

THE WEGEMATIC 1000 COMPUTING CENTRE, 1959-1964

Trans-local cooperation

Jaakko Suominen, Petri Paju, and Aimo Törn

1. Suominen, Department of Digital Culture, School of Cultural Production and Landscape Studies, University of Turku, Pori, Finland; jaakko.suominen@utu.fi, www.tuug.fi/~jaakko/
2. Paju, Department of Cultural History, University of Turku, Turku, Finland; petpaju@utu.fi
3. Törn, Department of Computer Science, Åbo Akademi, Lemminkäinengatan 14, Åbo, Finland; atorn@abo.fi

Abstract: The paper concerns the Alvac and Wegematic computer usage in the Nordic countries focussing on the Southern Finnish town of Turku. This topic has received little academic attention and frequently forgotten. In the paper, we examine the actions that the two universities and involved companies in the Turku region took after they had accepted the donation of a Wegematic 1000 computer. We argue that the Turku Computing Centre, created in 1960, firstly made an effort to combine scientific and educational aspects and commercial service in its activity and, secondly, participated in and benefited from establishing Nordic co-operation among the users of Wegematic computers. Therefore, we conclude that this Wegematic story is important for understanding the early phases of computerisation in Finland, at least outside the capital region of the country. We suggest the same could be true in Sweden and Norway. Further, we suggest that other Wegematic stories might be worth studying to improve our understanding of the Nordic trans-local interaction in early computing. Finally, we suggest applying a comparative method for these future studies.

Key words: Nordic cooperation, regional developments, computing centres, Wegematic 1000

1. INTRODUCTION

At the end of 1960, a Wegematic 1000 computer¹ became operational in Turku (Åbo), Finland. The two universities in Turku were joint recipients of a computer donated by the Axel Wenner-Gren Centre Foundation. Axel Wenner-Gren (1881-1961) was a famous Swedish and cosmopolitan industrialist and executive as well as being a public figure. In 1952 he had bought a North American company that produced early computers (Alwac computers).² The fact that the use of these computers in the Nordic countries is commonly forgotten and frequently left unstudied implies that this element in the history of computing is regarded as being unimportant. It might also be the case that the whole Wegematic story is an unsuccessful venture; a failure that does not seem worth studying. In this paper, we want to challenge these ideas by examining a Finnish computing centre based on a Wegematic computer and the Nordic trans-local³ co-operation that arose among Alwac and Wegematic users at the beginning of the 1960s.

In Southern Finnish town of Turku, the Wegematic 1000 computer became the heart of a new, local computing centre. At the time, at least in Turku, acquiring an electronic computer involved considerable effort.

¹ For a more detailed description of Wegematic technology see Appendix 2.

² Axel Wenner-Gren was also an important participant in the Swedish automation debate in the mid-1950s. He aimed to use the computers for planning in another project of his called the Alweg monorail. Wenner-Gren originally made his fortune with the Electrolux Company. He was also a known figure in Finland (cf. Apu 2/1960, 56-57, "Tulevaisuuden rautatie" ["Future Railway"]; Apu 18/1960, 38-41, 68, "Hän ei itsekään tiedä, kuinka rikas on" ["He don't know how rich he is"]). See also Wenner-Gren 1937. For more information on Axel Wenner-Gren and the Wenner-Gren Centre Foundation see Wennerholm 2002; Bohman & Dahlberg 1975; Det startat i 1919. Electrolux Konsernets Historie [<http://www.electrolux.no/corporate/history/overtheyears.html>].

³ *Trans-local* (or translocal) in cultural studies refers to emigrant and immigrant communities who have transferred their social and cultural practices to new geographical environments or territories. The communities and their origins are interconnected, but at the same time a part of their current multi-cultural context. (see eg. Peleikis 2000, <http://www.ceri-sciencespo.com/publica/cemoti/textes30/peleikis.pdf>) One other meaning of trans-local or trans-locality is used within arts and artist networks in the global sphere (see eg. Translocation call for proposals, <http://www.walkerart.org/gallery9/jerome/call.cfm>). Thus 'trans-local' refers to thematic cultural interaction, which takes into account and nourish the local identity and its specialities and possibilities. In this paper, we use the concept trans-local mostly in a sense of the latter definition. In this case trans-local refers to the interaction and co-operation of the local Wegematic user communities (centres) and their Nordic counterparts. The technological artefact and certain cultural historical context meant that part of the ways of using and seeing the meaning of computing was shared. However, the local context, that is local situations and interactions, also created unique styles of understanding the present day computing and data processing technology and ways of anticipating the future.

Therefore, it is no surprise that the universities existing at that time (the University of Turku and Åbo Akademi University – the Finnish and Swedish speaking universities), several local enterprises and the city of Turku were involved.⁴ We should note that this kind of local co-operation was quite new especially for the universities. In this paper, we consider the actions taken and by whom in Turku before and after the Wegematic 1000 arrived. We also examine the possibilities the computer opened up.

We present the history of the Wegematic Centre in Turku in roughly chronological order. The paper contains five sections. After the introduction, we describe the birth and functioning of the collaborative social networks that supported the idea of establishing a computing centre in Turku towards the end of the 1950s. We then sketch the activities in the Wegematic Centre during its early period, 1960-1962. After that, we examine the Centre's attempts to create and solidify Nordic cooperation under an association in the same period. We end by studying briefly the crisis in the late period of the Centre, 1962-1964. We conclude the paper with arguments on the importance of exploring this rather forgotten segment in the Nordic history of computing. We also suggest avenues for further historical investigation of the Alwac-Wegematic Centres.

The primary sources of the paper consist of archival material such as the minutes of the Turku Computing Centre and its administration, letters concerning Nordic dialogue as well as user logs, timetables, and work hour reservations of the Wegematic computer in Turku. We also used newspaper articles and interviews of the people involved.⁵

2. THE NORDIC AND LOCAL ASPECTS INVOLVED IN THE SELECTION OF A WEGEMATIC COMPUTER FOR TURKU

In 1960, Turku, with its population of ca. 112 000, was the second or third largest town in Finland (obviously after Helsinki and almost at the same level as Tampere). Turku is the oldest town in Finland and the former governmental centre of the Finnish province of Sweden (until 1809). The

⁴ The third university in Turku, School of Economics and Business Administration participated in the project as well, but not that actively.

⁵ The paper is partially based on the work conducted for an article in Finnish, "Varsinaissuomalainen linja Suomen tietoteknistymisen alkuvaiheissa 1959-1964. Turun Laskukeskus ja Wegematic 1000 tietojenkäsittelykone" published in *Tekniikan Waiheita - Tekniik i Tiden* 18(2000): 3, 24-46 (see <http://www.tuug.fi/~jaakko/tutkimus/wegematic/>). The sources are more closely documented there and in the reference section of this paper. See also Törn 2000.

Academy of Turku, the first and for a long time only university of Finland, was established already in 1640. After defeating the Swedes in Finland, the Russians had the Academy transferred to the new capital of the autonomous Duchy of Finland, Helsinki, following the conflagration of Turku in 1827. Roughly a century later, after Finland had gained independence in 1917, two universities, the Finnish speaking Turku University and the Swedish speaking Åbo Akademi University were founded in Turku with the help of donations of individuals, communities, and corporations. Even for geographical reasons, but of course for language and other reasons too, it was obvious that contacts between Turku and Stockholm had always remained close.

By the end of the 1950s, Turku had developed an extensive industrial base in fields ranging from shipbuilding to food carrying as well as the financial sector in banking and insurance. Major companies had also used accounting machines and punched card installations since the 1920s (the insurance company Sampo first installed punched card machines in 1927) and the 1940s (food carrying Huhtamäki since 1949) onwards. They also participated in the Punched Card Association, a Finnish society for the “punched card men” to teach and to learn from each other. From 1955 onwards, the Punched Card Association discussed the possibilities presented by the new, mostly IBM, electronic data processing machines or computers.⁶

Of course, some of the scientists in the universities of Turku were also interested in the new equipment for scientific calculations. However, these modern machines were quite new for the academia and people perceived them as being financially out of reach for the universities in Finland. Nevertheless, those scientists who knew about the recent developments in Sweden thought and hoped otherwise.

Unsurprisingly, Nordic scientific co-operation in Turku did not begin with the Wegematic 1000 computer in 1960. The contacts that the Physics Professors Kalervo V. Laurikainen (University of Turku) and Karl-Gustaf Fogel (Åbo Akademi) made while studying and doing research in Sweden and Denmark were very important for the Turku Computing Centre’s Nordic relations. Actually, these two men had first met in Lund as PhD students in 1948. In the 1950s, Laurikainen also made many professional visits to Stockholm and Copenhagen. It is well known that in all these places,

⁶ *Reikäkortti* 2/1956 (E. Luhtala: Kokemuksia reikäkorttimenetelmän sovellutuksesta Huhtamäki-yhtymässä [Experiences of punched card applications in Huhtamäki corporation]); Sormunen 1983, 149, 270-271; *Reikäkortti* magazines 1955-1959. See also Vehviläinen 1999 and Paju; this volume.

computers were taken into use very early on.⁷ (See Appendix 6—Major Computing Centres and Projects in the Nordic Countries in the late 1950s.)

The departments of nuclear physics and centres like NORDITA (Nordisk Institut för Theoretisk Atomfysik, 1957) in Copenhagen were especially important places for Laurikainen when he was building up contacts across the Nordic countries. The fashionable problems of nuclear physics also required the solution of computing power. For example, Laurikainen had sent his student, Olli Varho, to calculate deuterium models in Paris (the IBM computing centre) in 1956. Laurikainen also had a Finnish colleague (Kalevi Loimaranta) in the Swedish AB Atomenergie company in Stockholm.⁸

In 1959, Professor Laurikainen arranged to teach a course on 'mathematic machines' in Turku. The teacher was the former student of Laurikainen, Olli Varho, who was then working for the National Committee for Mathematical Machines (1954-1960). In 1959, the Committee was still finishing the ESKO, which was earlier supposed to be the first computer used in Finland. Additionally, the Committee also wanted to advance computing education in the country. In Turku, lectures on computing and data processing proved to be very popular. Among the audience were both academic and business people. This wide interest motivated Laurikainen to suggest that it was possible to obtain and locate a computer in Turku. For this purpose, they founded a Mathematical Machine Society in Turku. The society was a joint venture between the local universities, local businesses, the city of Turku, and IBM. Although the business sector was involved, it seems that academic experts were among the most active members in the project.⁹

In the summer of 1959, the Mathematical Machine Society examined the local needs for computing and data processing as well as gathering information on the concepts of existing computer centres. The first information on experiences of establishing a computing centre, were from the EMMA computing centre in Bergen. There they had an IBM 650 computer that was used by both the university and the industries. The IBM 650 set the standards by which they would compare other general-purpose computers. In Finland, one IBM 650 was already in use in Helsinki (in Post-

⁷ For more on early Nordic computing, see for example De Geer 1992; Heide 1996; Klüver 1999.

⁸ Laurikainen 1982, 16-24; Paju 2002, 142.

⁹ Turun Matematiikkakoneyhdistys - Abo Matematikförening, Toimintakertomus vuodelta 1959. Turussa 4.3.1960 K. V. Laurikainen, sihteeri, [Annual report of Turku Mathematical Machine Society 1959]; Kokouskutsu. Turun väliaikainen matematiikkakonetoimikunta. Turku 27.5.1959 [Invitation to a meeting of Turku Temporary Mathematical Machine Committee]. Archive of the Turku Computing Centre; Laurikainen 1982, 20-23; Paju 2002, *passim*. See also Paju; this volume.

Office Bank since the autumn of 1958) and another was on order (Folkpensionsanstalt, installed in the early of spring 1960). Although they explored other possibilities, the main question in the Society in Turku was soon: “IBM or not?”¹⁰

Soon an alternative solution, a Wegematic computer, arose. It raised an interesting Nordic – or more precisely Swedish – alternative to the IBM domination, as well as offering possibilities for expansion. The local history of Nordic scientific interaction and personal contacts probably contributed to the fact that someone in the Axel Wenner-Gren Foundation had heard of the growing interest in acquiring a computer to be located in Turku. The Foundation planned to donate several computers to Nordic and other universities. Presumably, they did this to get rid of their ageing machines or to penetrate to new markets across Europe—and even in the Soviet Union.¹¹ A further factor contributing to raising Turku’s profile as a possible site for donation was the first NordSAM conference held earlier in 1959 (Nordiskt Symposium över Användningen av Matematikmaskiner) in Karlskrona. Olli Varho had participated in the conference in May 1959. In October, the Wenner-Gren Centre Foundation informed Laurikainen that they could donate a Wegematic 1000 computer to Turku. They already had donated computers for some Swedish universities.¹²

In Turku, they needed more information about the offered Wegematic 1000 computer. Two measures were taken in the beginning of 1960. First, ten men from the Turku universities and firms involved made a trip to see the ADB-Institut in Gothenburg (where a Wegematic 1000/ALWAC was in use). Secondly, Laurikainen visited several computing centres and then reported on them (See Appendix 6). Later that spring, Nils Ivar Bech from Regnecentralen (Copenhagen) gave a lecture in Turku where he spoke about the Danish experiences. They also arranged a programming course

¹⁰ Turun yliopiston konsistorin kokouksen pöytäkirja 1.10.1959. Liite 1. Isännöitsijä H. W. Gullestad: EMMA - suunnitelma Bergenissä. Archive of University of Turku. [Protocol of meeting of Turku University Council. Appendix 1. Emma – a plan in Bergen]. See also IBM - Elektronisten tietojenkäsittelykoneiden käyttöalat. Esite. Liite Turun yliopiston konsistorin kokouksen pöytäkirjaan 1.10.1959. Archive of University of Turku [IBM – Areas of EDP Machines. Appendix of; Protocol of meeting of Turku University Council]. Turun Matematiikkakoneyhdistys - Abo Matematikförening, Toimintakertomus vuodelta 1959. Turussa 4.3.1960 K. V. Laurikainen, [Annual report of Turku Mathematical Machine Society 1959]; Brosveet 1999; Paju 2002, 192-197; Häggman 1997, 121-124.

¹¹ Paju 2002, 171-173.

¹² Muistio Laskentakeskuksen järjestämisestä Turkuun. Aikaisemmin kertyneen aineiston sekä apulaisprof. K. V. Laurikaisen ja fil. lis. K. Loimarannan kanssa käytyjen neuvottelujen pohjalta laatinut 2.11.1959. Dipl. Ins. A. Rantanen. [Memo of Organising Computing Centre in Turku. Reported by A. Rantanen based on earlier collected material and negotiations with K. V. Laurikainen and K. Loimaranta]. Archive of Tor-Erik Lassenius. See also *Turun Sanomat* 19.12.1959.

that spring. The teachers were from the ABN Company but paid by the Wenner-Gren Centre Foundation.¹³ To the contemporary eye, it must have seemed inspiring that a lively transfer of knowledge was emerging.

All help was of course welcomed in the universities of Turku, which had scant resources for experimenting new and costly ideas or equipment. The society in Turku compared the Wegematic 1000 with the IBM 650 computer, which had become the well-known “standard” for comparison. In their reports, they found the Wegematic computer—with the necessary IBM punched card machines (for input and output of data) —suitable for their needs. Moreover, the magnet tape memory seemed desirable.¹⁴ For the companies in the society, this idea of a computing centre was probably an essentially safe and inexpensive way of studying the new expert area and educating computing specialists of the future.

After the Wenner-Gren Foundation made the offer, IBM made a counteroffer with its 1620 computer, promising all academic discounts, which was typical of IBM’s international business strategy at the time. Understandably, however, they chose the Wegematic 1000. The heads of the society in Turku put forward three arguments for this solution. First, the Wegematic 1000 was perceived (and marketed) as a general-purpose computer and it was suitable for both scientific computing and commercial data processing. Second, it was an unconditional donation and was therefore inexpensive. Third, the donator guaranteed the delivery of the computer by the following summer (1960). This was faster than IBM could promise.¹⁵

¹³ Ruotsin ja Tanskan laskukeskuksista. Selostuksen laati 8. - 14.1.1960 suoritettujen tutustumismatkan perusteella K. V. Laurikainen [On Computing Centres in Sweden and Denmark. Reported by K. Laurikainen]; Raportti 2.10.1959. Kokoajana mahdollisesti A. Rantanen. USA:n ja Kanadan elektroniset laskentakeskukset huhtikuussa 1958. [Report on Computing Centres in USA and Canada in April 1958 by A. Rantanen]. Source *Computers and Automation*, July 1958; Pöytäkirja Turun Matematiikkakoneyhdistyksen kokouksesta 25.3.1960, [Protocol of meeting of the Society’s board]; Turun Matematiikkakoneyhdistys - Åbo Matematikförening, Toimintakertomus vuodelta 1960. Turussa 23.4.1961 K. V. Laurikainen, sihteeri, [Annual report of Turku Mathematical Machine Society 1960]. Archive of the Turku Computing Centre.

¹⁴ Muistio Laskentakeskuksen järjestämisestä Turkuun. Aikaisemmin kertyneen aineiston sekä apulaisprof. K. V. Laurikaisen ja fil. lis. K. Loimarannan kanssa käytyjen neuvottelujen pohjalta laatinut 2.11.1959. Dipl. Ins. A. Rantanen. [Memo of Organising Computing Centre in Turku. Reported by A. Rantanen based on earlier collected material and negotiations with K. V. Laurikainen and K. Loimaranta]. Archive of Tor-Erik Lassenius.

¹⁵ Turun Matematiikkakoneyhdistys - Åbo Matematikförening, Toimintasuunnitelmaluonnos vuodelle 1960. Turussa 14.12.1959, [Turku Mathematical Machine Society. Plan for the year 1960]. K. V. Laurikainen, sihteeri; Turun Matematiikkakoneyhdistys - Åbo Matematikförening, Toimintakertomus vuodelta 1959. Turussa 4.3.1960 K. V. Laurikainen, sihteeri [Annual report of Turku Mathematical Machine Society 1959]; Wegematic 1000 Brochure. Archive of the Turku Computing Centre; Turun yliopisto samt Stiftelsen för Åbo Akademi. Lahjoituskirje Stiftelsen för Wenner-Gren Centeriltä.

3. THE WEGEMATIC ARRIVES IN TURKU AND LOCAL CO-OPERATION TAKES SHAPE

The founding work for the Computer Centre started in 1960. Before the computer arrived, they engaged and trained employees, they held more information and programming courses for students and interested groups, and set up a tentative organisation. (See Appendix 5—The Organisation of Turku Computing Centre) Office space was also prepared at the University of Turku. The preparations included negotiating with users (about usage hour reservation for the computer) and customers as well as taking out bank loans. Later, the loans become a serious burden on the centre.

To prepare for the use of a computing centre in Turku, the Mathematical Machine Society transformed into “The Research Foundation for Applied Mathematics and Data Processing,” hereafter referred to as the Foundation. In September 1960, Laurikainen told the Foundation board that program exchange had begun. They received some programs from Sweden and several others in Turku. However, at this point they did not receive the Wegematic 1000 computer as promised. The shipment of it was delayed partially because some other universities were placed ahead in the Axel Wenner-Gren Centre Foundation’s donation schedule.¹⁶

The Wegematic computer finally arrived in November 1960 and officially became operational on First of December.¹⁷ Consequently, 1961 was the first fully operational year for the centre. Collaborating companies in the Turku region used and programmed Wegematic and other machines mostly with the help of Centre’s staff, but the most important users programmed the machines by themselves. The organisations involved had reserved usage hours in advance. (For a more detailed illustration of the usage in 1961-1962, see Appendices 3 and 4.)

Stockholm 19.1.1960. Birger Strid, [Donation letter of Wegematic 1000 Computer from the Wenner-Gren Centre Foundation]. Archive of the Turku Computing Centre.

¹⁶ An another founded new organisation was called to ”The Turku Computing Centre’s Supporters’ Association”. Sovelletun Matematiikan ja Tietojenkäsittelyalan Tutkimussäätiön hallituksen ensimmäinen kokous 9.5.1960, pöytäkirja. Turun Laskukeskuksen arkisto [First meeting of the board of The Research Foundation for Applied Mathematics and Data Processing]. Turun Laskukeskuksen kannatusyhdistyksen perustamisasiakirjat. Turun Laskukeskuksen arkisto. See also *Turun Sanomat* 6.3.1960; Wegematic 1000 Memories, an interview with Alfons Ahlnäs (<http://www.abo.fi/~atorn/History/Alfons1.html>). For example one installation was donated to the University of Oslo, Norway during the year 1960 (see *Datahistorien ved Universitet I Oslo. Fra begynnelsen til ut I syttiårene. Temanummer Fra Usit*, juni 1996.)

¹⁷ Ajopäiväkirja 1.12.1960. Ajopäiväkirja joulukuu 1960-elokuu 1961. Åbo Akademin laskentakeskuksen arkisto [User logs December 1960 – August 1961].



Picture 1. Professor Kalervo V. Laurikainen and the computer installation in the Turku Computing Centre in 1960 or 1961. (Courtesy of University of Turku Computing Centre.)

4. WORK FOR NORDSAC

The year 1960 was also important for the birth of the Alwac-Wegematic user community in North America. Luckily, this new activity was noticed in the Nordic region. North American Alwac users held a meeting in Oregon, USA. Klaus Appel, from the University of Uppsala, who was temporarily at University of Florida, participated in the meeting. He reported to Sweden on the discussed topics. They included the further development of the Alwac, programming, and program exchange. Firma Teledata, Bo Nymanbolagen supported Appel financially. This support had made his participation in the conference possible.¹⁸

In early summer of 1961, Bror Stenvik (from Turku) made a tour of Sweden and Norway in order to create closer co-operation and more efficient program exchange between Wegematic and Alwac computer centres in the Nordic countries. Based on these negotiations, one of the many points he suggested (as discussion topics) in the report was founding an association for the Nordic Wegematic and Alwac users, which was later to become known as NordSAC (Nordisk Samarbetsgrupp för Alwac-Wegematic Computers). They discussed this and other topics in two meetings held in Oslo during the NordSAM Congress 18-22.8.¹⁹

¹⁸ 4.6.1960. Rapport Från Alwac Users' Associations Konferens den 9-11 maj 1960 i Oregon [Report from Alwas Users' Association's Conference]. Archive of the Turku Computing Centre.

¹⁹ Bror Stenvik: Studie- och diskussionsresa i Sverige och Norge 29.5. - 9.6.1961 [Report on Educational and Discussion field trip to Sweden and Norway]; Protokollar fört vid Lunchmöten 19.8.1961 och 21.8.1961 i Oslo, [Protocols of two lunch meetings]. NordSACin

In September 1961, the Foundation board in Turku decided that Bror Stenvik would replace Laurikainen as the head of the computing centre, because Laurikainen had moved to University of Helsinki.²⁰ Nevertheless, Laurikainen reported on the discussions that had taken place in the founding meeting of NordSAC in Oslo. There, after discussing Wegematic program exchange, they appointed a Committee to make a proposal concerning the guidelines for the Nordic co-operation. They also acknowledged a need for a centre of these operations. The Computing Centre in Turku volunteered for this task.²¹

At the end of 1961, the co-operation between various users was still unorganised. The owner of the ABN factory had changed and this caused the Wegematic users to request that the technical service could continue as before. Laurikainen had talked to Birger Strid, Wenner-Gren's trusted man and other persons in Wenner-Gren Centre, but they found no solution.²²

Several NordSAC meetings had taken place in the autumn of 1961 and spring of 1962. Important questions included administration aid from the Wenner-Gren Centre for NordSAC, the creation of a service centre, and program exchange. In the spring of 1962, a service group began work, with a Wegematic 1000 computer, in the Royal Institute of Technology in Stockholm (Kungliga Tekniska Högskola). According to the company's representative, they had to use the computer for trying out ferrite core memory and magnetic tape units and for training technical personnel for the NordSAC members.²³

vuosikertomukset, kokouspöytäkirjat ja kirjeenvaihto. [See also Annual reports, letters and meeting minutes of NordSAC]. Archive of the Turku Computing Centre.

²⁰ The Wenner-Gren Foundation donated also another Wegematic computer into Finland, probably thanks to Professor Laurikainen. That installation was taken into operation under the department of nuclear physics, at the University of Helsinki in spring 1961. The two Finnish Wegematic centres agreed to co-operate but we do not know how true this co-operation became. (Toimintasuunnitelma v:ksi 1961. Hyväksytty säätiön hallituksen kokouksessa 19.12.1960 [Plan for the year 1961]; Helsingin yliopiston Wegematic 1000 - koneen huoltosopimus. Turku 11.4.1961, Helsinki 13.5.1961. [Service and Maintenance contract between Turku and Helsinki Centres]. Archive of the Turku Computing Centre. See also Helsingin yliopiston laskentakeskuksen ja fysiikan laskentatoimiston toimintakertomus vuodelta 1980 [Annual report of the Computer Centre in University of Helsinki 1980].)

²¹ Sovelletun matematiikan ja tietojenkäsittelyalan tutkimussäätiön hallituksen kokouksen pöytäkirja 8.9.1961, [Protocol of meeting of the Foundation's board]. Archive of the Turku Computing Centre.

²² Sovelletun matematiikan ja tietojenkäsittelyalan tutkimussäätiön hallituksen kokouksen pöytäkirja 15.12.1961, [Protocol of meeting of the Foundation's board]. Archive of the Turku Computing Centre. Birger Strid was invited to Turku in January 1962.

²³ See for instance Protokoll 28.-29.9.1962, hållet vid NordSAC-möte i Wenner-Gren Center, Stockholm, den 28/29 september 1962; 5.11.1962 Referat fra styremöte nr 1;

Finally, in the autumn of 1962, the rules for NordSAC were accepted and Klaus Appel was elected chair. Later that autumn, Mr Wenner-Gren died. Subsequently, the ABN Company proclaimed that it wanted to stop all forms of cooperation that were a financial burden on the company. In the summer of 1963, Appel refused to continue leading the cooperation due to lack of interest among the NordSAC participants.²⁴

In Turku, the Foundation then wrote a report in which they summarised how they had benefited from the Nordic co-operation. The points included the following: a) the exchange of programs, b) the receiving of information regarding the computer, c) the supply of spare parts after the producer had gone out of business, d) the creating of a service group (paid by the ABN Company), and e) general benefits of the Nordic cooperation.²⁵ After NordSAC, Nordic cooperation continued within other organisations (such as NordSAM) and through personal contacts.

5. THE PHASING OUT OF THE CENTRE, 1962-1964

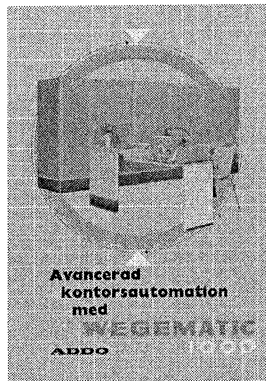
In Turku, Wegematic had seemed to offer an interesting Nordic alternative. For Professor Laurikainen, it even opened up possibilities for gaining a key national position within computing with help of governmental funding. The period from 1961 to early 1962 was central in this respect. During those months Laurikainen, Bror Stenvik, and other people of the Centre negotiated actively with national and international actors in the computing branch. The Research Foundation for Applied Mathematics and Data Processing sponsored new kind of education as well, namely the first system design courses in Finland in 1962. The new Wegematic centre and its computer had a certain image and status value. The computer functioned as a particular, material symbol of progress and modernity transferred in the local sphere.²⁶

18.4.1963 NordSAC. Fulcrum Aktiebolag utlägg t.o.m. 31.3.1963. Archive of the Turku Computing Centre.

²⁴ Klaus Appel: Till medlemmarna i NordSAC, kirje 24.6.1963, [Letter for the members of NordSAC]. Archive of the Turku Computing Centre.

²⁵ Säätiön hallituksen kokouksen pöytäkirja 6.6.1963, [Protocol of meeting of the Foundation's board]. Archive of the Turku Computing Centre.

²⁶ K.V. Laurikainen: Säätiön toiminnan laajenemisesta v. 1962. Luultavasti joulukuu 1961. Archive of the Turku Computing Centre. [On Expanding the field of the Foundation. Written by K. V. Laurikainen probably in December 1961]. For more on the symbolical value of computer technology see Suominen 2000, 66-78; Suominen 2003, 64-67.



Picture 2. Cover of a Wegematic 1000 brochure in the early 1960s. Archive of the Turku Computing Centre.

Several interrelated factors led to changes in the situation for the centre. These included: 1) The Wegematic computer was not effective and stable enough for all-purpose usage, so it was less useful than expected. This resulted in less income generation and an inability to pay back the loans. 2) The development of Wegematic computers declined because of the problems the manufacturer faced. Consequently, it never delivered the promised magnetic tape units. The Nordic collaboration within NordSAC was the primary means of resolving these problems. However, there were still some other factors bearing consideration. 3) An important and well-known “primus motor” of the Centre, Professor Laurikainen moved to Helsinki. 4) Manufacturers, like IBM, and user organisations presented new applications and second-generation computers, which confirmed the impression that Wegematic was completely out-dated (not everyone agreed with this in the universities). 5) The Wegematic computer had ceased to be unique on the national level. IBM, and its Finnish competitor Finnish Cable Works,²⁷ built up their own centres and delivered several machines to customers.²⁸ One can say that both the technical and symbolical value of the Wegematic computer and the centre decreased quite rapidly during the year 1962.

Already in late 1961, there were discussions about the possibility of purchasing a new mainframe for the centre in Turku. This proved to be financially impossible and the installation expanded only with a tabulating machine. During the winter 1962-1963, a committee for acquiring a new

²⁷ Finnish Cable Works, the predecessor of Nokia Electronics and Computers, imported and used for example Elliott and Siemens and later Bull machineries (see Aaltonen 1993).

²⁸ Suominen – Paju – Törn 2000, 37-40.

computer was established. Its purpose was to find a solution fulfilling the needs of both the commercial data processing and the scientific computing. The committee comprised mainly Ericsson, IBM, and Finnish Cable Works (they had sponsored the system design course as well). The competition between IBM and Cable Works offered considerable potential for resolving the difficult situation to the benefit of the Turku computing centre.²⁹

Finally, in the summer of 1963, IBM decided to build up its own computing centre in Turku. The Wegematic users managed to make a deal with IBM who promised to take care of the unpaid loans and serve the old customers. The IBM service bureau, with an IBM 1401 mainframe, opened in spring 1964 and the Wegematic Centre closed.³⁰ The two universities used the 1401 computer as well, but soon together purchased their own machines and continued cooperating.

6. CONCLUSION

In this paper, we have argued that the founding and operating of the Turku Computing Centre with the Wegematic 1000 computer needed, and even forced, the actors, that is local municipal, businesses and the universities, to negotiate and co-operate in novel ways. The centre also benefited from Nordic trans-local co-operation with other computing centres, mostly with those using Wegematic computers. The Nordic co-operation was soon organised within the NordSAC user association (1961-1963). Its operation included program exchange, organising joint courses, as well as demanding a shared service centre and other negotiations with the Wegematic manufacturer, the ABN Company in Tyresö, near Stockholm.

²⁹ Säätiön toimintakertomus vuodelta 1963 [Annual Report of the Foundation 1963]; Säätiön hallituksen kokouksen pöytäkirja 17.12.1963 [Protocol of meeting of the Foundation's board]; Omaisuustase, kevät 1964 [Balance of Capital, spring 1964]; IBM tietojenkäsittelyjärjestelmämainos [Brochure of IBM]; Ehdotus Turun Yliopiston ja Åbo Akademin 1620 tietokoneistoksi 6.5.1963; [Proposal for IBM 1620 installation for the University of Turku and Åbo Akademi] BULL Gamma 30-koneen tarjous 12.-13.2.1963. Bengt Widing, Kurt Wikstedt [Offer for BULL Gamma 30 installation]; Konekomitean kokousten pöytäkirjat ja koneita koskeva vertailumateriaali. Kevät 1963, [Meeting minutes and comparison material of the New Machine Committee]. Archive of the Turku Computing Centre.

³⁰ Ehdotus Turun Yliopiston ja Åbo Akademin 1620 tietokoneistoksi 6.5.1963 [Proposal for IBM 1620 installation for University of Turku and Åbo Akademi University]; Diskussion den 11.6.1963 med IBM/dir. Dickman [Report on discussions with Director Dickman of IBM in Finland]; Turun Laskukeskuksen toimintakertomus 1.1.1964 - 25.5.1965. [Annual Report of Turku Computing Centre 1.1.1964-25.5.1965]; Sopimusluonnos IBM:n ja Laskukeskuksen välillä [Draft of contract between IBM and Turku Computing Centre]. Archive of the Turku Computing Centre.

Further, we argue that strategic collaboration was prevalent among those players regarded as being economically and symbolically strong at the time. However, it was also emblematic to seek alternatives and counterbalances in the rapidly transforming field of computing and data processing technology. The collaboration between the powerful bodies affected the ways in which they organised work; they also combined technological requirements as well as ways of organising training.

In this paper, we have focused on examining the strategic level of collaboration, planning, and negotiating. This does not mean that we should forget the tactical level, for example the daily work conducted on these computers. Questions that remain unanswered include the following. How did the people in computing centres work on a daily basis? Which way the computer work was perceived by the users and the people in the local community? We propose that researchers should also try answering these kinds of questions, but perhaps with other sources and with other research methods than the ones used in this paper.

We conclude that Turku's Wegematic story is important for understanding the early phases of computerisation in Finland, at least outside the capital region of the country. Leaning on this Finnish case, we suggest that the same could be true for the Wegematic cases in Sweden and Norway. Further, we suggest that the Wegematic stories in Sweden and Norway might be worth studying to improve our understanding of several aspects of the Nordic trans-local interaction in the emerging field of computing. These aspects include education, the start of computing in universities, businesses and local administration and professional development. We think applying a comparative method to these Nordic developments would have particular value. There is plenty of research undone in the Nordic history of computing and there is no reason why the history of the Wegematic could not serve us with good material for studies on many of these questions.

REFERENCES

Archival Material

- Tietotekniikan liiton arkisto [Finnish Information Processing Association]
- Turun yliopiston arkisto [University of Turku]
- Turun yliopiston ATK-keskuksen arkisto [University of Turku, Computing Centre]
- Turun Laskukeskuksen arkisto [Archives of the Turku Computing Centre (Collected and saved by Jaakko Suominen & Aimo Törn)]
- Turun Sanomat [Local newspaper]
- Tor-Erik Lasseniuksen arkisto [Private archive of Tor-Erik Lassenius]
- Åbo Akademin arkisto [Åbo Akademi University]
- Åbo Akademin laskentakeskuksen arkisto [Åbo Akademi, Computing Centre]

Interviews and Letters

Janis Bubenko Jr.: "Alwac Memories". E-mail to Jaakko Suominen 6th January 2003.
Erik Grannas, phone interview 23.8.2000 (Petri Paju).
Ilkka Junnila, e-mail to Petri Paju in 1999.
Pentti Kaarnisto, phone interview 23.8.2000 (Petri Paju).
Veikko Oula, phone interview 23.8.2000 (Petri Paju).
Aarni Perko, letter to Aimo Törn 13.8.2000.
Wegematic Memories. Collected by Aimo Törn [<http://www.abo.fi/~atorn/History/Page31.html>].

Websites

The ALWEG Archives [<http://www.alweg.com/>]. Viewed 1.8.2000.
Electronic Computers Within The Ordnance Corps, Appendix VII -- Approximate Costs [<http://ftp.arl.army.mil/~mike/comphist/61ordnance/app7.html>]. Viewed 10.9.2000.
Encyclopedia of Computer Science 4th Edition. Timeline of Computing. [<http://www.macmillan-reference.co.uk/science/ComputerScienceTimeline12.htm>]. Viewed 10.9.2000.
Det startet i 1919. Electrolux Konsernets Historie [<http://www.electrolux.no/corporate/history/overtheyears.html>]. Viewed 10.9.2000.
Törn, Aimo: Early History of Computing in Turku. [<http://www.abo.fi/~atorn/History/Contents.html>]. 1999-2003.

Newspapers and Magazines

Apu 1960
Reikäkortti 1956 (Punched Card journal)
Turun Sanomat 1959-1962
Uusi Aura 1960
Åbo Underrättelser 1960

Literature

Aaltonen, Aarre: "Nokian elektroniikkateollisuuden synty: nuorten kokeilijoiden ja keksijöiden pajasta huipputeollisuudeksi. [The Birth of Electronics Industry of Nokia, in Finnish]", in Martti Tienari, ed., *Tietotekniikan alkuvuodet Suomessa*, [The First Years of Information Technology in Finland, in Finnish.] Helsinki 1993, 108-126.
Bohman, Ragnar & Dahlberg, Ingrid: *Dansen kring guldkalven* [Dancing around the golden calf, in Swedish], Askild&Kärnekull. 1975.
Brosveet, Jarle: "IBM Salesman Meets Norwegian Tax Collector: Computer Entrepreneurs in the Making." *IEEE Annals of the History of Computing* 21(1999): 2, 5-13).

- Datahistorien ved Universitet I Oslo. Fra begynnelsen til ut I syttiårene. Temanummer Fra Usit*, juni 1996.
- De Geer, Hans: *På väg till datasamhället. Datatekniken i politiken 1946-1963*. [On the way to information society. Information Technology in Politics 1946-1963, in Swedish]. Stockholm 1992.
- Heide, Lars: *Hulkort og EDB i Danmark 1911-1970*, [Punched card machines and electronic data processing in Denmark 1911-1970, in Danish]. Århus 1996.
- Helsingin yliopiston laskentakeskuksen ja fysiikan laskentatoimiston toimintakertomus vuodelta 1980. [Annual report of the Computer Centre in University of Helsinki 1980, in Finnish.]
- Häggman, Kai: *Suurten muutosten Suomessa. Kansaneläkelaitos 1937-1997*. [Finland in Great Changes, Social Insurance Institution 1937-1997, in Finnish.] Helsinki 1997.
- Klüver, Per V.: *From Research Institute to Computer Company: Regnecentralen 1946-1964. IEEE Annals of the History of Computing* Vol. 21, No. 2, 1999.
- Laurikainen, Kalervo: *Fyysikon tie*. [A Path of a Physician, in Finnish] Helsinki, Hyvinkää 1982.
- Lindqvist, Svante: "Forskningsens fasader: Wenner-Gren Center som symbol för svensk vetenskap [Façade of the reseach: Wenner-Gren Center as a symbol for Swedish science, in Swedish]," *Lychnos* 1997.
- Paju, Petri: *Ensimmäinen suomalainen tietokone ESKO ja 1950-luvun suunnitelma kansallisesta laskentakeskuksesta*, [The First Finnish Computer ESKO and a 1950's Plan of a National Computing Center, in Finnish]. Licentiate Thesis, Cultural History. University of Turku, Finland 2002.
- Peleikis, Anja: "The Emergence of a Translocal Community. The Case of a South Lebanese Village and its Migrant Connections to Ivory Coast." *Cahiers d'etudes la Méditerranée orientale et le monde turco-iranien*. No 30, juin-décembre 2000. [<http://www.cerisciencespo.com/publica/cemoti/textes30/peleikis.pdf>].
- Sormunen, Tapio: *Keskinäinen vakuutusyhtiö Sampo osana Suomen vahinkovakuutus toimintaa 1909-1970*, [Insurance Company Sampo as a Part of Indemnity Insurance in Finland 1909-1970, in Finnish]. Licentiate Thesis, Finnish History. University of Turku, Finland 1983.
- Suominen, Jaakko – Paju, Petri – Törn, Aimo: "Varsinaissuomalainen linja Suomen tietoteknistymisen alkuvaiheissa. Turun laskukeskus ja Wegematic 1000 tietojenkäsittelykone [Early Computerization in Finland, 1959-1964. A Study of the Beginnings of Computer Center in Turku and Wegematic 1000 Electronic Data Processing Machine, in Finnish]". *Tekniikan Waiheita* 18(2000): 3, 24-46. [Webified version: <http://www.tuug.fi/~jaakko/tutkimus/wegematic/>]
- Suominen, Jaakko: *Sähköaivo sinuiksi, tietokone tutuksi. Tietotekniikan kulttuurihistoriaa* [Getting Familiar with the Electronic Brain, Getting to Know the Computer, in Finnish]. Publications of the Research Center for Contemporary Culture, No. 67. Jyväskylä 2000.
- Suominen, Jaakko: "Koneen kokemus. Tietoteknistyvä kulttuuri modernisoituvassa Suomessa 1920-luvulta 1970-luvulle." [Experiences with machines. Computerised culture in the process of Finnish modernisation from the 1920s to the 1970s, in Finnish], Tampere 2003.
- Tienari, Martti (edit.): *Tietotekniikan alkuvuodet Suomessa*. [The First Years of Information Technology in Finland, in Finnish.] Helsinki 1993.
- Törn, Aimo: *Early History of Computing in Turku, 1959-1964*. Rapporten från datacentralen vid Åbo Akademi. 1.12.2000.
- Vehviläinen, Marja: "Gender and Computing in Retrospect: The Case of Finland." *IEEE Annals of the History of Computing*, Vol, 21, No. 2, 1999, 44-51.

- Wenner-Gren, Axel L.: *Vetoomus jokaiseen*. [Appeal for Everyone, in Finnish] Suom. Väinö J. Vatanen. Helsinki 1937.
- Wennerholm, Staffan: "Vetenskapen (och publiken) i framtidens samhälle. Om en forskningspolitikens konferens i Wenner-Gren Center 1963 [Science (and the public) in future society. On a conference of research policy in the Wenner-Gren Center 1963, in Swedish]," *Lychnos* 2002, 196-223.

APPENDIX 1

A Brief Chronology of Wegematic

1952	Axel Wenner-Gren buys Research Logistics (USA). The company starts to construct Alwac computers (Axel Leonard Wenner-Gren Automatic Computers)
1954	The first Alwac III computer is produced and followed by the Alwac III-E model (in 1955)
1958	Research Logistics closes down and is sold
Spring 1959	Information and computer programming course held in Turku NordSAM (Nordiskt Symposium över Användningen av Matematikmaskiner) 1959 in May
Autumn 1959	The Turku Mathematical Machine Society comprising of the universities, the city of Turku and ten local enterprises plans the purchasing computer
October 1959	Announcement of the possibility of obtaining a Wegematic 1000 computer to Turku
1959-1960	Bo Nyman Ab begins to build Wegematic 1000 computers, based on Alwac III-E model (produced since 1955)
19 th January 1960	The official donation letter of the computer by the Wenner-Gren Centre Foundation
4 th May 1960	North American Alwac users meet in Oregon State College, USA
Spring 1960	Preparing office space (130 square metres at the University of Turku) for the Centre The first employers are engaged The Turku Mathematical Machine Society ends its work Turku Computing Centre's Supporters' Association is formed The Research Foundation for Applied Mathematics and Data Processing takes control of the computer and the Computing Centre Programming and information courses taught in Turku
November 1960	The Wegematic arrives in Turku
1 st December 1960	The first official program is operated with the Wegematic at the Turku Wegematic Centre
20 th December 1960	The Wegematic computer and the Centre are introduced to local press
20 th January 1961	The official opening of Turku Computing Centre

Spring 1961	Another Wegematic Computer is taken into operation at the department of nuclear physics, at the University of Helsinki and the two centres agree to co-operate on use and service
8-22 August 1961	NordSAC (Nordisk samarbetsgrupp för Alvac-Wegematic Computers) is formed in NordSAM 1961 meeting
Autumn 1961	The head of the centre, Professor Laurikainen moves to Helsinki Some early investigations into purchasing a new computer, which is soon learned to be financially impossible The machinery is completed with several accounting machines like tabulator
Winter 1961-1962	The Centre negotiates about co-operation with the Finnish Cable Works and its computer centre
Autumn 1962	The first course for system design near Helsinki and is funded by Foundation and its sponsors
September 1962	The rules of NordSAC are approved and Klaus Appel from Uppsala is elected as the chairman
November 1962	Axel Wenner-Gren dies and the Wegematic manufacturer, ABN (Bo Nyman Ab) goes bankruptcy soon after
Spring 1963	A committee is organized for preparing the purchasing of a new computer to Turku. Consultations takes place with IBM, Cable Works and L. M. Ericsson
Summer 1963	IBM decides to set up its own service centre in Turku
June 1963	NordSAC ends its activities
Autumn 1963	IBM promises to take care of the loans (6 million FIM in the beginning) and the customers of the Wegematic Centre
Spring 1964	IBM opens its local computing centre in Turku with a 1401 mainframe. The Wegematic is shut down and stored.

APPENDIX 2

Wegematic 1000 Technology an a Nutshell

The Swedish businessman Axel Leonard Wenner-Gren's company Logistics Research, Inc in California had built computers since 1952, and the predecessor to Wegematic 1000 the Alvac III-E since 1955. The price for Alvac III-E was \$76 950 as compared to \$55 000 for IBM 610, and \$182 000 for an IBM 650 with tapes [<http://ftp.arl.army.mil/~mike/comphist/61ordnance/app7.html>]. The Alvac III-E has even been characterized as an early minicomputer [<http://www.macmillan-reference.co.uk/science/ComputerScienceTimeline12.htm>]. The first installations were at military units and universities in Canada and the USA. The Alvac III-E was "a first generation" computer (1950-1960). These computers were characterized by the use of vacuum tubes as their switching technology. The most popular memory technique including the prime memory was the rotating drum.

The production of Alvac III-E was shifted to Sweden and under the name Wegematic 1000, it was manufactured by Bo Nyman AB in Bollmora. The processing unit comprised of an operating board and some six meters of racks holding a vertically oriented magnetic drum memory (3 600 rev/min) with 261 channels (tracks), about 10 000 diodes and about 500

electron tubes on laminate circuit boards. The maximum energy consumption was about 15 kW/h. For administrative applications, punched cards were used as a secondary memory. For programs, paper tape was used for input (150 char/s) and output (50 char/s). Correcting program errors was made by cutting out part of the tape and taping in a new part.

The magnetic drum held four registers A-E (part of one channel), the working (prime) memory (four channels) and the main (secondary) memory (256 channels). Each track could store 32 words plus a check word, each word consisting of 32 bits plus a sign bit. The prime memory consisted of four channels with a multiple of read/write heads. The 128 words in the prime memory were addressable half-word wise in hexadecimal from 00 to FF. An addition (subtraction) took 1 ms, a multiplication (division) 16 ms, excluding fetch times. A comparison took 0.5 ms. Fetch times for data and instructions in prime memory were on the average 4 ms and 2 ms respectively, for secondary memory 8 ms. Copying from secondary memory to a prime memory channel and execution of code in another prime memory channel could take place in parallel.

The operating board consisted of a typewriter, paper tape units, and a console containing some arrays of small lights and switches making it possible to view and change the content of a word in the prime memory or in the registers. As an alternative to the normal processing mode, a one-step processing mode could be chosen, which made it possible to check the execution step by step.

Programming was made with a machine code with absolute addresses using hexadecimal representation. There was no floating-point operation; the programmer had to keep track of the exponent for each data stored and explicitly make the shifts necessary for retaining the accuracy in the arithmetic operations. The internal representation was binary and the transformations from decimal to binary on input and from binary to decimal on output had to be included in the program code. A word normally contained two instructions, so for instance 794B 614F means: first, copy to A (79) the content of 4B, and then add to A (61) the content of 4F.

APPENDIX 3

Hours of Real Usage 1960-1962 ³⁶³

Computer Use 1960	Computer Use 1961	Computer Use 1962	Service, repairs, and testing 1961	Service, repairs, and testing 1962
Couple of hours for testing	1094 h 26 min (Univ. 267 h 44 min, others 826 h 42 min)	1841 h 38 min (Univ. 315 h 44 min, others 1525 h 54 min)	793 h	629 h 10 min

³⁶³ Source: Laskukeskuksen toimintakertomukset 1960-1962, [Annual Reports of the Turku Computing Centre].

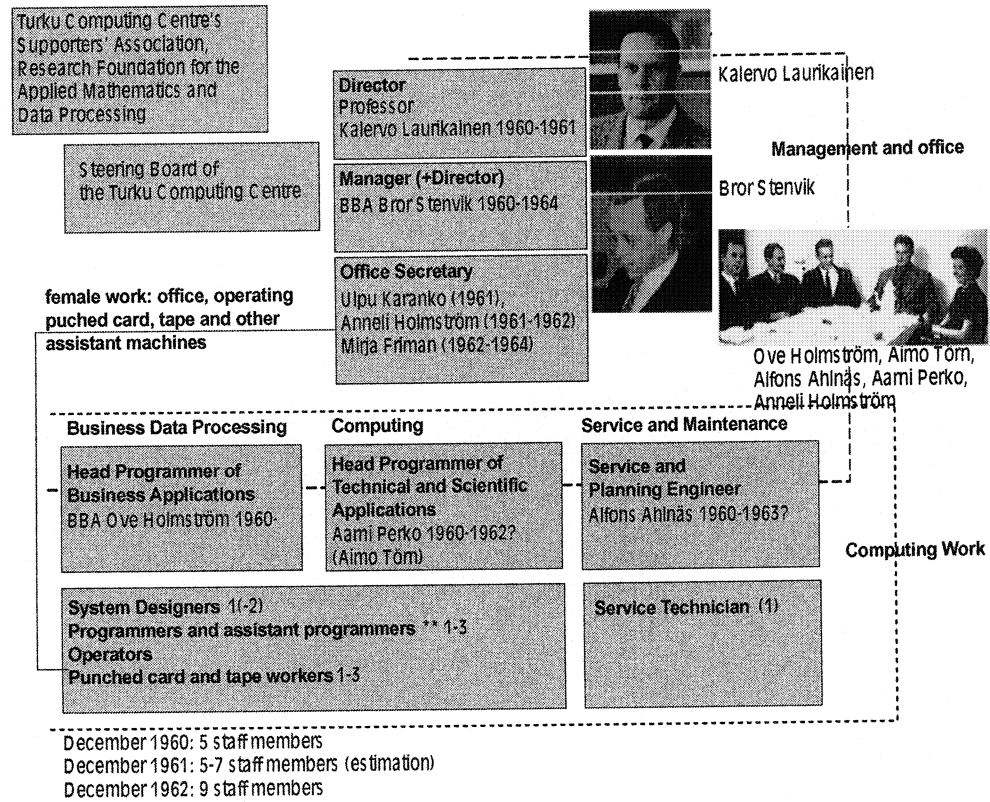
APPENDIX 4

Computer Users (Other Than Universities) and Reserved Hours ³⁶⁴

User	Reserved hours 1960 (not used)	Reserved hours 1961	Reserved hours 1962	Reserved hours 1963 (no document about usage)
Huhtamäki Oy Food industry etc., large punched card operations? Decreased usage	312	624	312 (624)	
Paraisten Kalkkivuori Oy – Pargas Kalkberg Ab Mining corporation, decreased usage	200	400	400	240
Wärtsilä Oy. Crichton Vulcan Ship builder, docks measurements of strength and profitability, increased usage	20	50	75	150
The City of Turku The computer was used mainly for billing customers in the electric department, increased usage	20	40	70	320 (office of measuring 100, technical departments 220)
Raision Tehtaat Agriculture, food processing	6	10	2	2
Neste Oy Oil company	5	10	10	10
Verdandi Insurance company	1	1	5	10
Lounais-Suomen Sähkö Electric company, database of 5000 punched cards, billing?	18	30	30	46
Lounais-Suomen Osuusteurastamo Slaughterhouse		5	5	
Oy Juurikassokeri Food industry, sugar manufacturing			30	30
Ky Kumiote Rubber productions			25	
Keskusosuusliike Hankkija Agriculture, wholesale, customer databases, stores, accounting in general?			100	
Professor Laurikainen	1			

³⁶⁴ Source: Laskukeskuksen toimintakertomukset 1960-1962, [Annual Reports of the Turku Computing Centre].

APPENDIX 5. The Organisation of the Turku C computing Centre*



* There was no official or stable organization table.
This one is a reconstruction based on the archival material.

** Tasks of system design, programming or operating machines were not strictly separated and neither was the work done in the office and assisting in the operating the machines.

APPENDIX 6.

Major Computing Centres and Projects in the Nordic Countries in the late 1950s Reported by prof. Laurikainen in Turku

Finland

Committee for Mathematical Machines (1954-1960, ESKO)
Post-Office Bank, Helsinki (IBM 650 aka ENSI, 1958)

Sweden

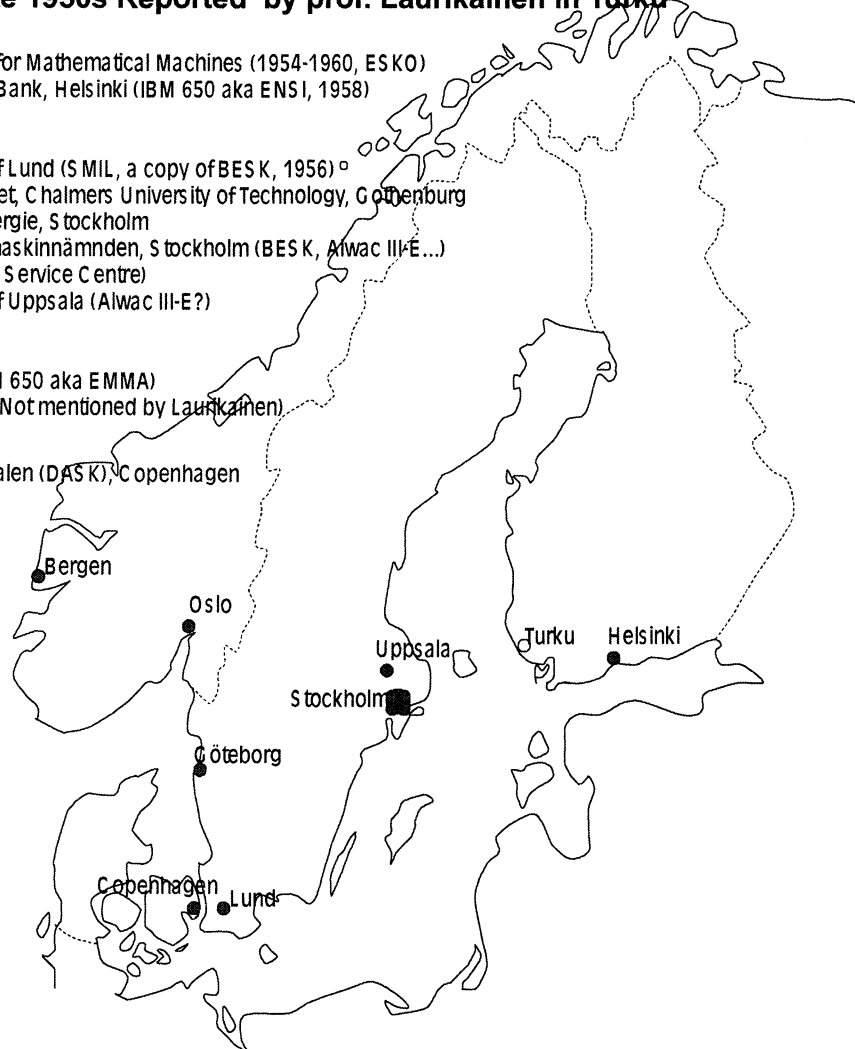
University of Lund (SMIL, a copy of BESK, 1956)
ADB Institutet, Chalmers University of Technology, Gothenburg
Ab Atomenergie, Stockholm
Matematikmaskinnämnden, Stockholm (BESK, Alwac III-E...)
(IBM Nordic Service Centre)
University of Uppsala (Alwac III-E?)

Norway

Bergen (IBM 650 aka EMMA)
NCC, Oslo (Not mentioned by Laurikainen)

Denmark

Regnecentralen (DASK), Copenhagen



APPENDIX 7. Wegematic and ALWAC IIIE Centres in the Nordic Countries

Finland

Turku Computing Centre (ÅB (AB)*)
University of Helsinki (HY)

Sweden

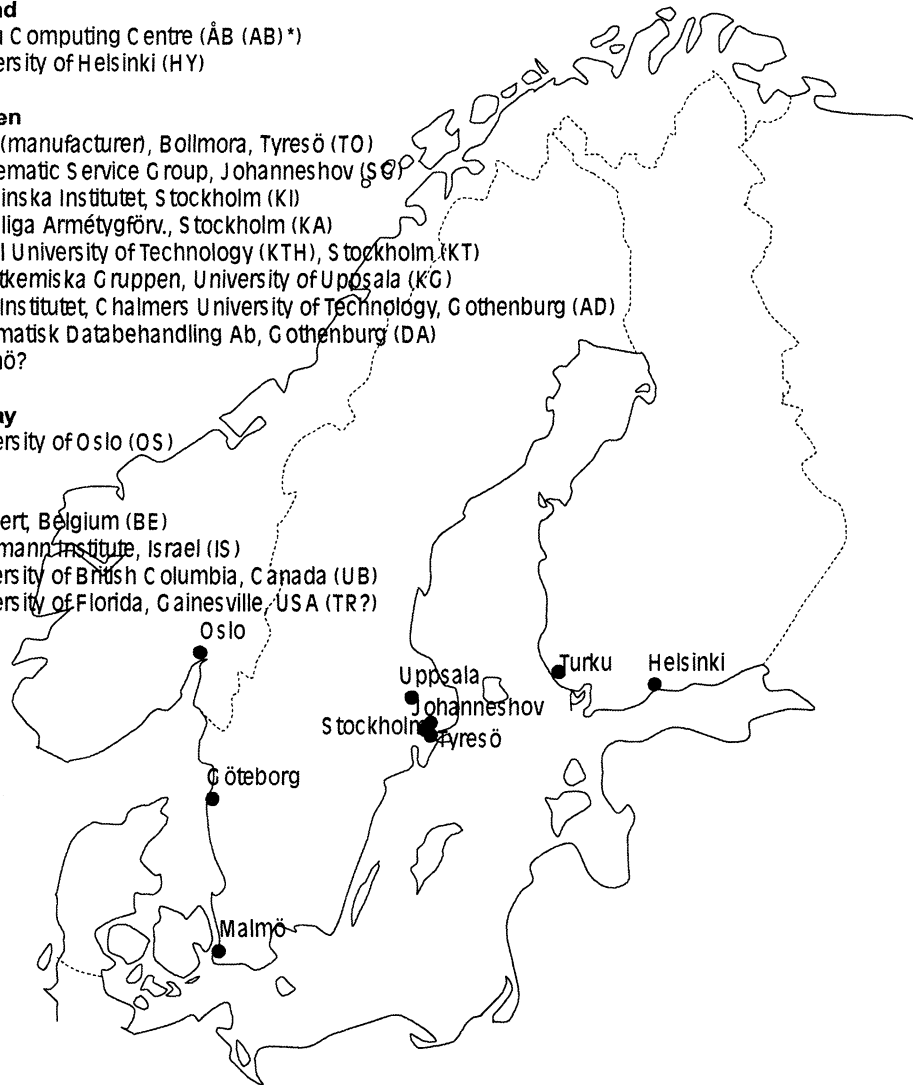
ABN (manufacturer), Bollnäs, Tyresö (TO)
Wegematic Service Group, Johanneshov (SE)
Karolinska Institutet, Stockholm (KI)
Kungliga Armétygförv., Stockholm (KA)
Royal University of Technology (KTH), Stockholm (KT)
Kvantkerniska Gruppen, University of Uppsala (KG)
ADB Institutet, Chalmers University of Technology, Gothenburg (AD)
Automatisk Databehandling Ab, Gothenburg (DA)
Malmö?

Norway

University of Oslo (OS)

Other

Gevaert, Belgium (BE)
Weizmann Institute, Israel (IS)
University of British Columbia, Canada (UB)
University of Florida, Gainesville, USA (TR?)



* These acronyms were used in the international co-operation, for instance program exchange, between the computing centres.