 10 years after the first plans had been introduced.

It should be noted that the third phase shows much less public debate, argumentation, and rhetorical features than the previous two phases. One explanation of this could be that the CFU project had lost most of its political interest, and by the end of the 1960s, it had become a bureaucratic task that had to be carried out. Indeed, there were even signs of regarding it as a dead end, since new solutions for the big national registers were appearing. Another explanation might be that the debate concerning centralization versus decentralization—or the struggle for power between central government and the regional authorities—had found new arenas. As the chief politician responsible for the rationalization of the state administration, the Minister of Finance had to fight on two fronts: It was important to show progress toward making the administration more efficient—and for this he had taken computerization as an ally. But at the same time, he had to manage the latent conflict that regional policy versus central government involved. Also, the industrial policy aspects of this controversy had implications far outside the simple question of which computer to select for the CFU system. Sträng had to show strong resolve in his decisions in order to make the whole rationalization process trustworthy. But once the fight was won, new arenas of power exertion had arisen. So we can assume that the CFU project in its initial phase became a controversy with high symbolic value, apart from the technological discourse, but that toward the late 1960s, it had lost charisma.

Stabilization

The stabilization process of the CFU project began when all computers had been delivered and were functioning at the 19 county computer centers. The auditors' revision was the last trial of the two computer systems; the auditors reported that the computer centers as a whole were underutilized and thus uneconomic, but that Saab's D21 was the more efficient and therefore more eco-

nomic of the two computers used. The report from the auditors was followed up by CFU's own statistics, where once again it was shown that the D21 was the better of the two systems. As an outcome of this, Parliament decided that all IBM systems should be replaced. Thus Saab became the winner of the technological part of the controversy. The D21 won on both technical (speed) and economic (more cost-efficient) grounds.

But the outcome of the trial also had organizational implications. By suggesting a reduction of the number of county computer centers, the main actors introduced a new interpretative flexibility as to how the CFU routines should be divided among a certain number of computer centers.

Redefinition

Even though the auditors' trial led to stabilization—with the D21 found to be the best computer—another interpretative flexibility was being signaled. After the CFU system had been made homogeneous (one computer type), reduced, and optimized to get acceptable degrees of utilization of the remaining computer centers, it was questioned again. New trends toward centralized registers were suggested by Statskontoret (the National Bureau of Statistics) and other strong actors (e.g., the computer industry). The decentralized system would become obsolete because of new online system solutions for register and data retrieval. It was also obvious that the symbolic value tied to the CFU system had faded, computers having become much more common within the state administration and in Swedish industry and other private organizations. These new online system solutions for register and data retrieval presented hard competition for presumptive service bureau jobs for the county computer centers. We can conclude that both technological and organizational developments during the 1960s had rendered invalid the arguments for the "double solution," the regional decentralized system, and the promotion of competition.

The main themes of the arguments have already been hinted at in the recapitulation of the third phase above. After the third trial of the two computer systems, all actors agreed that the D21 was the best system for the CFU computing tasks. No new testing of this or other computers was necessary. Instead, economic arguments became much more decisive for the outcome of the whole controversy.

Both the auditors and CFU verified that the IBM System/360 computers in the configuration used for the CFU system were slower and thus gave inferior cost/performance ratios. The D21 gave shorter processing times, showed higher capacity, and therefore was more cost-efficient. To support this argument, operating statistics were used (rhetoric of numbers).

One strong argument the CFU used as to why the D21 and not the IBM computers should be kept was the rental agreements made between the state and Saab/IBM. The Saab contracts expired five months later and gave better conditions for renewal (IBM's contract expired on 17 November 1968; Saab's on 17 April 1969). Even though the CFU system with distributed computer centers was threatened from outside, it was defended internally by the county administrative boards and CFU. Distributed computer power and the ability to take on external jobs could, in the third phase of the controversy, overcome the centralization trends. Of the original 19 centers, 14 were kept. Maybe the investments were too heavy. The CFU computer centers could not just be given up, could they? Another aspect has to do with prestige. For a county to lose its computer center was, of course, a loss of prestige and power. Conversely, to keep it or even expand it could mean that the connection with the future was enhanced.

Summary and Conclusions

Now for some concluding remarks on the first large Swedish computerization project. What wider scope of the CFU computer center controversy can be pointed out?

At its outset, the controversy concerning the CFU project seemed to be technological—IBM or Saab computer—but analysis of the discourse indicated that arguments were often taken from *other* sources than technical properties. When the different actors tried to persuade others that either computer presented the best solution for the CFU system, their arguments were often taken from the economic and organizational sphere. To this was added the political and/or ideological dimension of, e.g., general progress, rationalization of state administration, industrial policy, and job (loss) arguments. We can therefore assume that the CFU computers became a symbolic issue, with implications far beyond the selection of either Saab or IBM. Some of these implications were as follows:

- The CFU project reached the top political agenda immediately, since the Minister of Finance was the main politician responsible for rationalization of the state administration. By showing that the state administration (exemplified by the CFU system) could be more efficient through the use of computers, the arguments for higher efficiency of the whole state apparatus through computerization could be assembled.
- The practical effects that could be gained by rationalization of the CFU registers by using computers also mixed with the high symbolic value coupled to computerization/automation in society as a whole (this could be compared with attitudes toward atomic energy up to approximately 1970). Computerization offered a direct link to progress and the future. It was not until the 1970s that the problematization of technology as a positive social transformer began in Sweden.
- The computerization project also got involved in the conflict of regional versus national policy: Centralization was, for many, a natural part of rationalization, but there was an equally strong trend toward moving power away from central administration and Stockholm. This goes well with the two opposed technical *and* organizational paradigms of centralized computer power and hierarchy versus decentralized computers and distributed power that competed in the initial phase and recurred in the late 1960s, when the CFU system redefinition began.
- Industrial policy and industrial protectionism were opposing themes in this technological controversy, expressed e.g., in the arguments "buy the best" or "buy Swedish." A bottom line in the criticism of the CFU controversy, both while it was going on and later by historians, has been that the UOK/CFU and DBK committees together with Statskontoret were biased in favor of IBM and deliberately made it hard for Saab to compete for this procurement.
- At some points in this discourse, it has been necessary to call attention to the lack of an explicitly rhetorical argu-

mentation. I have presented some examples of advertising documents that had a certain type of rhetoric (selling); most texts were nonrhetorical but of course persuasive in their purpose to win other actors for one solution of the CFU project. I found more argumentative texts in the early phases, but later the whole project became more and more executive—it was something that had to be carried out. The county computer centers became a technicality or, even worse, a drawback for the state's rationalization process. Was the CFU a dead end?

- It has been difficult to deconstruct the underlying line of development. Did the Minister of Finance have a hidden agenda? Were the arguments about regional policy steering decisions (the new county division)? Were the arguments about employment and support of national industry, as well as rationalization as an all-embracing objective, used mainly to show authority? To exhibit that the press, industry, and administrative bodies could not decide for him?
- Beating Big Blue was maybe not the major reason for why Saab got involved in the CFU project. But clearly the whole computerization project became an issue in which Saab, IBM, and the computers they did sell were used as rhetoric devices by actors outside the electronics industry. The changing technological frames of this period (from centralized to decentralized to networked computers) can be used to describe ways of looking at technology in a wider respect than just which computer vendor to choose for a certain computerization project. The CFU system was being built up during a period when computerization expanded all over society, and new uses as well as new problems were identified rapidly. At the same time, the technological development presented new solutions to old problems in an even higher speed. So maybe we should not blame the people responsible for the CFU system design for not being able to foresee what would happen 10 years after the outset of the project that began in the late 1950s.

One question remains: How did Saab develop into Sweden's first big computer manufacturer? On this I have no definite answers, only a couple of observations. As for much of the early computer industry research and development, Saab could rely on big state procurements for financing its long-term knowledge investments. An aircraft project like "Viggen" ran for 10 to 20 years from the first tenders until the plane was delivered. This made it easier for Saab compared to other Swedish companies that tried to produce computers and that had to sell their products before they could be developed. Later, in the 1970s when the D23 computer was launched, Datasaab had to confront the same problems; the company did not have enough sustainable capital to manage the design of a whole new computer generation in an industry that was much more mature than in the early 1960s. Also, the international competition had increased enormously.

Technically, the situation was extremely favorable at Saab around 1960. Saab had long (at least relatively) experience from using computers of different types for its own design process. There were many projects going on involving miniaturization of "intelligence" for robots and aircraft. And not least, some very inventive people at the mathematics and avionics departments could free their capacity for the computer project. We can also argue that Saab moved into the computer business at a moment when a little consensus on what this technology could be used for had been established. Saab also managed to launch the right combinations of speed, capacity, and peripherals compared to other leading-edge manufacturers. This made Saab's position easier to defend, I think.

But we should not belittle the national motives either. Saab had proven to be able to build several qualified aircraft since its establishment in 1939, and the mere thought of an "in-house" computer manufacturer must have appealed to many actors with influence over national industrial policy issues. So, who did the beating, really?

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The main source for this research has been the Datasaab archive, deposited at Landsarkivet in Vadstena in 1991, from which much of my material on Saab/Datasaab, the D21 computer, and the CFU project has been gathered. Saab's press cuttings on this controversy are also stored in the archive. I have gone through the whole archive and also interviewed people who worked at Saab and were active in the CFU project (among them, Viggo Wentzel, Tore Gullstrand, and Börje Langefors). IBM Svenska AB, when asked, reported that it had nothing on the CFU project in its archives. Most of the official positions on the CFU project can be found in State Official Reports (SOU), propositions to the Swedish Parliament, and bills from the Swedish Government. The National Tax Board (Riksskatteverket) holds an archive for UOK (the first seven years of the project), which I have studied.

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All prices are given in 1960s value, 1 Swedish krone ≈ $0.19 U.S.

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