

History of Computing in Chile, 1961–1982: Early Years, Consolidation, and Expansion

Juan Alvarez and Claudio Gutierrez
University of Chile

Digital computing in Chile dates back to the years between 1961, when the first digital computer arrived in the country, and 1982, when the discipline reached a critical mass in equipment, personnel, education, research, and applications. The authors distinguish three stages in this historical period: the introduction of computers; the convergence and consolidation of academic, state, and industrial development; and the expansion of the discipline.

Computer historians are still trying to understand the globalization process of computing.¹ Whether this process should be considered “diffusion” from the center to the periphery or a global network of exchanges is a matter of debate.² Case studies, particularly those on computing in the “terra incognita”—Africa and Latin America—can help support a more global discussion.³ Recently, historians have begun to address this research deficit for Latin America at the regional level.⁴

This article provides a history of computing in Chile between 1961 and 1982. Following a period of “industrial advance and the dawn of mass politics,”⁵ beginning in the 1930s, the early 1960s involved social changes within the context of the regional Alliance for Progress and saw the election of a Christian democrat president in 1964. A social revolution followed, leading to the election of a socialist president in 1970. A bloody coup d’état in 1973 overthrew the democratically elected socialist government and established a right-wing dictatorship. The military regime thus created in Chile an environment for extreme, neoliberal economic, education, pensions, labor, and health policies. As a result, computer historians have shown great interest in understanding how computing evolved in Chile and when this process began.

Scholars have offered different interpretations of the development of computing in Chile. A naive view associates the inception of the discipline with the free market policies

implemented by the dictatorship after 1973.⁶ However, based on a solid historical methodology focused on the state, Eden Medina showed that there were previous important developments, particularly between 1964 and 1973.⁷ This article studies an even wider period, beginning in 1961 with the installation of the first digital computer in the country and ending in 1982, when the discipline reached a maturity level and marking the advent of microcomputers and networks, opening a new, qualitatively different era.

This work presents an integrated look at the development of administrative computing in the state, scientific computation in universities, professional training, and industrial applications. Using primary sources and oral history, our research emphasizes how these disparate streams interacted in Chile.

It is tempting to tell this story by aligning the developments in computing with the political events that occurred in Chile between 1961 to 1982. Instead, we distinguish three stages according to internal developments in the discipline. Our findings indicate that computing in Chile started with just a few computers, in two independent applications areas: administration in state agencies and scientific computing at universities. This first period ended in 1965, when the government and university activities began to converge, rendering it more convenient to study the process as a whole. Thus, the second period, 1966 to 1975, is characterized by the advent of general-purpose computers, unified and massive training of personnel for

both areas, and the creation of a National State Computing Company, where people from universities and state agencies converged. During this period the discipline consolidated, as reflected in the size of applications, number of machines, creation of the first computer science departments, and the graduation of the first engineers and university programmers. In a third stage, 1976 to 1982, computing expanded, decentralized, and diversified. Some indicators of this stage are the influx of new types and brands of computers, the emergence of software and consulting companies, new computer science departments, the first master's computer science students to graduate in Chile, the return of the first PhD graduates who had studied computer science abroad, and the establishment of a research community.

Background and Context

One of the earliest proposals for the development of information and communication technologies in Chile is the 1954 *Chilean Telecommunications Policy* report, written by prominent engineers.⁸ This report motivated the establishment in 1960 of the National Telecommunications Commission and the creation of the National Telecommunication Company (ENTEL, *Empresa Nacional de Telecomunicaciones*) in 1964 as a branch of the Chilean Agency for Technological and Industrial Development (CORFO, *Corporación de Fomento de la Producción*, created in 1939). ENTEL encouraged the development of domestic wireless communications as well as a domestic and international telecommunications network.⁹

State and industrial needs also strongly boosted demand for professional information processing. Before the first digital computers arrived, some offices of the Chilean state had gained experience in data processing automation after first using punch cards in its 1930 census. These early technological exposures were progressively broadened to more elaborate punch-card processing through unit-record machines such as sorters, collators, reproducers, calculators, and interpreters.¹⁰

At the same time, engineering and scientific processing (such as structural analysis, statistics, and numerical analysis) required automatic calculations. These issues were being discussed in academia, as suggested by a 1944 engineering thesis project at the University of Chile on the design of a machine to calculate integrals.¹¹ The universities began

**At the beginning of the
1960s, administrative
and scientific
computing ran
in parallel, with
little interaction
between them.**

experimenting with analog computers in the late 1950s. At the University of Chile in 1958, Guillermo Gonzalez assembled a Heathkit analog computer in the Laboratory of Computers and Servos, and the university acquired an Analog Computer Applied Dynamics AD2 64PB with 64 operational amplifiers in 1962.¹² At the Technical University Federico Santa María in Valparaíso, professors of electrical engineering Guillermo Feick, Esteban Azpiri, and Juan Hernández initiated analog computing. They acquired an EAI computer (made in the US) that allowed representation of real-world processes and systems with many parameters allowing flexible tuning.¹³ At the Catholic University, Carlos Grandjot built an analog computer for solving systems of algebraic equations.¹⁴ Years later, the University of Concepcion acquired a YEW analog computer for automatic control.

Chile's early experiences with digital computers began in this context. The two sets of actors involved were state companies and organizations demanding advanced technology for processing administrative information and universities dealing with analog machines and engineering problems.

First Computers (1961–1965)

At the beginning of the 1960s, administrative and scientific computing ran in parallel, with little interaction between them. The initial incorporation of computers was a product of individual institutional initiatives rather than central planning. At universities, those promoting computer acquisitions were university engineers and scientists.

The first computational experiences occurred in three cities: the capital city of Santiago; Valparaíso, the main port, 120 km

west of Santiago; and Concepción, a historically influential city, 500 km south of Santiago. Among the eight existing universities in the academic area, the University of Chile, the biggest and most traditional public university with branches in Santiago and several provinces, pioneered the incorporation of computer technology. There were also three private, state-subsidized universities: Catholic University in Santiago; University of Concepción in Concepción; and the Technical University Federico Santa María in Valparaíso.

Covering 1961 to 1965, the first phase began with the installation of the first digital computers in each of the two main application areas: state administration and academic engineering and science at the universities. (Except for the machine providers, the private sector did not play a relevant role during this period.) This made way for a parallel move, both, from punch-card machines and analog computers, to digital computers with transistor technology.

Due to the newness of the technology, no professional specialists existed. Training was the responsibility of pioneering researchers and computer vendors. The most important computer supplier, IBM, performed most of state personnel training.¹⁵ (In Chile, 12 of the 14 existing computers running until 1965 were IBMs.)

State Developments

In the early 1960s, various state institutions acquired digital computers to meet the challenges posed by the growing volumes of data and to ensure greater speed, reliability, and flexibility in data processing. In 1961, the Valparaíso Customs Agency installed the first computer for administrative guidance in Chile: an IBM-1401 with a 4-Kbyte memory, a 1402 punch/reader machine that could process 400 hundred cards per minute, and a 1403 printer that printed 600 lines per minute.

The first uses of these systems were the automation of a statistical system for imports and later the development of a payroll system and a personnel database. The programs were written in the SPS and Autocoder programming languages.¹⁶ Over the next two years, several other similar IBM 1401 computers were put to work in areas such as the treasury, railways, navy, internal revenues, army pensions, and air force.¹⁷ These early computers were predominantly used for administrative or management applications

(which were called “commercial” at that time), involving huge amounts of data but simple arithmetic calculations (sums, averages, percentages, and so forth).

Computers were used at factories as well. The Pacific Steel Company (CAP, *Compañía de Aceros del Pacífico*) in Huachipato installed an IBM-1401 with the first magnetic drum for secondary storage in 1963. The first industrial applications was a 70,000-item inventory system, followed by production planning and operations research. CAP installed the computer at the plant entrance, where it worked day and night and garnered the admiration of its workers.¹⁸

The technical staff in all these services consisted of programmers, system analysts, and operators (of computer and punch-card machines) from diverse backgrounds such as engineering students, navy engineers, punch-card machine operators, and skilled young people without prior work experience.

The Academic Thread

The first digital computer put to work in academia was a German Standard Elektrik Lorenz computer ER-56 (locally was known by its Spanish nickname “Lorenzo”) installed in 1962 in the School of Engineering at the University of Chile. The acquisition process began in 1959, and it cost approximately US\$400,000. It used transistor technology, with memory for 3,000 words of 7 digits, a 60-Kbyte magnetic drum, and a paper-tape reader. It was operated without an operating system by programs written in machine language and an Algol converter (Alcor).¹⁹

Next, Catholic University (1963), the Technical University Federico Santa María (1964), and the University of Concepción (1965) acquired IBM 1620 computers. The main purpose of these first academic computers was to support the necessary calculations to solve problems in other disciplines, such as numerical calculation, differential equations, statistics, linear programming, structural analysis, and network analysis. The State Technical University received a Datatron computer in 1964.²⁰

The first computer installations in universities required the organization of computer centers that mainly functioned to manage the use and operation of the machines and to provide programming services to various university and external users. A power struggle developed among mathematicians and electrical engineers regarding where these centers should be located. Some other voices

claimed that such centers were unnecessary.²¹ However, the high-level activity made possible by the first center at the University of Chile proved that it was justified. The center facilitated graduation projects and research on structural analysis, system simulation, and operations research, and it provided services to ministries, government agencies, and CORFO (roads, electricity, irrigation, and so on).²²

These centers also offered the first courses in computing and programming for potential users. One of the first in the university environment was a systematic course in programming the ER-56, given in 1961 by Guillermo González, an electrical engineering professor.²³ Then in 1962, the German computer scientist Wolfgang Riesenköning, who was sent by the company that sold the ER-56, taught a course on Algol at the University of Chile and a programming course at the Technical University Federico Santa María in 1963. In 1964, the mathematicians Robert Frucht and Alberto Saenger gave courses on Fortran programming, a “language similar to algebra that can be learned in a few lessons,”²⁴ at the Technical University Federico Santa María and Catholic University, respectively. The lecture notes used for programming training at the University of Chile in 1966 are a good example of the state of the art at this time. They cover the history, contextualization, and scope of digital computers; a digital computer’s structure and functional units; and programming in the ER-56’s machine language.²⁵

The computer center activities were complemented by the publication of notes and information regarding the use of hardware and available software. These centers were the seeds from which the future computer science academic departments in Chile grew.

Thus, the academic and administrative computing activities in this first stage used different hardware and developed applications for different problems, and the people involved in each area had little or no contact.

Convergence, Coordination, and Consolidation (1966–1975)

The late 1960s witnessed a convergence of the administrative and scientific branches of computing in Chile. This integration served to centralize, coordinate, and consolidate the discipline.

From a technological point of view, the driving force behind this convergence was the advent of general-purpose computers

The late 1960s witnessed a convergence of the administrative and scientific branches of computing in Chile.

that allowed for the development of both administrative and scientific applications on the same machine. The hardware on these machines is considered third generation (solid-state technology, precursor of integrated circuits). The first computers of this kind in Chile were the IBM System/360s, acquired in 1966 by the national oil company ENAP and the University of Chile.

The second half of the 1960s was also an era of political and administrative central planning in Chile. This strategy followed the recommendations of the United Nations Economic Commission for Latin America (CEPAL, *Comisión Económica para América Latina*) and international cooperation policies, which recommended the development of a national infrastructure for science and technology. Thus, the Chilean National Science Foundation (CONICYT, *Comisión Nacional de Investigación Científica y Tecnológica*) and the Agency for Technological Development (INTEC, *Instituto Tecnológico de Chile*) were created.²⁶ In this context, the National State Enterprise for Computing (ECOM, *Empresa Nacional de Computación*) attached to CORFO was created in 1968. ECOM was to play a leading role in centralizing state efforts in computing and reducing costs at the machine, system, and personnel levels.

From the education and academic perspective, three aspects symbolize this convergence: the creation of university programs, the first systematic efforts toward research development, and the creation of the first academic computer science departments.

Two institutions in particular led this process: the universities and ECOM.

Universities

In December, 1966, the University of Chile installed an IBM-360/40, one the first of its type in a Latin American university. This

machine had 128 Kbytes of memory, a 7.2-Mbyte disk, a magnetic tape drive, a punch-card reader, and a printer for continuous paper forms. The machine, which cost US\$600,000, was a landmark of the potential offered by computer technology for the local environment. A good indicator of how important this was for Chile is highlighted by President Eduardo Frei's presence at the inauguration of this IBM computer. The speech by Efraín Friedmann, director of the university's Computer Center, expressed the rationale behind the acquisition: "It will be used not only by professors, students, researchers and administrative of this university, but also by Government agencies."²⁷

The rapid spread of the capabilities and potential of computers triggered the creation of a three-year program in computer programming at the University of Chile in 1968, the first computing career offered in Chile. As a result of the university reform process efforts to modernize higher education and meet the demands of the country, the University of Concepcion and Catholic University followed quickly, creating university programs in computer programming in 1970 and 1971, respectively.

Subsequently, to help prepare higher-level professionals in the area, four-year technical engineering (*Ingeniería de Ejecución*) programs were also created: information processing at the University of Chile (1971); computing and informatics at the State Technical University (1972); and information systems at the Technical University Federico Santa María (1975). At the graduate level, the University of Chile offered a master's in information management systems in 1971.²⁸

Over these years, the scientific and technological research activity began in computer centers, at ECOM, and in academic mathematics, electricity, industry, and medical departments. This was reflected in the realization of national conferences in Concepción (1966) and Valparaíso (1968 and 1974). The 1968 conference was called the "First National Computing Meeting" and was organized by the Technical University Federico Santa María and Chilean Association of Information Processing (ACHITI). Later, in 1974 the Catholic University at Valparaíso organized the "First Discussion Panel on Computer Topics."²⁹

These initiatives helped to consolidate computer science, promoting the creation of computer science departments, bringing together all the resources dispersed in the

mathematics, industry, and electrical engineering departments and the computer centers. Such developments encouraged and promoted the creation of the first academic departments inside engineering schools at Technical University Federico Santa María and University of Chile in 1975, with some reservations from the traditional engineering disciplines.

In 1975, the Technical University Federico Santa María began offering a graduate diploma in computer science and informatics, and the University of Chile a master's degree in computer science.³⁰ The same year, the State Technical University created the Department of Mathematics and Computer Science in its Science Faculty, offering a "Licenciatura" in mathematics and computer science, with the goal of training teachers. Two years earlier, the first high school textbook on programming using mini-Fortran was published.³¹

National Data Processing Company

Rapidly after its creation in 1968, ECOM established itself as the principal computing center in Chile. A highly skilled group of people from both academia and industry were recruited, symbolizing the convergence of the two areas.³² For example, ECOM's first director, Efraín Friedmann, was the former director of the University of Chile's Computer Center.

During its first two years, ECOM offered services to state agencies and organized and conducted a broad training program in computer programming and systems analysis. By 1971, it was able to develop systems to solve data processing problems common in industry and services. The technical solutions developed were highly innovative, including parametric and automatically generated programs in areas such as payroll, accounting, checking accounts, inventories, and wages systems.³³

The best example that highlights the efforts to incorporate computing into the country's administrative and social fabric was the futurist project Cybersyn. This flagship project implemented under Salvador Allende's socialist government³⁴ was a joint effort with CORFO and INTEC started in November 1971. Cybersyn's goal was to plan and coordinate production companies in the area of public ownership. In parallel, INTEC tried to build a computer; its design was completed but was never constructed due to lack of funding for importing components and measurement equipment.³⁵

ECOM initially acquired IBM System/360s. Later, in the early 1970s, in an effort to diversify suppliers and reduce dependence on individual American manufacturers, ECOM bought a Burroughs 3500 computer. In 1973, it also commissioned two French CII computers (Iris-80 and Iris-60) for the Santiago headquarters and the Concepción branch, respectively.

In 1974, a two-month temporary lift of import tariffs (which followed the dictatorship's economic policies) resulted in a massive influx of computing machines.³⁶ This new environment created a huge deficit of computer professionals, which was addressed in a 1975 national plan calling for intensive training of specialists (PLANACAP) coordinated by ECOM in collaboration with the University of Chile, State Technical University, and Catholic University.³⁷

Other Developments

Another important state effort was the early development of a teleprocessing network implemented by the State Bank (*Banco del Estado*) in 1969. Among other tasks, this allowed for the management of about a million savings accounts geographically distributed throughout the country. The network was run by an IBM System/360-40 with 89 terminals.³⁸

Outside the capital Santiago, two attempts were made to install regional computing centers. In the late 1960s, universities in the Valparaíso area developed a cooperative project that eventually failed.³⁹ In Concepción, a regional center for computing (CRECIC, *Centro Regional de Computación e Informática de Concepción*) was created in 1975 to provide services to enterprises and institutions.⁴⁰ This proved successful.

By the late 1960s the development of computer infrastructure in the private sector grew slowly (although large vendors such as IBM, Burroughs, and NCR had headquarters in Chile). In 1967, COPEC-Abastible acquired an NCR 315 computer. Some companies, such as the Paper and Paperboard Manufacturing Company (CMPC), rented university computer processing "jobs" or "block time" by the hour. In 1969, the Bank of Chile, Bank Edwards, and the copper company Cobrechuiqui (mixed state and private property) each acquired an NCR Century 200 computer.

When the number of computer imports sharply increased in the 1970s, private computing expanded, especially in the emerging financial sector, the largest buyer and user

Computing as well as other scientific and technological disciplines in Chile have yet to complete a systematic evaluation on the impact of the coup d'état on their development.

of computer technology. By this time, the first specialized consulting firms were established, among them, SONDA and LatinData in 1974.^{35,41}

In the early 1970s, the company SID introduced ARIEL, a poll-processing system for the Ministry of Housing and the first software developed in Chile. Beginning in 1972, the United Nations Food and Agriculture Organization distributed ARIEL to more than 20 countries.⁴²

The Role of Political Events

On 11 September 1973, the overthrow of democratic and constitutional rule in Chile shook the grounds of the republic in several respects. Medina writes that "the history of computing [in Chile] will inevitably intersect with a history of political violence and repression."⁴³ The dictatorship's policies affected the computing field in terms of personnel and long-term planning. For example, the military fired staff at ECOM who were sympathetic to Allende's government and subsequently suspended the Cybersyn project. It also canceled the purchase of Iris-80 and Iris-60 computers from the CII French company and began to limit ECOM's role in promoting and centralizing information from the state. In 1975, an army colonel was appointed the national delegate of informatics.^{32,44} University administrations were taken over by military "delegates" who then fired academics in many areas.

In spite of this environment, the inertia inherited from both the initial development of the discipline and the modernization of

Table 1. Number and type of computers in Chile, 1962–1975.*

Year	IBM 1401	IBM 1620	IBM 1130	IBM 360	NCR 315	NCR 200	Burroughs 3500	PDP-8	Other	Total
1962	3								1	4
1963	8								1	9
1964	10	2							2	14
1965	10	2							2	14
1966	13	3		1					2	19
1967	13	3	1	6	1				2	26
1968	14	3	3	8	1				3	32
1969	14	3	4	10	1				4	36
1970	14	3	8	12	1	3		1	4	46
1971	14	3	9	14	1	3	2	4	7	57
1972										60
1973										80
1974										120
1975										330

* Figures for 1962–1971 are from the United Nations,⁴⁵ 1972–1975 numbers are approximations,⁴⁶ and Ramon Barquin estimated a total of 52 computers by 1970.⁴⁷

the universities through reform processes of the late 1960s and early 1970s permitted continuity in the computing landscape in Chile and even prompted the creation of the first academic departments of computing in 1975.

The change of regime primarily impacted the structural level. In fact, three years later, the economics of the regime shifted from a nationalistic and centralized view toward a liberalization of the economy and the boosting of the private sector, allowing the import of computer machinery. In computing, as in other areas (such as education and agriculture), the new authorities' liberal policies were based on the know-how acquired by people trained during the previous decade.

Computing as well as other scientific and technological disciplines in Chile have yet to complete a systematic evaluation on the impact of the coup d'état on their development.

In short, the second stage, covering the 10-year period between 1966 and 1975, was characterized by the convergence of administrative and scientific computing; the strong involvement of the state in the use, coordination, and promotion of computing; the consolidation of the discipline at the universities; the increasing size of applications; and the diversity of computer brands. By the end of that period, Chile had more than 300 computers (see Table 1). This stage ends with the certification of the first generation of engineers and university programmers.

Expansion (1976–1982)

The next stage computing in Chile, a period of expansion, is characterized by the diffusion, extension, and decentralization of the discipline. The sustained increase in the number of computers in the country helped diversify suppliers, types of computers, and applications. Particularly important was the massive incorporation of computers in the financial sector and services.

In the long run, however, the most important development of this period was the maturation of the discipline in academia as well as the establishment of a community in the field.

Universities

During this period, universities acquired more powerful computers with terminals that allowed for remote and distributed use. The State Technical University, University of Chile, Technical University Federico Santa María, and Catholic University at Valparaíso each installed an IBM 370 (1975–1976); the Catholic University in Santiago acquired a Digital DEC 10 (1979); and the University of Concepcion installed a Burroughs 1700 (1978) and a MAI Basic Four (1980).

Three new academic computing departments were created—at the University of Concepcion in 1980, Catholic University in 1981, and the University of Santiago (formerly the State Technical University) in 1982. Theoretical and applied research, as

well as joint projects with industries, were developed. Examples include the Bibliographic Information Retrieval and Dissemination System (BIRDS) project developed at the University of Chile for Burroughs and a large project developed by the Catholic University for the Register Office.⁴⁸

By this time, the first master's students had graduated from Chilean universities and were now employed as university academics or in companies, especially computer providers. Simultaneously, the first PhD graduates in computer science were returning home from studying abroad.⁴⁹

These developments helped establish a research community at the national level. The *Panel de Discusión* event was created in 1974. Its initial scope was local, but the event soon gained national coverage. In 1977, the Discussion Panel turned into a Latin American event and gave rise to the Latin American Studies in Informatics (CLEI, *Centro Latinoamericano de Estudios en Informática*) in 1979. (The 37th meeting of the CLEI Latin American Conference on Informatics was held in 2011.)

In 1979 and 1980, the University of Chile and Catholic University jointly organized another national conference. In 1981, this became the International Conference of Computer Science, which triggered the creation of the Chilean Society of Computer Science in 1984. The society continued organizing the conference after that and held its 30th gathering in 2011. In 1978, the University of Chile also created the System Engineering Workshop with a track on information systems. In 1979, the Northern University in Antofagasta organized the first Symposium on Computer Applications (INFONOR, *Simposio de Aplicaciones de Informática*), oriented toward mining (mainly copper) applications. INFONOR held its 12th meeting in 2010.⁵⁰

At the training level, the "Ingeniería de Ejecución" engineering university program significantly increased its enrollment, reflecting the growing interest in the area. New programs were added at the University of Concepcion (1977), Northern University (1980), and Catholic University at Valparaíso (1982).

As a consequence of a new university law imposed in 1981, the discipline witnessed two major changes. First, six-year civil engineering degrees in computing programs were created, matching traditional studies with highest solid social status and tradition.

Our findings reveal a certain continuity in the efforts to incorporate computing in Chile's social fabric during this whole period, despite the political turmoil.

The Technical University Federico Santa María, University of Chile, University of Concepcion, and Catholic University established such programs. Second, the law also authorized private institutions to offer programmer and technical engineer programs.

Further Developments

This stage witnessed a considerable increase in the use and application of computing in the private sector, driven by the increased importation of computers, principally mini-computers that allowed small- and medium-sized companies and organizations to automate their administrative processes. Originally just IBM, Burroughs, and NCR, the market now included other companies such as Wang, Digital, Texas Instruments, and Basic Four.⁵¹ As a result of this increased computer use, the local magazine *Informática* for industry and professionals was created in 1979. Its monthly circulation is maintained even today.⁵²

The explosive increase of the number of computers also triggered the development of a software and consulting industry. One example is the company ORDEN, created in 1979 by Carlos Lauterbach and other Catholic University professors. At its peak, the company employed 100 engineers and its product, DUNGA, a "fourth generation software," was a technical and commercial success.⁵³

The banking sector was one of the most important application areas in the beginning. This sector advertised its services as "perfect, efficient, and agile," thanks to the new technologies. In the early 1980s, the privatization of pensions and healthcare required intensive computer support. There were also industrial applications at the copper company

CODELCO, the petroleum company ENAP, the copper manufacturing company MADECO, and the paper company CMPC.⁵⁴

A less standard area of application that merits mention is the “hidden information battle” within the human rights realm. Chile’s intelligence organization (CNI, *Central Nacional de Informaciones*) began using computers to record and document opposition groups and coordinate with other South American repressive regimes.⁵⁵ At the same time, in 1979, the Catholic Church created a system to help people and document human rights violations by developing a database system to support lawyers in their related cases.⁵⁶

At the end of this period in 1981, ECOM implemented the first public network for data transmission. Unexpectedly, in 1982, due to the flooding of the Mapocho river after a storm that struck Santiago, ECOM lost its computer equipment, the most valuable in the country. This symbolically marks the beginning of the end of ECOM—that is, of state centralized computing. As Friedmann, the first ECOM director, wrote in 1986,

the country had trained an adequate number of skilled people. Data processing was used widely and efficiently in ever-increasing new areas. Eventually, the need for government committee review of projects became unnecessary, as each department had a management fully capable of making proper decisions. The national Data Processing Service also became less important, as many private, national and foreign owned centers were established offering good services at reasonable cost, due to market competition.⁵⁷

The introduction of personal computers in the early 1980s dramatically changed the computing landscape. Computing extended to all corners—offices, homes, and schools⁵⁸—which together with the arrival of computer networks,⁵⁹ marked the beginning of a new era.

Conclusion

Our findings reveal a certain continuity in the efforts to incorporate computing in Chile’s social fabric during this whole period, despite the political turmoil. This is particularly evident at the infrastructure, applications, and training levels as well as in the assimilation of computing by political, entrepreneurial, and academic entities. We believe this is the result of the social relevance gained by the new discipline of computing in Chile.

These findings also show that the three periods we detected in Chile coincide with international contemporary standards of classification of computer activity levels.⁶⁰ In the first stage, Chile reached a basic technological level with a few computers and some basic applications in government settings. Chile reached an operational level during the second stage, with many computers, educational institutions, specialized courses, and the design and production of science and engineering software and applications. The third stage saw the country move from an operational to a more advanced computational status, with a range of computer-related study programs and specialized computers of all sizes.

From the Chilean case, we can also derive another conclusion. Two streams of problems (administrative and scientific) that were treated independently in terms of people and technology converged into one domain when their common ground and generic solutions with computers was recognized. At this point, a discipline was born. After it was consolidated, this new knowledge and universal technology began to spread into society.

We think it would be interesting to have comparative studies to determine if this pattern has counterparts in other Latin American countries. Such a model could complement other generic models proposed in the literature.³

References and Notes

1. J.W. Cortada, “How Did Computing Go Global? The Need for an Answer and a Research Agenda,” *IEEE Annals of the History of Computing*, vol. 26, no. 1, 2004, pp. 53–58.
2. J.P. de Albuquerque et al., “Challenging the Ontology of Technoscientific Artifacts: Actor-Network Theory in the Context of Developing Countries,” *Proc. Int’l Workshop Understanding Development Through Actor-Network Theory*, LSE, 2011; M. Carmagnani, *The Other West. Latin America from Invasion to Globalization*, Univ. of Calif. Press, 2011.
3. T.J. Misa, “Understanding ‘How Computing Has Changed the World,’” *IEEE Annals of the History of Computing*, vol. 19, no. 4, 2007, pp. 52–63; J.W. Cortada, “Patterns and Practices in How Information Technology Spread around the World,” *IEEE Annals of the History of Computing*, vol. 30, no. 4, 2008, pp. 4–25.
4. J. Aguirre and R. Carnota, eds., *Historia de la Informática en Latinoamérica y el Caribe* [History of Computing in Latin America and

- the Caribbean], Univ. Nacional Rio Cuarto, Argentina, 2009; I Simposio de Historia de la Informática en América Latina y el Caribe [Symposium on the History of Computing in Latin America and the Caribbean], 2010; www.gabrielmarques.com.br/clientes/pesc-is.
5. S. Collier and W.F. Sater, *History of Chile, 1808–2002*, 2nd ed., Cambridge Latin Am. Studies Series 82, Cambridge Univ. Press, 2004.
 6. Several works support this view: S.E. Goodman “Computing in a Less Developed Country,” *Comm. ACM*, vol. 34, no. 12, 1991, pp. 25–29; R.A. Baeza-Yates et al., “Computing in Chile: The Jaguar of the Pacific Rim?” *Comm. ACM*, vol. 38, no. 9, 1995, pp. 23–28; M. Barrera, *La Difusión de la Tecnología Computacional en una Economía Abierta* [The Diffusion of Computer Technology in an Open Economy], working document no. 4, Centro Estudios Sociales, July 1986.
 7. E. Medina, “The State Machine: Politics, Ideology, and Computation in Chile, 1964–1973,” doctoral dissertation, Dept. of History and Social Study of Science and Technology, Massachusetts Inst. of Technology, 2005.
 8. R. Harnecker et al., “Política Chilena de telecomunicaciones” [Chilean Telecommunications Policy], *Anales del Instituto de Ingenieros* [Annals of Inst. of Engineers], nos. 5–6, 1954, p. 117.
 9. L. Ortega Martínez et al., “CORFO: 50 años de realizaciones 1939–1989” [CORFO: 50 Years of Achievements, 1939–1989], History Dept., Univ. of Santiago, 1989.
 10. L. González, “Elementos de Contabilidad Mecanizada” [Mechanized Elements of Accounting], Memoria de Contador Auditor [Accountant Auditor Report], Univ. of Chile, 1967. See also Medina, “The State Machine,” chap. 2.
 11. E. Bachmann Kehr, “Máquina para Cálculo de Integrales” [Machine Calculation of Integrals], School of Eng., Univ. of Chile, 1944.
 12. G. González, “Reseña de los Orígenes del Departamento de Ingeniería Eléctrica de la Universidad de Chile: El Instituto de Investigaciones y Ensayos Eléctricos” [Overview of the Origins of the Department of Electrical Engineering at the University of Chile: The Institute of Electrical Research and Assays], Scientific Research and National Development (ICARE), 1959.
 13. J. Hernández, “Aspectos de los Comienzos de la Computación en la UTFSM” [Aspects of Early Computing in UTFSM], 15 Dec. 2008.
 14. Carlos Grandjot, “Resolución numérica de ecuaciones algebraicas” [Numerical Solution of Algebraic Equations], publication no. 12, Electronic Computing Lab., Catholic Univ., 1965.
 15. E. Medina, “Big Blue in the Bottomless Pit: The Early Years of IBM Chile,” *IEEE Annals of History of Computing*, vol. 30, no. 4, 2008, pp. 26–41.
 16. G. Fliess and R. Cabezas, (Aduana contemporary staff) and F. Cavada, (IBM system support staff), interview by J. Alvarez and C. Gutierrez, Aug. 2010. See J. Alvarez, “El primer computador digital en Chile” [The First Digital Computer in Chile], *Revista BITS* [BITS Magazine], no. 6, 2011. pp. 19–24; http://dcc.comopapel.com/revista_bits_de_ciencia/6/#/page/20-21.
 17. “Computador Electrónico 1401” [Electronic Computer 1401], *Ann. Report 1964*, State Railways, Chile, p. 12; “Instrucciones relacionadas con la próxima recepción de computador” [Instructions on the Next Computer Desk], *Boletín de la Dirección de Impuestos Internos* [Bulletin of the Inland Revenue], vol. IX, no. 108, 1962, pp. 3270–3272; F. Villanueva, A. Aclé, F. Cavada, and P. Maturana, (IBM contemporary executives), interview by J. Alvarez and C. Gutierrez, 4 May 2009.
 18. W. Muñoz, O. Sáez, and J. Durán, interview by J. Alvarez, Jan. 2009; they were part of the first group of engineers that developed the first applications. All of them studied at the Tech. Univ. Federico Santa María and were influenced by J. Hernández.
 19. This information was provided by G. González in his presentation in the first Workshop of History of Computing in Chile, 2009.
 20. The machine donation was arranged by J. Michelow. Information provided by J. Michelow, interview by J. Alvarez and C. Gutierrez, 2009.
 21. “Acta del Consejo de la Facultad de Ciencias Físicas y Matemáticas” [Minutes of Council of the Faculty of Physical Sciences and Mathematics], 17 Aug. 1961.
 22. Faculty of Physical Sciences and Mathematics, “El Centro de Computación” [The Computing Center], 1964, pp. 24–31.
 23. G. González, “Curso de Programación del Computador ER-56” [Computer Programming Course ER-56], 1961.
 24. UTFSM monthly newsletter, no. 25, Sept. 1963, p. 3. R. Frucht was a German graph theorist who came to Chile in the late 1930s. A summer school Fortran course introduced the Tech. Univ. Federico Santa María community to the recently acquired IBM 1620.
 25. A. Kardonsky and V. Sánchez, (revision), “Curso de Programación” [Programming Course], Computer Center, Univ. of Chile, 1965.
 26. See Ortega Martínez et al., “CORFO,” especially the chap. “La Corfo entre 1965 y 1970” [The Corfo Between 1965 and 1970].
 27. E. Friedmann, “El Centro de Tratamiento Electrónico de la Información y su significación para nuestro país” [Electronic Processing Center of Information and its Significance for our

- Country], *Boletín de la Universidad de Chile* [Bulletin of the Univ. of Chile], no. 74, May 1967, pp. 11–14.
28. H. Segovia, P. Fritis, and V. Sánchez, interview by J. Alvarez and C. Gutierrez, Jan. 2009; they were the creators of the first university career program in computer science at the Univ. of Chile in 1968. Information about Univ. of Concepcion and Catholic Univ. taken from presentations of Y. Farrán and I. Casas (respectively) at Workshop of History of Computing in Chile, Nov. 2009.
 29. C. Lauterbach, interview by J. Alvarez and C. Gutierrez, Mar. 2011. See also the presentation by W. Riesenköning and A. Migliaro at the I Workshop on Chilean Computer History, Nov. 2009.
 30. J. Alvarez, “Antecedentes, creación y primeros años del Departamento de Ciencias de la Computación de la Universidad de Chile” [History, Creation and Early Years of the Department of Computer Science, University of Chile], *Revista BITS*; no. 4, 2010; www.dcc.uchile.cl/revista/2009/Bits_de_Ciencias-04.pdf. C. Castro, “Algunos Antecedentes Sobre la Historia de la Computación en la UTFSM” [Some Background on the History of Computing in UTFSM], *Proc. 1st Workshop of History of Computing in Chile*, 2009; C. Castro and J. Gana, “Algunos Antecedentes Sobre el Programa de Magister en Ciencias de la Computación e Informática de la UTFSM” [Some Background About the Master’s Program in Computer Science and Informatics UTFSM], *Proc. 1st Workshop of History of Computing in Chile*, 2009.
 31. J. Michelow, interview by J. Alvarez and C. Gutierrez, Apr. 2009. The textbook is J. Michelow and I. Harding, *Elementos de Computación* [Elements of Computing], Edit. Universitaria, 1973.
 32. Presentations of ECOM contemporary executives R. Beca, H. Segovia, I. Bozzi, and I. Benadof at in the “40 Years of the Creation of ECOM” Meeting, Dec. 2008.
 33. A detailed description of these developments is available in the conference documentation: *Facilidades de Procesamiento Electrónico de Datos para Empresas y Organismos Gubernamentales* [Electronic Data Processing Facilities for Business and Government Agencies], ECOM, 12 June 1973.
 34. E. Medina, *Cybernetic Revolutionaries: Technology and Politics in Allende’s Chile*, MIT Press, 2011. The original report is Project SYNCO, “Conceptos y Práctica del Control; Una experiencia concreta: la dirección industrial en Chile” [Concepts and Practice of Control. A Concrete Experience: Industrial Management in Chile], CORFO, Feb. 1973. See also the Project Cybersyn website, www.cybersyn.cl.
 35. “LatinData, Obras son Amores” [LatinData, Actions Speak Louder], *Informática*, vol. 1, no. 9, 1979, pp. 11–14.
 36. “Rebaja derecho ad valorem a bienes de capital que indica” [Reduced Duty to Capital Goods Indicated], decree 1130, Ministerio de Hacienda [Ministry of Finance], 19 July 1974. This decree was suspiciously “urgent” (only applicable to those imports before Dec. 1974), and it referred only to “magnetic readers.” A new decree, 1383, on 3 Sept. 1974 changed the wording “magnetic readers” to “automated machines for information processing.” In her doctoral dissertation, Medina estimates the tax drop from 120 to 10 percent (p. 318).
 37. “Plan Nacional de Capacitación Intensiva en Procesamiento de Datos” [National Training Intensive Data Processing], *Boletín ECOM*, vol. 1, no. 5, 1975, pp. 72–82. The plan’s development is analyzed in F. Silva, “Formación de Recursos Humanos en Procesamiento de Datos” [Human Resources Training in Data Processing], *Proc. Tercer Panel de Discusión sobre Tópicos de Computación* [Proc. 3rd Panel Discussion on Computer Topics], Valparaíso, 1976, pp. 215–225.
 38. T. Villalba, “Banco del Estado de Chile: Cien años de sobriedad (Entrevista por S. Prenafeta)” [State Bank of Chile: One hundred Years of Sobriety (interview with S. Prenafeta)], *Informática*, vol. 6, no. 8, 1984, pp. 8–12.
 39. Wolfgang Riesenköning, presentation at the I Workshop of History of Computing in Chile (2009). Also A. Finerman, “Computing Capabilities at Argentina and Chilean Universities,” *Comm. ACM*, vol. 12, no. 8, 1969, pp. 425–431.
 40. “Centro Regional de Computación e Informática de Concepción Ltda. S.P.A., CRECIC” [Regional Center of Design Computing and Informatics Ltd. SPA CRECIC], *Seminario de Administración de Centros de Procesamiento de Datos, Estudio de Casos* [Seminar on Management of Data Processing Centers, Case Studies], Univ. of Chile, 1976, pp. 19–33.
 41. For Sonda’s history, see www.sonda.cl/acerca/historia.
 42. “ARIEL, Embajador de un software Autóctono” [ARIEL: Ambassador of Native Software], interview with J. Muñoz Porras, *Informática*, vol. 5, no. 10, 1983, pp. 6–10.
 43. See the whole point of view in Medina, “The State Machine,” introduction.
 44. Decree 887, 1975, *Official Journal*, 18 Aug. 1975.

45. "The Application of Computer Technology for Development," Second Report of the Secretary-General, United Nations, 1973.
46. J. Durán, A. Castruccio, and O. García, "Desarrollo de la utilización de la tecnología de computadores en Chile" [Developing the Use of Computer Technology in Chile], *Informática*, vol. 1, no. 3, 1979, pp. 21–26.
47. R.C. Barquin, "Some Political Effects of Computation in Latin America," working paper 655–73, A.P. Sloan School of Management, MIT, 1973.
48. *BIRDS: Proc. 1a. Conferencia Nacional en Teoría de la Computación y Desarrollo de Software*, Aug. 1979, pp. 128–140. For Registro Civil, C. Lauterbach, interview by J. Alvarez and C. Gutierrez, Mar. 2011.
49. Some of the first to return with PhDs from foreign universities were Carlos Lauterbach (University of California, Berkeley, 1977) to Catholic University; Atendolfo Pereda (PUC Rio Janeiro, 1979) to University of Concepcion; Raúl Camposano (Karlsruhe, 1981) to the Northern University in Antofagasta; and Alfredo Piquer and Patricio Poblete (University of Waterloo, 1982) to University of Chile.
50. *Simposio Nacional de Aplicaciones Computación e Informática* [Proc. Nat'l Symp. Computer Applications and Information], Northern Univ., Antofagasta, 1979.
51. J. Durán, "Incremento del Parque de Computadores en Chile, período Enero 1979 a Junio 1980" [Increase Computer Park in Chile, January 1979 to June 1980], *Informática*, vol. 2, no. 8, 1980, pp. 32–36.
52. *Informática* was created in 1979, and directed by José Pino, a professor at the Univ. of Chile.
53. C. Lauterbach, "La Computación se prestigia con Orden" [Computer is Very Proud to Order], *Informática*, vol. 4, no. 6, 1982, pp. 18–22. Information reaffirmed in interview with Lauterbach, Mar. 2011.
54. "Seminario de Administración de Centros de Procesamiento de Datos, Estudio de Casos" [Seminar on Management of Data Processing Centers, Case Studies], Univ. of Chile, 1976. For Codelco, see J. Acuña, "La Informática en Codelco Chile" [Informatics in Codelco Chile], *Revista Colegio de Ingenieros* [College of Eng. Magazine], no. 74, 1977, pp. 71–72.
55. Medina, "The State Machine," pp. 319–325.
56. Information provided in 2011 by J. Chateau, P. Gutiérrez, C. Garretón, and J. Alvarez, contemporary members of the project.
57. E. Friedmann, "The Informatics Revolution and the Developing Countries," North-South Roundtable, Pakistan, 1986.
58. G. Jiménez, "Aprendizaje y Computación: Una brillante realidad" [Learning and Computing: A Brilliant Reality], *Revista Creces* [Scientist], vol. 4, nos. 6–7, 1983, pp. 19–30.
59. J. Piquer, "Antes del Internet" [Before the Internet], *Revista BITS* [BITS Magazine], no. 2, 2009, pp. 10–13. See also remembrances by P. Poblete, J. Piquer, E. Krell, and S. Mujica in "El primer e-mail de Chile se envió desde Beauchef" [The First Chilean Email Was Sent from Beauchef], *Revista FCFM*, no. 50, 2011, pp. 48–51.
60. "The Application of Computer Technology for Development, Report of the Secretary-General," report E-4800 GE-70-11926, United Nations Economic and Social Council, 1970.



Juan Alvarez is a lecturer in the Department of Computer Science at the University of Chile. His research interests include computer science education and computing history. Alvarez has a MS in Computer Science from the University of Waterloo. He is member of the Chilean Society of Computer Science. Contact him at jalvarez@dcc.uchile.cl.



Claudio Gutierrez is an associate professor in the Department of Computer Science at the University of Chile. His research interests include the semantics of Web data and the history of science. Gutierrez has a PhD in computer science from Wesleyan University. He is the author of *Educación, Ciencias y Artes en Chile (1797–1843)* [Education, Science, and Art in Chile (1797–1843)] (Ril Editors, 2011). Contact him at cgutierrez@dcc.uchile.cl.



Selected CS articles and columns are also available for free at <http://ComputingNow.computer.org>.