Precursors of the IT Nation: Computer Use and Control in Swedish Society, 1955–1985

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Abstract. This paper is a presentation of a research project that aims at writing the history of computing in Sweden in the mainframe age from a user perspective. Rather than beginning with the history of hardware, this project takes as its point of departure the way in which actors in different sectors of society used computer technology in order to achieve a higher degree of control over crucial processes, whether through electronic data processing systems, process control or technical/scientific computation.

Keywords: Control, historiography, history of computing, IT-history, Sweden, users

1 Introduction

This paper is a presentation of the research project "Precursors of the IT Nation: Computer Use and Control in Swedish Society, 1955–1985."[1] The aim is to draw upon the experience and sources accumulated in the project "From Computing Machines to IT" and to write the history of computing in Sweden in the mainframe age from a user perspective [1, 2]. The focus of this paper is on the wider context and central concepts, rather than the details of the work process.

In the last twenty-five years, Sweden has consistently received the designation as an IT nation. When the Economist Intelligence Unit made a ranking of IT competitiveness in 2009 with Sweden ranked third [3]. Through the 1990s and 2000s,

[1] The program is funded by Handelsbanken Research Foundations.

similar rankings by IDC and Forbes consistently landed Sweden in one of the top spots.[2] The high level of computer diffusion, internet penetration, and computer literacy has been a constant feature of the adoption of computer-based information technology in Sweden since the advent of the personal computer in the late 1970s.

When the PC became widely available in the early 1980s, digital computing already had a thirty-year long history. The purpose of this project is to provide the first comprehensive research on the way people and organizations used computers during this period. We will not deal explicitly with the continuities to the eras of personal computing and the internet or with any outright comparison with other countries. Rather, the project aims at providing an understanding of the first thirty years of computing in Sweden in its own right.

The history of digital computing in Sweden begins with the efforts of the state towards transferring computer hardware and skills from abroad after World War II. In November 1948, the Swedish Board for Computing Machinery was appointed and in November 1953, the first digital computer, the Binary Electronic Sequence Calculator (BESK), went into use. A group of young Swedish engineers, some of whom sent by the board to the United States on fellowships to study the new technology of digital computing constructed the BESK. At that time, BESK was an advanced computer, and leading computer scientists including John von Neumann, Howard Aiken, and Konrad Zuse, visited it [4]. Due to BESK, Sweden became one of the leading nations in the development of this new technological field.

The BESK project often becomes the point of departure for the history of computing in Sweden. The main topic of discussion centers around the reason the national computer project failed in the early 1960s after such a successful start. Although BESK was ahead of its time and despite its high expectations, the project did not result in the development of an internationally competitive computer industry. In 1957, the chief engineer Erik Stemme and most of the technical staff left the project for the electronics firm Åtvidabergs Industrier (later Facit) to develop scientific and administrative mainframe computer systems for the commercial market [5]. They abandoned the project after only a few years as its proponents realized that Swedish firms would not be able to compete with IBM and other American firms. Instead, Erik Stemme and the progenitors of BESK later devoted themselves to a rather successful development of peripheral equipment to computers. Annerstedt has argued that the lack of government support was a key factor in this negative development [6]. Other researchers have challenged his analysis but the overall emphasis remains on the issue of why a national computer industry did not materialize [7, 5].

The international historiography of computing is marked by a similar focus on the early development of large mainframe computers such as the ENIAC and the rise of the leading hardware manufacturers like IBM, Univac, DEC, and ICL. We now have an impressive collection of literature on the development of computer hardware [8–11]. Recently, the research has extended to software development [12, 13]. However, there is a tendency in the existing studies to deal with the development of computers

[2] For example, Sweden topped the IDC/World Times Information Society Index (ISI) between 2000 and 2003.

more or less in isolation, without relating them to the wide range of users of computers and their appropriation of computer technology [14].

The focus on the manufacturing of computers rather than their use is especially misleading for small nations like Sweden, where it imported from abroad the vast majority of computers in use and computerization relied more on the appropriation of imported technologies than on domestic hardware development. Our ambition is to take computer users as the point of departure for a new and different historiography, which does not point in the direction of a failed computer industry, but to a Swedish tradition of rapid adaptation to computer technology. The most important long-term consequence of the activities was not the accumulation of expertise about the construction of computers, but the fostering of a considerable number of very competent users. In total, more than 1,300 people attended the board's training courses between 1952 and 1961 [15]. Civilian and military scientists, engineers, and administrative personnel, who disseminated knowledge of the new technology to different sectors of society, used BESK and its various modified copies (SMIL at the University of Lund, SARA at Saab in Linköping, DASK in Copenhagen, and the Facit EDB machines sold by Åtvidaberg) extensively. For example, meteorologists from Stockholm University used BESK to carry out the first numerical weather forecasts. Moreover, in 1961 when the Swedish Defense Research Agency (FOA) purchased an IBM 7090 mainframe computer for advanced scientific calculations, they could benefit from many years of practical experience of programming and use of advanced digital computers. From the late 1950s, the competence created by the training courses and technical-scientific computations was increasingly integrated with experience of other forms of information technology. Punch-card machinery for administrative purposes had been in use in Sweden since the 1910s and the installed value of IBM punch card machinery in Sweden doubled between 1956 and 1960. Numerically controlled machine tools and process control technologies increasingly integrated with digital computers. In parallel with the activities at the board, other processes prepared users for the computer age.

In the project, we follow this thread from the Swedish Board for Computing Machinery, from punch-card equipment and from early process control and industrial automation technology, and we analyze the subsequent development of computer systems in Sweden from the perspective of the users. Computer technology did not spread by itself; actors in different sectors of society appropriated it to achieve a higher degree of control over crucial processes. This appropriation often entailed the development of new applications that brought users in touch with computer suppliers, consultants, and the new professional groups of programmers and systems developers.

If we are to understand the early appropriation of computer technology and thus the historical roots of the IT-nation, we must look in detail at the specific traits that characterized computing before the personal computer revolution of the 1980s. Mainframe computing associated with the centralized and hierarchical structures of Fordism rather than the dynamic networks of the information age had characterized the first thirty years of computing in Sweden [16]. Many economic historians and sociologists have identified the computer, together with microelectronics and telecommunications, as the core of a third industrial revolution or the coming of an information age [17–20]. Regardless of the particular perspectives, these scholars are mainly concerned with computers as we know them from the 1980s and onwards:

distributed, networked, and flexible. We argue that while there certainly was a revolutionary turning point in the 1980s, there were also continuities from the age of mainframe computing which deserve further study.

Between the macro-level descriptions of information ages and industrial revolutions on the one hand, and the detailed orientation towards technology and manufacturing on the other, there is a huge gap, which this project intends to fill. We believe that historians have an urgent task in writing the history of how users of computers appropriated the globally available computer technology, adapted it to their own purposes, and constructed computer systems to extend their control of people and activities.

2 Computers and Control in the Fordist Age

The period covered in this project is the years 1955 to 1985, which corresponds to the *era of the large, centralized, mainframe computers*. The first computers of the 1950s were gigantic in size; they required very large investments and had limited storage capacity and compatibility with other systems. As a result, they were associated with large organizations, a centralization of information processing, and often with large projects for specific purposes. Over time, these characteristics became less marked, as prices fell, smaller computers appeared, and networked computing became more widespread. Nevertheless, we argue that the period from 1955 to the early 1980s characterizes an era of mainframe computing. While there certainly were currents pointing to the future paradigm of personal computers and distributed computing, the mainframe maintained its dominance of the concept of computing.

Because of the scale economies, mainframe computing was strongly associated with *large organizations* and *large projects*. Only large organizations were capable of the high investment and high volume of information processing necessary for owning and running a computer system. Small- and medium-sized organizations could gain access to computing only through service bureaus; therefore, they had a limited ability to develop tailor-made computer systems. Instead, they used computers for the mechanization of previously manual routines. In larger organizations, computer systems development often took shape in the form of projects to develop completely new capabilities. In a project, experts with different kinds of competence and different kinds of experience came together for a limited time in order to develop a certain endeavor. Tasks could evolve informally beside the ordinary hierarchies [21]. These projects were complex and people usually carried them out as collaborative efforts between a number of organizations, mostly involving both suppliers of computer technology and the future users.

We will study a number of large computer projects in different sectors of society. In many cases, the aim of such projects was rationalization for cost-cutting purposes, a mechanization of manual routines that did not fundamentally change the way of doing things. In other cases, the purpose of computer systems development acquired a meaning of developing new capabilities that allowed organizations to do new things in new ways. It is important to observe that the initial objectives were not always achieved – several of the projects studied failed or did not lead to the intended

consequences, as systems development was influenced by external actors or by the forces unleashed by the new availability of information.

As described above, the central idea of the project is that *actors appropriated* computer technology to achieve *control*.

Appropriation refers to the way in which technologies are constructed in a negotiation between the original technology and the users [22]. The computer hardware used in the Swedish systems differed little from the one used abroad. Computer technology was available from a global pool and circulated globally. As noted above, previous research has tended to follow an American paradigm where a strong relation exists between domestic computer manufacturing and computer use. While Sweden had a domestic computer industry at the time, its total output amounted to only a tiny share of the Swedish market. IBM alone had a market share of two-thirds through most of the period of study and other foreign suppliers such as DEC, ICL, Bull, Univac, and Wang followed it. Therefore, computer diffusion is far more relevant than computer manufacturing from the point of view of computerization in a small nation as Sweden. The computer systems developed in the encounter between the mostly multinational suppliers and the domestic users, often in long negotiations and with the participation of other actors such as consultants and academic experts. This perspective also raises the question of the extent to which the computer projects that we study reflect a generic, international model of computerization and to what extent they reflect Swedish particularities [23]. While this issue can only be fully explored in a comparative study, it nevertheless raises important questions about the relevance of Swedish particularities within each of the subprojects (e.g. policy of military non-alignment, one of the world's most extensive welfare states, an unusual predominance of big business, a Swedish tradition of infrastructure governance) [22].

Control is the pivotal concept of this study. Following Cortada's perspective, computer systems constituted a *digital hand* by which certain actors acquired a new tool for the processing of information and controlling a wide range of activities [24–26]. At the same time, it must be stressed that the control efforts were ambiguous, often fostering counter reactions from those who subjected greater efficient control, sometimes leading to other outcomes than expected, and nearly always resulting in some degree of internal struggle for mastery of information control. Thus, control is not monolithic, and important questions are what forms of control resulted from these changes: Control by whom, of what, and over whom? Moreover, what were the consequences for those subjected to control? This question will be a connecting thought for all four subprojects.

To understand fully the relation between computer systems and control, we must define how the development of computer technology interacted with different actors and social groups. Since systems development took place within large projects, identifying the structures and boundaries of these projects will be a primary task of the project. Which actors entered and left the project? What were their relative roles? The new forms of control affected the relative power of managers, IT departments, finance departments, salesmen and workers within organization as well as the relations to a large number of external actors. The key issue here is to identify the articulation of ideologies of control and resistance based on computer technology. How did computer systems development mesh with different professional cultures?

Different categories of users integrated computers in their professional identities in different ways, with huge ramifications for the development of organizations as well as computer systems. In other words, the era of mainframe computer projects was a social construction, as different actors appropriated the computer technology to achieve new forms of control. Through their efforts, they constituted and created the precursors of the IT nation Sweden.

3 Subprojects

3.1 Controlling the Citizens

Controlling the Citizens sheds light on the construction and implementation of computerized systems for the production, accumulation and processing of individual data within public authorities in the Swedish welfare state during the period 1955–1985. We have taken case studies from the Swedish Public Employment Services (AMS) and from preventive health care screenings.

Computers were an important tool in the rationalization of administrative tasks: for instance, for the British public administration, they became instruments for the control of welfare procedures and thereby for some aspects of the citizens' behavior [27]. In Sweden, politicians and civil servants saw computerization as a way to eliminate loopholes in the tax systems and to enhance welfare services. One major aspect of these developments was the establishment of computed files: records and information systems for the classification and retrieval of data over the citizens.

The hypothesis is that with the introduction of computerized systems, the institutions of the welfare state reshaped their practices of control of social problems (e.g. unemployment) and individual or public responsibilities (e.g. employability).

3.2 Controlling the Firm

In the world of big business, electronic data processing initially represented a continuation of that mechanization of clerical routines already under way, using punch card and other electromechanical equipment. However, computer-based information systems soon became the basis for new and extended control systems and they were integrated in the management of the firm, and thus in its power relations. The subproject deals with how different individuals and social groups – owners (especially Marcus Wallenberg), CEOs, vice presidents, line organization middle management, external consultants (notably Stanford Research Institute), rationalization experts, computing professionals, and labor unions – appropriated computer technology to extend their control of the firm and its environment. The focus is on the electrical engineering giant ASEA, a major user of computers for data processing, technical computation and process control, as well as an increasingly important supplier of systems for process control and industrial automation. The ASEA case complements the research by Atlas Copco and Volvo. The subproject, moreover, includes research on the service bureau industry as the main provider of

computing services for small and medium-sized firms in the age of mainframe computing.

3.3 Controlling the Battlefield

Another area in which computerized systems were introduced during this period was the armed forces, where digital technology opened up new ways of controlling the battlefield. The main purpose of the subproject *Controlling the Battlefield* is to study the development and implementation of computerized command and control systems in the Swedish Armed Forces during the Cold War. More specifically, the project is articulated around two separate case studies: the introduction of digital real-time computers in the air defense system in the 1950s and 1960s, and the failed attempt by the Swedish Defense Staff to implement computerized systems in support of military decision making in the 1970s and 1980s. The case studies are the radar-based air defense network STRIL-60 and the computerized command system LEO.

3.4 Controlling the Flow

Castells' notion that the control of flows is the main source of power in the modern network society inspires this subproject [20]. We focus on flows of different types and analyze how the introduction of computers enabled new forms of control of these flows from the mid-1950s onwards. The flows that are included in the study are *flows of current* (the electricity infrastructure at Vattenfall and Sydkraft), *flows of money* (interbank clearing, SIBOL, giro systems, and ATMs in the banking industry), and *flows of goods* (the distribution networks for goods).

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