THE ADVENT OF THE FIRST GENERAL-PURPOSE COMPUTER IN ICELAND
Its impact on science and engineering

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Abstract: This paper first tells the rather unusual story of the acquisition of the first scientific computer by the University of Iceland. It then goes on to describe the efforts by the staff of the University Computing Centre to introduce key persons to the use of computers and to teach selected groups of people programming and assist them in using the computer. Finally, it lists several applications in widely different areas that ensued during the first six years of the computer's operation.

Key words: IBM 1620, education, applications, record linkage

1.   THE ADVENT OF THE IBM 1620 - PERSONAL REMINISCENCES

This is a story of how the University of Iceland came to acquire the first general-purpose computer in Iceland. In 1960, a few Icelandic students had encountered electronic computers during their university studies abroad. I had actually started using the EDSAC I computer in Cambridge in England already in 1950, using machine language. At the instigation of the Icelandic Mathematical Society, two engineering students in Denmark spent 3 months in 1960 working on the DASK computer at Regnecentralen, using machine language. One of them went on to work on the GIER computer using Algol a couple of years later. One student in England had begun to use the Mercury computer in 1960, using Autocode. Two students in the United States started work on IBM 650 and 704 computers around 1960, using

machine language and later FORTRAN and MAD (Michigan Algorithm Decoder). These people, with different computing backgrounds, were the human resources available to initiate scientific computing in Iceland.

Thus, in the beginning of the 1960's a few scientists and engineers in Iceland had used computers in their studies abroad but no computer was available in Iceland. The possibility of acquiring a computer had been looked into, e.g. acquiring a Mercury computer, but that possibility was not realistic. An Icelandic engineer visited Regnecentralen in Copenhagen in 1959 and its director, Niels Bech, came to Iceland in the summer of 1960. He even broached the idea of setting up a branch of Regnecentralen in Reykjavík with a GIER computer, but that was not a realistic idea and the matter did not go further.

In September 1960 the representative of IBM in Iceland, Ottó A. Michelsen, wrote to the Faculty of Engineering at the University of Iceland, and to the National Research Council, offering a 60% Educational Allowance on the purchase or rent of an IBM 1620 Model I computer that had been launched in October 1959. Neither the University nor the Council felt able to accept the offer at the time.

In a proposal from 1961 for the establishment of a Science Institute at the University of Iceland, a recommendation was made to acquire an electronic computer for the institute.

In 1963, an Icelandic electrical engineer spent several months at Regnecentralen in Denmark studying the GIER computer. The idea was to obtain components and assemble a GIER computer in Iceland. That plan did not materialize.

In October 1963, the IBM representative arranged for an IBM 1620 Model I computer to make a "stop-over" in Iceland en route from Canada to Finland,. Courses in FORTRAN programming were held with support from IBM in Denmark and people were given the opportunity to use the computer. This aroused great interest, primarily among scientists and engineers. IBM followed that up by again offering the University of Iceland a 60% Educational Allowance on the rent or purchase of an IBM 1620 computer and now the University responded positively.

The Rector of the University entrusted me, the only professor with computer experience, with the task to obtain funds to rent a computer and to set up a computing centre. This involved obtaining financial support from the Government and Parliament and possibly other sources. I discussed this matter with the Minister of Education, dr. Gylfi Þ. Gíslason, who showed an interest but stressed that the running costs of the computing centre be covered, at least partly, by income derived from the use of the computer. I approached the directors of governmental and municipal institutions and private firms and convinced most of them of the potential benefit of the use of the computer. I thus managed to obtain from several institutes

"subscriptions" to 1-3 hours of computer time per month. The next step was to write a proposal to the Budget Committee of the Parliament for funds to rent the computer.

As I was writing the proposal, the Minister of Education called me and asked about the purchase price of the computer. Although I had been preoccupied with the rental costs, I could give the Minister an approximate price in Icelandic krónur. About ten minutes later, he called me again and said that the Icelandic Development Bank had decided to donate to the University the purchase price of the computer on the occasion of its 10th anniversary! It turned out that the Minister was actually at a meeting of the Board of Directors of the bank where the directors were discussing how the bank should celebrate the anniversary. An agreement for the purchase of an IBM 1620 Model II computer, that had been announced in December 1962 and was a significant improvement on Model I, was signed in December 1963 for delivery in December 1964. That is how the University of Iceland came to acquire the first general-purpose computer in Iceland.

The University Computing Centre was set up in December 1964 with an IBM 1620 Model II computer with a memory of 40,000 binary coded decimals (BCD) and a card read/punch unit. Later we purchased two magnetic disk drives, each removable disk holding 2 million digits, with funds from the US Atomic Energy Commission. We also acquired a line printer on loan from IBM. Scientific computing was introduced in Iceland with this equipment.

In the preparation for the setting up of the computing centre, I had the invaluable assistance of Dr. Oddur Bendiktsson, who had just returned from the United States. He later became the first professor of computer science at the University. Helgi Sigvaldason, who was one of the Icelandic engineers at Regnecentralen in 1960 and who had worked on GIER in Copenhagen from 1962 to 1964, came to the Computing Centre at the start. Both of them have contributed to this conference. The third member of the initial staff was Dr. Ragnar Ingimarsson. These three came from different computing backgrounds, having used FORTRAN, Algol, and MAD respectively. Figure 1 shows the principal people involved with the project.
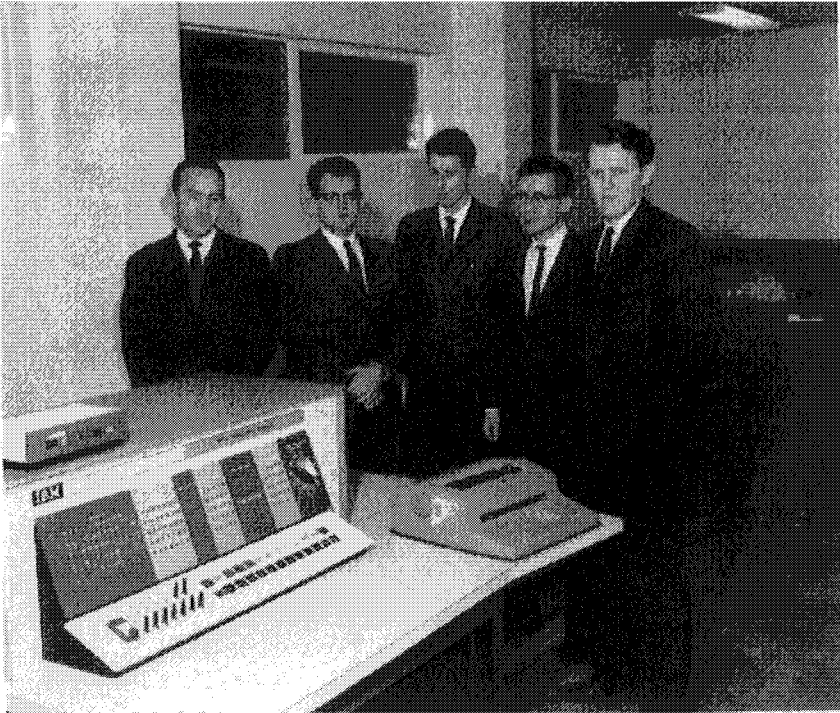
Figure 1. The IBM 1620-II computer in the University Computing Centre in 1964. On the picture from left: Þórhallur M. Einarsson (IBM), Ragnar Ingimarsson, Helgi Sigvaldason, Oddur Benediktsson, and Magnús Magnússon

2.   INTRODUCTORY COURSES IN THE USE OF COMPUTERS AND IN PROGRAMMING

Initially, we held courses for directors and senior staff of institutes and private firms to introduce them to the use of computers and their potential usefulness, but not to make them proficient programmers. That was the aim with courses for the junior staff and students. In some cases, this worked out differently. For example, we held courses for staff and students of the Medical Faculty at the University. The senior staff reacted and started planning the use of the computer in their research, whereas the students did not. The Business Administration faculty and students showed little interest.

We held intensive Fortran II programming courses for the junior staff of research institutes and engineering firms. Many of them became enthusiastic users of the computer. We also introduced them to various

programming packages relevant for their work. Most importantly, courses were held for engineering students at the University. The first courses were optional but in 1965-66, they became a compulsory part of the curriculum. The University of Iceland was one of the first universities in the Nordic countries to introduce compulsory programming courses in university curricula. These students became key persons in the development of the use of computers in science and engineering in Iceland.

3.   SOME EXAMPLES OF PROJECTS
UNDERTAKEN USING THE COMPUTER

Many and varied projects emerged that required use of a computer. Some of them were quite successful, others not. In addition to holding FORTRAN programming courses, we placed an emphasis on encouraging and assisting people in the use of the computer in their own work.

At the University, the first project was to computerize the calculation of the Almanac for Iceland, which had been calculated by hand and by the use of electric calculators. This led to a great improvement in the form and scope of the Almanac. Data from the Magnetic Observatory in Reykjavik were processed and analyzed on the computer. Other applications followed.

Engineers were introduced to program packages such as COGO (Coordinate Geometry), a civil engineering software package, and CPM (Critical Path Method) or PERT (Program Evaluation and Review Technique). The staff of the City Engineering Department used COGO extensively in their surveying and planning work. CPM/PERT was not much used. The business administration software package COBOL (Common Business Oriented Language) did not catch on, due to lack of interest by business administration people. The Public Roads Administration and the staff of the Computing Centre worked out the layout of the first major road in Iceland, between Reykjavík and Keflavík Airport, using the 1620. The staff of the State Electricity Authority began using the computer in their geodetic survey work. A major long-term project on the simulation of electrical power systems was undertaken in cooperation with the National Power Company. This involved the optimization of the use of reservoirs and thermal resources. (Sigvaldason 1967) Several engineering firms started using the computer. This revolutionized their work in many ways.

In 1965, the Genetics Committee of the University of Iceland initiated, in cooperation with the Computing Centre, a research project in human genetics, which was supported by the US Atomic Energy Commission. This involved an extensive record linkage program, at least by the standards of

the time, covering persons in the Icelandic National Census of 1910 and those born since. The census records were linked, using the Symbolic Programming System (SPS), to the National Register of living persons or to death records, recording inter alia the cause of death. Similarly, the birth records from 1910 onwards were linked to the National Register or to death records. Thus a database of the 85,000 in the Census and the 165,000 born since, about 250,000 persons, was set up. Blood group records of 27,000 persons were linked to the database. This unique database was used in various human genetics studies. The record linkage project aroused considerable international interest and was presented at meetings in the US and UK (Magnússon 1968). It was for this project that we acquired two magnetic disk drives, each removable disk holding 2 million digits.

An operational analysis of the herring industry was planned in 1965. This was to involve collecting and analyzing data on the location and catching of the herring, the landing ports, the landing facilities, and capacity of the processing plants as well as distances from the fishing grounds. The idea was to optimize the whole system taking into account the overall economy and to be able to direct the fishing boats to the most advantageous landing ports from the point of view of distance to the ports, time for landing the catch and distance to the next fishing grounds. The owners of the fishing vessels and processing plants showed little interest, however, choosing to rely on the judgment of their skippers and, perhaps, to guard their interests as owners of the plants. The project was abandoned.

An operational analysis project to optimize the use of trawlers for supplying fish for freezing plants in North Iceland was undertaken in 1969 by the staff of the Computing Centre in cooperation with the Fisheries Association. This involved assembling and analyzing large amounts of data on the Icelandic fishing fleet, the number and sizes of trawlers, their catch on each trawl, the fishing grounds and so on. Comparison was made between the profitability of trawlers of different sizes. The conclusion was that the most economical size of trawlers was 400 to 500 tonnes. However, the authorities and the fishing industry ignored this conclusion and larger and less economical trawlers were built. (Benediktsson et al. 1969)

Due to the rapid changes in sea conditions around Iceland and the danger it entails for small fishing boats, an attempt was made to forecast the wave conditions around the coast of Iceland. This was actually prompted by the loss of a fishing boat due to unforeseen sea conditions. A program was developed for this purpose. The idea was to obtain data from the Meteorological Office in the afternoon, feed the data into the computer, run the program, and broadcast the forecast at midnight. The program worked well in hindcasting but the problem was that it took the IBM 1620 24 hours to make a 3 hour forecast!

Already in 1965, I had the idea that we should attempt to make a computer model of the Icelandic economy. In discussions with Professor Koopmanns, later a Nobel Prize winner in Economics, at a meeting in Iceland in 1965, I pointed out that the Icelandic economy was dominated by the fishing industry and it should therefore be relatively simple to model. Professor Koopmanns agreed and encouraged us to make the attempt. An economic modeling program package was obtained from the University of Vienna for this purpose. However, little progress was made at the time, largely due to lack of interest by economists who were not ready to embark upon such an undertaking.

The computerization of the real estate assessment process was started in 1966 and became a long-term project. (See the paper by Oddur Benediktsson et. al. at this conference).

In medicine, there was interest in using the computer right from the beginning. The Cancer Register, i.e. a register of all known cancer cases in Iceland, was processed and analyzed on the 1620. The Heart Association put all the records from the extensive epidemiological studies undertaken by the Association on the computer for processing and statistical analysis.

Several institutes and companies started long-term projects in applied statistics using the computer. Of these the Agricultural Research Institute, the Marine Research Institute, and the Meteorological Office were particularly active. Furthermore, actuaries from insurance companies used the computer to analyze the car insurance business among other things.

In the humanities, a very interesting pioneering project was initiated on the IBM 1620. The project involved the frequency analysis of the words occurring in an Icelandic novel and led to a concordance project. Later similar analyses were made of several Icelandic sagas.

4.   CONCLUSION

As seen from these examples, it is clear that the staff of the Computing Centre succeeded in introducing computer applications in very diverse fields by their dedicated work. Although the IBM 1620 computer was extremely modest by modern standards, it had a profound impact on the use of computers in science, engineering and other fields in Iceland. It played a decisive role in the introduction to the computer age in Iceland.

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