

COMPUTATION IN LATIN AMERICA

An Annotated Bibliography and Other Sources of Information

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INTRODUCTION

There has been a great deal of interest recently in problems of computation in developing countries. The Jerusalem Conference on Information Technology held in Israel in 1971 (see Bibliography Key, Jerusalem) was dedicated wholly to the topic, and since then the Rio Symposium on Computer Education for Developing Countries (see Rio), and the IBI-ICC Conference on Informatics in Government (see Florence), both held in 1972, have dealt directly with these problems. Latin America has been intent on benefiting from the application of computer technology to development, but the advent of the technology has not always met with the success that was expected. However, the lack of policy that brought about the random introduction of computers into a country, often sacrificing other equipment or services also critical to its development, is now giving way to more rational procedures. A number of countries (Brazil, Chile, Colombia, Cuba, Mexico) are presently engaged in detailed studies of their systems and those of other developing nations in order to learn from their experiences. This article is an attempt to aid that research effort by providing an annotated bibliography and other sources of information on computation in the region.

OVERVIEW OF COMPUTATION IN THE REGION

A categorization of the Latin American countries according to their potential for computer usage identifies five distinct groups in the region (see table 1). These are directly mappable to levels of data-processing (DP) sophistication as defined by the United Nations, which indicate the present status of the computer industry in each country.

There are over four thousand computer installations in Latin America today (see table 2). The approximate yearly cost to the region for the hardware alone is well over \$300,000,000. Of this amount, nearly three quarters is concentrated in Brazil, Mexico, and Argentina. If Vene-

TABLE 1. *Categorization of the Latin American Countries According to Level of Computer Potential*

<i>United Nations Level</i>	<i>Countries</i>
Initial	Haiti
Initial-to-Basic	Bolivia, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Paraguay
Basic	Chile, Colombia, Costa Rica, Cuba, Panama, Peru, Uruguay
Basic-to-Operational	Puerto Rico, Venezuela
Operational	Argentina, Brazil, Mexico

Source: Derived from R. C. Barquín, "Computation in Latin America," *Datamation*, March 1974, pp. 73–78.

zuela and Puerto Rico are also included, these five countries account for 85 percent of the actual number of computers and nearly 90 percent of the value. Most Latin American nations concentrate their computers in the national capitals, with about 80 percent of all computation being done there. A notable exception is Brazil, where 75 percent of all computers seem to be installed in the São Paulo–Rio de Janeiro area. Governments are, of course, very big users; nonetheless they account for only about half of the computers installed. Large private national and multinational organizations account for the rest.

U.S. manufacturers are dominant by far in the Latin American marketplace (see table 3). While IBM is the principal vendor, Burroughs, NCR, Univac, CDC, DEC, Honeywell-Bull, and Hewlett-Packard have considerable numbers of computers installed. Most of the installations in Latin America are running conventional data processing applications deviating very little from the North American pattern. Sophisticated functions are found only in certain government agencies, banking operations, or large regional centers of multinational corporations. The computer manufacturers in general account for the larger share of education in the operations, programming, and systems-analysis area. Universities are involved only to a minor degree in the smaller countries and have not, in our opinion, adopted a realistic approach in many of the larger ones,

TABLE 2. *Table of Computer Installations in Latin America*

Country	Computers	%	\$ (Month)*	%
Argentina	500	11.9	2,595,227	10.3
Bolivia	16	0.4	42,280	0.2
Brazil	1500	35.6	10,607,544	42.2
Chile	60	1.4	425,983	1.7
Colombia	100	2.4	812,030	3.2
Costa Rica	35	0.8	148,798	0.6
Cuba	70	1.7		
Dominican Rep.	40	0.9	70,054	0.3
Ecuador	30	0.7	63,398	0.2
El Salvador	30	0.7	92,221	0.4
Guatemala	35	0.8	114,325	0.5
Haiti	0	0.0	0	0.0
Honduras	20	0.5	63,000	0.3
Mexico	850	20.2	5,433,398	21.6
Nicaragua	17	0.4	64,353	0.3
Panama	35	0.8	146,000	0.6
Paraguay	10	0.2	18,833	0.1
Peru	100	2.4	531,483	2.1
Puerto Rico	310	7.3	1,464,364	5.8
Uruguay	40	0.9	189,871	0.8
Venezuela	420	10.0	2,232,908	8.9
	4218	100.0	25,115,070	100.0

Source: Updated from R. C. Barquín, "The Transfer of Computer Technology: A Framework for Policy in the Latin American Nations" (Ph.D. diss., Massachusetts Institute of Technology, 1974).

*Monthly rental in U.S. dollars approximated from typical configuration estimates as given in Neil Macdonald's "Monthly Computer Census," which appears regularly in *Computers and Automation*.

emphasizing scientific computing as opposed to commercial DP education.

The scarcity of qualified personnel at the higher levels of information-processing activities is the biggest problem confronting Latin American computation. This is often compounded by a double "brain drain," one external and one internal. The external drain is the classical migration of the skilled and well-educated who aspire to higher salaries and greater professional opportunities. The internal drain drives people from the lower-paying areas, such as government and smaller national enterprises where their skills are most needed, to foreign enterprises and multi-

TABLE 3. *Manufacturers with Computers Installed in Each Country*

	Bur-roughs	CDC	CID	CII	DEC	Elltott	Hewlett-Packard
Argentina	X				X		
Bolivia							
Brazil	X				X		
Chile	X				X		
Colombia	X						
Costa Rica	X						
Cuba			X	X		X	
Dominican Rep.							
Ecuador							
El Salvador							
Guatemala							X
Haiti							
Honduras							
Mexico	X	X			X		X
Nicaragua	X						
Panama							
Paraguay							
Peru	X						
Puerto Rico	X	X			X		X
Uruguay					X		
Venezuela	X				X		X

national corporations that might advance them out of the country if they are good enough.

The annotations that follow are of works that present introductions to the topic, and treat it integrally, or as part of a greater whole. Since the Bibliography is in two parts, citations in the text will give the appropriate section (A or B) as well as the author and date of publication. When more than one work exists for an author in a given year, the first few words of the title are also given. Pieces with no identifiable author are given by title. Unless otherwise stated, the date of publication will serve as an indicator of how current the information provided in the work may be.

LATIN AMERICA, GENERAL

General overviews and an introduction to the principal problems are found in Beltran (A, 1968), Boehm (A, 1970), and Barquín (A, "Computation in Latin America," 1974). The Beltrán work is brief, yet grasps the

Table 3 Continued

	Honey- well- Bull	IBM	NCR	RCA	Sie- mens	Uni- vac	Others
Argentina	X	X	X			X	X
Bolivia		X	X				
Brazil	X	X	X		X	X	X
Chile		X	X				X
Colombia		X	X			X	X
Costa Rica		X					X
Cuba							
Dominican Rep.		X				X	
Ecuador		X				X	
El Salvador		X					
Guatemala		X	X				
Haiti							
Honduras		X					
Mexico	X	X	X	X		X	X
Nicaragua		X					
Panama		X	X				
Paraguay		X	X				
Peru		X	X				
Puerto Rico	X	X	X	X		X	X
Uruguay	X	X					
Venezuela		X	X			X	X

Source: R. C. Barquín, "The Transfer of Computer Technology."

main difficulties that were confronted by the industry in Latin America up to that year. Boehm's article goes much beyond, and although he only deals with the principal countries of the region, he adds considerable depth, including case studies of situations in several installations he visited. He gives the first global vision of the general-systems capacity and the volumes installed in the nations he researched during his field trip. Barquín does likewise, but he provides more breadth by covering every country of Latin America and incorporates updated information on volumes, market share by manufacturers, personnel distribution, etc. Conolly (A, 1968) presents a good chronology through 1967. This is a valuable document in spite of some slight inaccuracies. It details the occurrence of principal events, such as the establishment of permanent offices by the main hardware manufacturers; the installation of the first computers by type; the implementation of principal applications by government and private industry; etc. The information provided, of course, only goes up to

the year prior to publication. Barquín (A, "Categorization," 1973) maps the countries into affinity groups according to their potential for developing a computer industry. The Gibson and Gibson (A, 1973) work provides a good view of how Latin American computer professionals perceive computation both in their own nations and in the region. It is based on a large survey and many personal interviews conducted by the authors during an extended field trip. One basic flaw is that, although the number of questions asked is large, many of the really important areas are not covered. For example, no information is available on the use of programming languages, operating systems, salary scales, cost of hardware, etc. Nonetheless, it has much valuable information, including case studies by country. Lee (A, 1971) gives specific business data on the industry for Argentina, Brazil, Mexico, and Venezuela. For example, he supplies figures obtained from the U.S. Department of Commerce and the countries themselves on the import and export volumes of data processing gear for previous years, and he gives basic legislation in the mentioned nations that deal with importation of computer hardware, listing the corresponding customs duties and the like. Gingold (A, 1970) covers the South American scene quite well with insights into some of the principal problems confronting the countries he studied. Although the basic thrust of his work was to analyze the potential for U.S. manpower in the South American DP market, he surveys the field excellently, providing information on installed systems, personnel, and budgets that should be valuable for future research. In addition, he cites other sources of data for Argentina, Brazil, Chile, Colombia, and Venezuela, plus some numbers and dollar amounts on the installed base which may be compared to Boehm for validation purposes. Barquín (A, "Transfer," 1974) includes a computer summary for the region as a whole, and a country-by-country census by manufacturer and system model. This research provides general coverage for Latin American computation while including a framework for the transfer of the technology to the region. It also provides the complete results of various surveys conducted throughout Latin America which give a detailed account of the state of computer arts there.

SURVEY BY COUNTRY

Argentina

A somewhat dated census of systems can be found in García Romeu (A, 1968) and updated in a report by the Consejo Nacional de Ciencia y Tecnología (A, "Informe de la Comisión," 1971). The Lauría, Frediani, and Bescardi (A, 1971) work is undoubtedly the best source of information on computation in the country up to its date of publication. In addition to

providing innumerable charts and ratios on the Argentine DP industry, its distribution by computer manufacturer, by computer types, by user industry, and other important data, it presents a definite strategy for the future development of computation. A slightly more recent work, with a historical perspective, is Ferreres (A, 1972), but with no in-depth analysis as to a developmental strategy for the country. Computer education nationally has been covered by Lauría, Vissio, et al. (A, 1972), Lauría (A, 1972), and Kohan (A, 1971, 1971, 1972, 1973), who have described the activities undertaken at the nations' principal universities. Finerman (A, 1969) presents an equally descriptive view of computer education here, as well as for Chile, and, to a lesser extent, Uruguay. This multinational comparison, done by someone with solid experience in computer education in North American universities, serves commendably in giving an overview of such activities through 1968. In addition, he gives his impressions of the computing centers of these institutions. Pollitzer (A, 1971) approaches the educational problem more conceptually. He does not attempt to describe current activities but prefers to analyze some of the methods being utilized, and he looks at the goals and objectives of computer education in Latin America through Argentina. Cowan, et al. (A, 1969) cover the educational panorama and place it in the perspective of the other major countries of the region. Although seven years have passed since the date of their report, the situation has not changed very drastically. Hardware at some of the institutions has been updated, however. Lauría, Frediani, and Bescardi cover the concepts of a national computer policy, but the "Informe de la Comisión" should not be overlooked since it provided much of the factual data with which Lauría et al. worked. The "Política Nacional de Computación" (A, 1974) provides a new approach to the problems of computer policy, with a more nationalistic outlook based on new technological developments in computation and the political happenings of 1973 in Argentina.

Brazil

The "Censo de Computadoras" (A, 1969) and the Ianuzzo (A, 1970) article are the starting points for studying computation in Brazil. The best and most complete data to date are found in the surveys conducted by CAPRE (Comissão de Coordenação das Atividades de Processamento Eletrônico) in 1973, and available in "Distribuição das Computadoras" (A, 1973) and "Resultado da Pesquisa" (A, 1973). Here, a comprehensive panorama of the systems inventory in Brazil is obtained, together with extensive data on the geographical distribution, market share by manufacturer and model, and DP personnel information. The survey on DP manpower

resources also provides good data on those aspects of the technology dealing with the distribution of personnel, educational background, salary scales, etc. Some additional but older data are provided by the *Association for Computing Machinery, São Paulo Chapter Newsletter* of July 1972 (see appendix A). The U.S. Department of Commerce EMD 73-138 also provides statistics on that nation's computer industry, and Lee gives added information, especially from the businessman's viewpoint. Computer education in Brazil has been covered extensively. Boehm expounds on the topic, based on his visit to the Pontificia Universidad Católica (PUC) in Rio. Since then, of course, the PUC has acquired an IBM 370/165, placing it at the head of all other Latin American installations according to computing power. Cowan, et al. give some added dimensions and cover a wider spectrum of institutions. More recently, Lucena (A, 1970) and Fadigas Torres (A, 1972) offer probably the best overall treatment, although the Rio Symposium on Computer Education in Developing Countries included a number of additional papers on the Brazilian experience. On the general approach and attitudes of the government to computation, there are two important documents: The opening speech of the Rio symposium by Minister of Planning dos Reis Velloso (see Rio); and the Flanzer (A, 1972) paper at the IBI-ICC conference in Florence (see Florence). Together they highlight the importance given by the Brazilian government to the use of computers in public administration and the steps they have taken to manage the technology.

Chile

The key to computation in Chile is ECOM (Empresa Nacional de Computación), the national computer enterprise, even though its power and scope have been reduced since the fall of Allende. The fundamentals of ECOM and the conceptual theory behind its foundation are given by Friedmann (A, 1971). Since he was the founder and first director of ECOM, his ideas on this are crucial, as they are for the additional structure for the establishment of computer policy at a national level in developing countries. Durán (A, "Analysis," 1972) provides the best overview of computer activities up to 1971, as well as a summary of computer systems installed in the country, past and present. Additional information on the activities of Chilean universities can be found in the *Revista* of the Asociación de Centros Universitarios de Computación and through the newsletter of the Universidad de Chile's datacenter (see appendix A). Finerman must also be studied for a view of Chilean computer education, and here the same comments made for Argentina apply. Cowan, et al. provide the complementary vision of the educational environment through 1968. Changes have not been very many.

Colombia

Although somewhat dated now, Lechter López (A, 1968) presents an interesting overview of computation in Colombia from its beginnings to 1967, as well as a detailed analysis of the factors behind its introduction and the dynamics of its diffusion in the country. A census of computer systems has been provided periodically by *ACUC Noticias* (Asociación Colombiana de Usuarios de Computadoras) since April 1972 (see appendix A). On computer education in Colombia one has to rely on Cowan, et al., however dated.

Cuba

Because of Cuba's experiment in the manufacture of minicomputers, there has been strong interest in the developments of computation in that country. Carnota Lauzán (A, "La Aplicación," 1972) provides an overview of present-day activities and a chronology of the Revolution's approach to the problem. Barquín (A, "Computation in Cuba," 1973) draws heavily on Carnota Lauzán, but he also gives a historical view of computation prior to the Revolution and places Cuba in perspective within the Latin American region and the world. Barquín (A, 1975) updates this and presents a layman's view of the Cuban entry to the cybernetic era. Chacón (A, 1972) describes a very interesting view of automated data processing in the Cuban sugar industry. Carnota Lauzán (A, "El analista," 1972) provides the only worthwhile presentation of computer education in Cuba today, together with the education-related sections of his prior work. By reading through the educational news sections of *Economía y Desarrollo*—the journal of the Instituto de Economía de la Universidad de La Habana—one can obtain additional insights on the computer education process in Cuba. Thus we can learn of the creation of the CINAG (Centro Nacional de Información Aplicada a la Gestión), the opening of a new computation center at the Universidad Central de Las Villas, etc. On computer policy at a national level, the key work is Dorticós (A, 1973). This is the complete transcript of a speech by President of the Republic Osvaldo Dorticós Torrado and goes into substantial detail on the future applications and uses of information systems in Cuban developmental plans. It provides fertile ground for political and technological analysis in the way it attempts to highlight Soviet and Eastern European achievements in the field. Nonetheless, all Cuban hardware to date is either nationally made or manufactured in the West.

Mexico

There is not very much information in the literature on computation in Mexico, nor is there much to go on outside. There appears to be no published census of computer systems, although SMCE (Sociedad Mexicana de Computación Electrónica) does have much information based on personal diligence and various surveys they have conducted. The best documentation available is for the data processing systems in the Mexican government, in "El Programa Mexicano" (A, 1972). It details existing systems, market distribution, personnel categorizations, and previews certain policy alternatives contemplated by government sources. Hirsch (A, 1972) provides little beyond what he was told by the SMCE and what he saw at the Semana Internacional de Computación para Latinoamérica conference. In view of the lack of information, the U.S. Department of Commerce EMD 73-146 serves the important purpose of making known some of the basic statistics of the Mexican computer industry. Lee dedicates a small section to Mexico from which similar data may be derived and also gives some information on import duties, basic needs, principal legislation, etc. Information on the state of computer education is not much better. Cowan, et al. give an appreciation of the state of computer education in the country as of 1968. More recently, Murray-Lasso (A, 1972) gives some insights into certain special aspects, based on his personal experience. The best document, however, is "El Uso de Computación" (B, 1972) prepared by the Comisión Nacional de Ciencia y Tecnología. On national policy, the above-mentioned "El Programa Mexicano de Reforma" and Melrose (A, 1972) constitute the only available works. The latter is basically an overview of certain plans for policy, in the process of discussion and initial implementation in Mexico today.

Paraguay

Although there were no computers in Paraguay until 1971, there was SPCPI (Sociedad Paraguaya de Computación y Procesos de Información). The educational plans that they tried to implement in order to insure an optimal entry of the country into the computer age are very interesting. It is especially enlightening to analyze the activities introducing data processing developed in secondary schools as described in Meyer (A, 1970, 1972) and the *Newsletter* of the Centro Nacional de Computación.

Puerto Rico

Alvarez and Barquín (A, 1970) present a good starting point for looking at data processing in Puerto Rico. This overview must be updated by some of

the *PRISM* (see appendix A) issues with information on new installations and applications. The "Case History: Puerto Rico" (B, 1967) is a good study of an installation in the country, although the hardware has changed from NCR 315s to a Burroughs B3500. Barquín (A, "Computer Usage," 1974) presents the results of a survey of the Puerto Rican computer industry in line with the research done for the rest of Latin America in previous works. It gives a basic overview of the Puerto Rican situation, although the sample seems to be slightly biased toward the larger systems.

Venezuela

Quite complete censuses of computers in the country are found in Ramos (A, 1967, 1968–69), Caressi (A, 1971) and "Instalaciones de Computadoras" (A, 1974). Ramos (B, "La computación en el Gobierno," 1967) gives a good description of computation within the Venezuelan government in the mid-1960s. The U.S. Department of Commerce EMD 73–145 (Computers and Related Equipment, Venezuela) has basic statistics on the national industry. Silva (A, 1973) provides a good introduction into computation outside the Caracas area, being a feasibility study for the establishment of a service bureau in Cumaná. There is nothing of relevance to this review available on computer education aside from Cowan, et al. and the brochures and catalogs of the universities offering degrees and courses in the area, such as the Universidad Central de Caracas and the Universidad Simón Bolívar. National computer policy does not yet exist, although there are government entities studying some approaches to the problems of computation. Kennerley (A, "Discussion," 1971) does contribute the thinking of a United Nations interregional expert on the policy problems in training computer experts in government.

Central America and Panama

The works of King on his U.N.-sponsored trip throughout Central America and Panama are the principal sources of information on computation in the region, and they are relatively current in spite of their 1972 date of publication. King discusses computer education at the University of Panama and includes a section describing the present state of Panamanian computation (A, March–April 1972); deals with the expansion of computer education at the University of Costa Rica and the state of computation in that country (A, April–May 1972); and presents a three-year plan for the development of the National Electronic Computing Center in Nicaragua, also dealing again with the general situation of computation in that nation (A, May–June 1972). Barquín (A, "Some Obstacles," 1973) presents an

overview of computation in Central America, although its main intent is to analyze the obstacles to future regional programs in computation. Feoli (A, 1971–72) provides some information on computer education but is mainly interested in the reorganization of the University of Costa Rica's computing center. There is not much available on computer policy in any country of the region, and, in effect, there is nothing resembling policy in any one of the Central American countries as of yet.

Other Countries in the Region

Computer education in Peru is somewhat touched on in Cowan, et al., and general information is found in Gibson and Gibson and Barquín (A, "Transfer," 1974). Uruguay presents a similar situation, with some notes on education found in Finerman and additional information available from the newsletter of the Centro de Computación de la Universidad de la República (see appendix A). On Ecuador and Bolivia, Gibson and Gibson is a good source for what little exists. Barquín (A, "Transfer," 1974) also provides some information and very briefly covers the Dominican Republic and Haiti (where there are no computers as yet).

SURVEY BY TOPIC

Education

Computer education is the best-covered topic of all those dealt with here. The fact that the United Nations ad hoc Committee on Computer Technology recognized its importance (see "The Application of Computer Technology to Development," United Nations Publication, New York, 1971) in the effective utilization of computer technology for development led to a flurry of articles and papers on the subject. There had been two excellent works: First, the Cowan, et al. report for the Organization of American States (OAS), which covered computer education in the universities of Mexico, Venezuela, Colombia, Peru, Chile, Argentina, and Brazil; and second, the Finerman document, which concentrated on Argentina and Chile and covered Uruguay, although briefly. In spite of the fact that both of these works are the result of research done prior to 1969, the basic description of the institutions they visited still holds. Much hardware has changed since their field visits, to be sure, and new faculty have been added at the more progressive universities. Nonetheless, most of the educational centers they studied have the same basic curricula and general orientation to the computer sciences. The Jerusalem Conference on Information Technology (JCIT) generated a strong response and some of the Latin American participation in the conference was strongly sup-

portive of education. Pollitzer is possibly the best of the related papers at the JCIT. Prior to Jerusalem, the IFIP-sponsored World Conference on Computer Education (Amsterdam, The Netherlands, 1970) had elicited Lucena (1970); Mascarenhas, Pinatti, and Ferreiras (B, 1970); and Meyer (A, 1970), each recounting experiences in their home countries. By August 1972 and the Rio Symposium on Computer Education in Developing Countries, many more researchers and professors in Latin American universities hurried to participate. From this conference came Armoza, Da Silva, Fadigas Torres, Gil, Jonathan, Lauría, Leite, Meyer, Murray-Lasso, Lucena (all A, 1972), and Pollitzer (A, 1971), among others.

Politics

There is not very much dealing with the political effects of computers in Latin America or the work being done with computers in politics. Nonetheless, Barquín (A, "Some Political," 1972) presents a general view of some of the main features that characterize the area and describes the approaches taken by different Latin American governments in their handling of computation in general. Under the country headings specific works on the establishment of national computer policies are mentioned. Here, as a more general piece of research, we must again mention Friedmann. Lastly, Mussi (A, 1972) gives some notion of the international scene and its interaction with national developments.

Economics

Much of the existing literature on economic applications of computation in Latin America comes from the Conference on the Role of the Computer in Economic and Social Research in Latin America (Cuernavaca, Mexico, 25–29 October 1971). Many of the papers from this conference, edited by Nancy D. Ruggles (see Cuernavaca) were published by the National Bureau of Economic Research, which cosponsored the event, in 1974. Among the papers published here is the Morales Vergara (B, 1974) work on the CELADE (Centro Latinoamericano de Demografía). It provides a very good introduction to the data stored as well as an indication of user costs, general organization, and background on some of the studies and research that have already been carried out by this demographic center. Souza and Monteiro (B, 1974) and Naylor, et al. (B, 1974) attack the problem of economic modeling in Brazil as do Beltrán del Río and Klein (B, 1974) in Mexico. Lastly, Salazar-Carrillo (B, 1974) presents a large computer application, analyzing large price files in a Latin American environment.

Business

Computers in business and the business of computers in Latin America must be looked at in the light of two types of documents. First, computers in business is a topic found only in local newspapers and trade journals. We have been able to find little in this area, although Alvarez and Barquín mention some areas of interest in Puerto Rico and "The Electronics Era" (A, 1969) also gives some details of computers in business in Brazil. The business of computers provides more sources. There have been a number of articles in U.S. periodicals relevant to data processing and computation. For example, *Electronic News* has carried a number of headlines and bylines on Latin American computation as business for U.S. vendors (A, "Computer in Brazil," 1970; A, "Growth in Mexico," 1970; A, "Mexico," 1967; A, "Mexican Software," 1970; A, "Opportunity," 1970). Likewise, *International Commerce* (A, "Data Processing," 1970; A, "Small Computers," 1970) and *Commerce Today* (A, "Brazil, Argentina," 1971) have included some information in their general coverage of the industry. The U.S. Department of Commerce has published three *Export Market Digest* works on Latin America, (EMD 73-138 [Brazil], EMD 73-145 [Venezuela], and EMD 73-146 [Mexico]) which provide excellent data on computation.

Other Areas

In medicine, "Case History: Puerto Rico" discusses the installation, use, and general history of the Puerto Rico Medical Center's computer facility. The situation there has changed substantially since publication, but it gives the general flavor of a case study in the health-care delivery field. Chorny (B, 1972) also deals with the health care industry by presenting a computer model for the financing of medical services in Mendoza Province, Argentina. In finance, many fine works have been published by Felaban (Federación Latinoamericana de Bancos) in their magazine, *Revista de la Federación Latinoamericana de Bancos*. Felaban has organized CLAB (Centro Latinoamericana de Automatización Bancaria), which serves as an information dissemination and support center for computerization in Latin American banks. Works published by them can be obtained from: Centro Latinoamericano de Automatización Bancaria, Apartado Aéreo 13997, Bogotá, D.E., 1, Colombia. García Márquez (B, 1972) has tried to develop an adaptation of the management information system (MIS) concept to government administration in Latin America. Rizzo (B, 1972) has devised a computerized approach to social security systems in Argentina, with some potential for applications in other areas within the region. Lastly, Pimentel (B, 1972) describes a computerized model of the Uruguayan cattle industry.

In the bibliography, which covers a wide set of topics, we have attempted (1) to include all known works on computation in the Latin American countries which we considered important and (2) to provide a varied selection of published material on the application of computers in various fields within the region.

APPENDIX A

DATA PROCESSING JOURNALS, PERIODICALS, AND NEWSLETTERS

Argentina

Boletín Informativo del Centro de Computación. Newsletter of the computation center. Facultad de Ingeniería, Universidad de Buenos Aires, Buenos Aires.

Computadoras Electrónicas. Monthly journal. Avenida Presidente R.S. Pena 615, Buenos Aires.

Computadoras y Sistemas. Bimonthly journal. Ediciones Experiencia, Cangallo 935, 2° Piso, Ofic. 211, Buenos Aires.

Brazil

Association for Computing Machinery (ACM), São Paulo Chapter Newsletter. Prof. Lucio Goelzer, Depto. de Eng. de Electricidade, EP USP, Caixa Postal 8174, São Paulo, SP.

CAPRE Boletim Informativo. Newsletter of CAPRE. Av. Pres. Antonio Carlos, 375-S/613, Castelo, ZCP 20000, Rio de Janeiro, GB.

Dados 1° Ideias. Bimonthly journal published by SERPRO (Serviço Federal de Processamento de Dados), Administração Central, DSS. Rua da Lapa 236-10° Andar, 20000, Rio de Janeiro.

Electrônica. Burroughs newsletter. Rua Araujo Porto Alegre, 36-80, Rio de Janeiro, GB.

RDC noticias. Newsletter of the Rio Datacenter of the PUC.

Rio Datacenter e Depto. de Informatica: Relatório Anual. Annual report, Rio Datacenter, Pontificia Universidade Católica (PUC). Rua Marques de São Vicente 209, Gauca, Rio de Janeiro, GB.

SUCESU—Guanabara Informa. Monthly newsletter-journal of SUCESU (Sociedade dos Usuarios de Computadores Eletrônicos e sus Equipamentos Subsidiarios). Rua do Resende, 37-6° Andar, Rio de Janeiro, GB.

Chile

Boletín Iberoamericano de Centros Universitarios de Computación. Mimeographed newsletter of the Iberoamerican University datacenters, August 1973 (2d edition). c/o Fernando Silva, Centro de Computación, Avda. Blanco Encalada 2008, Casilla 2777, Universidad de Chile, Santiago.

Informativo Centro de Computación Universidad de Chile. Newsletter-journal of the University of Chile's computation center. (Address as above.)

Revista de la Asociación Chilena de Centros Universitarios de Computación. Journal and catalog of the Association of Chilean University Computation Centers. c/o Prof. José Durán, Centro de Computación y Ciencias de Información, Universidad de Concepción, Concepción.

Colombia

ACUC Noticias. Newsletter of ACUC (Asociación Colombiana de Usuarios de Computadores). c/o Carlos

Amaya, Ave. Jimenez 4-03, Ofic. 11-04, Apartado Aéreo 4542, Bogotá.
Delta. Journal of ACCIO (Asociación Colombiana de Computación Electrónica e Investigación Operacional). Apartado Aéreo 53603, Bogotá, D.E.
Delta Noticias. Newsletter of ACCIO. (Address as above.)

Cuba

Actualidades del Ceis. Centro de Información Científica y Técnica, Universidad de La Habana, La Habana.
Ciencia y Tecnología de la Información. Centro de Información Científica y Técnica, Universidad de La Habana, La Habana.
Economía y Desarrollo. Bimonthly journal published by the Instituto de Economía, Universidad de La Habana, La Habana. Numbers and subscriptions are available from Instituto Cubano del Libro, Departamento de Exportación, Apartado 605, La Habana 1.

Mexico

Bit. Publication of the SMCE (Sociedad Mexicana de Computación Electrónica) on the celebration of I^{er} SICLA (1971). SMCE, Yacatas 435, México 12, D.F.
Informática. Monthly data processing journal. c/o Victorio Sánchez. Apartado Postal 5-291, México 5, D.F.
Nonotza. Newsletter of IBM México. c/o Martín Casillas, Paseo de la Reforma 195, 6^o Piso, México 5, D.F.

Paraguay

Boletín de Informaciones: Centro Nacional de Computación. Newsletter of the Centro Nacional de Computación, Universidad Nacional de Asunción. Avenida España 1098, Casilla Postal 1439, Asunción.

Peru

Quipus. Publication of IBM Perú. c/o Hugo Hesse, IBM del Perú, Guzmán Blanco 309, Apartado 151, Lima.

Puerto Rico

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Uruguay

CCUR Boletín Informativo. Newsletter of the Centro de Computación de la Universidad de la República. Julio Herrera y Reissig 605, 5^o Piso, Montevideo.

Venezuela

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Mensaje IBM de Venezuela. Newsletter of IBM Venezuela. Casilla 388, Caracas.
Sistemas y Procedimientos. Trimonthly publication. Apartado Postal 61.398, Caracas.

A P P E N D I X B

PROFESSIONAL ORGANIZATIONS AND USER GROUPS IN LATIN AMERICA

Argentina

CIS—Colegio de Ingenieros de Sistemas
c/o Ing. J. A. Chamero
CAECE
Suipacha 245, 1^{er} Piso, Buenos Aires
CUCBA—Club de Usuarios de Computadoras Burroughs en Argentina
c/o Carlos A. Etcheverry
Bairesco

Ave. Pte. Figueroa Alcorta 3259,
Buenos Aires
SAC—Sociedad Argentina de
Computación
c/o Mauricio Milchberg
Cerrito 264, 4° Piso, Buenos Aires

Brazil

ABRACE—Associação Brasileira dos
Computadores
c/o Werner Koshnitz
Av. 13 de Maio 47, S/1809, Rio de
Janeiro, GB

ACM São Paulo Chapter
c/o Prof. Lucio Goelzer
Depto. de Eng. de Eletricidade
EP USP

Caixa Postal 8174, São Paulo, SP

SUCESU—Sociedade dos Usuarios de
Computadores Eletrônicos e sus
Equipamentos Subsidiarios
Rua do Resende 37, 6° Andar, Rio de
Janeiro, GB

Chile

ACTI—Asociación Chilena de
Tratamiento de la Información
c/o Prof. José Durán
Centro de Ciencias de Computación e
Informática
Universidad de Concepción,
Concepción

Asociación de Centros de
Computación Universitarios
c/o Fernando Silva
Centro de Computación
Ave. Glanco Encalada 2008
Casilla 2777
Universidad de Chile, Santiago

Colombia

ACCIO—Asociación Colombiana de
Cálculo Electrónico e Investigación
Operativa
c/o Ernesto Rojas Morales
Apartado Aéreo 53603, Bogotá

ACUC—Asociación Colombiana de
Usuarios de Computadores
c/o Carlos Amaya
Ave. Jiménez 4–03, Ofic. 11–04
Apartado Aéreo 4542, Bogotá

Costa Rica

APAP—Asociación Profesional de
Analistas y Programadores
Apartado 2389, San José

Mexico

AMECOPI—Asociación Mexicana de
Computación y Procesos de
Información
c/o Director, ILACIC
Apartado Postal 70273, México 20, D.F.

SMCE—Sociedad Mexicana de
Computación Electrónica
c/o Ing. Ernesto Jiménez Díaz
Yacatas 435, México 12, D.F.

Paraguay

SPCPI—Sociedad Paraguaya de
Computación y Procesos de
Información
c/o Ing. Luis Fernando Meyer
Estados Unidos 924, Asunción

Puerto Rico

ADSEI—Asociación de Directores de
Sistemas Electrónicos de
Información
c/o Adán Baez Pabón
Centro de Cómputos
Universidad de Puerto Rico, Rio
Piedras

Uruguay

SUDIOC—Sociedad Uruguaya de
Investigación Operativa y
Computación
c/o Ing. Ulises A. Anaya
Andes 1193, Montevideo

Venezuela

AVERPRAN—Asociación Venezolana de Programadores y Analistas de Computación

c/o Ing. L. J. Díaz Zuluaga

Edificio Sede IESA

Avenida Occidente, San Bernardino, Caracas

AVICE—Asociación Venezolana de Ingeniería de Computación Electrónica

Apartado de Correos 2006, Caracas

A P P E N D I X C

PRINCIPAL SOURCES ON COMPUTER FACILITIES IN EACH COUNTRY

Argentina

Centro de Cálculo

Universidad Tecnológica Nacional

Medrano 971, Buenos Aires

SAC (see appendix B)

Bolivia

CENACO (Centro Nacional de Computación)

Cajón Postal 5264, La Paz

Centro de Cálculo

Universidad Mayor de San Andrés

Edif. Facultad de Ingeniería, 6° Piso

Avenida Camacho 1175, La Paz

Brazil

CAPRE (Comissão de Coordenação de Atividades de Processamento Eletrônico)

Av. Pres. Antonio Carlos 375, S/613

Castelo, ZCP 20000, Rio de Janeiro, GB

SUCESU (see appendix B)

Chile

ACTI (see appendix B)

ECOM (Empresa Nacional de Computación)

Huerfanos 1376, 9° Piso, Santiago de Chile

Colombia

ACCIO (see appendix B)

ACUC (see appendix B)

Costa Rica

APAP (see appendix B)

SEDCA (Sistemas Electrónicos de Datos y Ciencias Administrativas)

Apartado 5366

Edificio Numar 5° Piso, San José

Cuba

CINAG (Centro de Informática Nacional Aplicada a la Gestión)

Instituto de Economía

Universidad de La Habana, La Habana

Dirección de Cálculo Electrónico

JUCEPLAN

La Habana

Dominican Republic

CICE (Centro de Investigaciones y Cómputos Electrónicos)

Colegio de La Salle

Ave. Bolívar 173, Santo Domingo

IBM

Ave. John F. Kennedy, Santo Domingo

Ecuador

IBM de Ecuador

12 de Octubre 368, Quito

Sistemas de Control, S.A. (Univac)

San Gregorio 120, 3^{er} Piso, Quito

El Salvador

IBM de El Salvador

Rubén Darío 930
Apartado 205, San Salvador
NCR de El Salvador
Ave. Morazán 106, San Salvador

Guatemala

Centro de Procesamiento Electrónico
de Datos
Ministerio de Finanzas
Via 5, 4-50, Zona 4
Edificio Maya Oficina 208, Guatemala
IBM de Guatemala
7 Ave. 12-32, Zona 1
Apartado 354, Guatemala

Haiti

Crann and Sons and Co.
P.O. Box 501, Port-au-Prince

Honduras

Centro de Cómputo Electrónico para
Ingeniería Civil
5a. Avenida 946
Apartado 875, Tegucigalpa
IBM de Honduras
Apartado 310, Tegucigalpa

Mexico

IBM de México
Mariano Escobedo 595, México, D.F.
SMCE (see appendix B)

Nicaragua

Centro Nacional de Computación
Electrónica
Ministerio de Hacienda, Managua
IBM de Nicaragua
Edificio IBM
Apartado 568, Managua

Panama

Computadoras y Servicios, S.A.
Apartado 2760, Panamá

IBM de Panamá, S.A.
Apartado 851, Panamá 1
NCR de Panamá
Apartado 1071, Panamá

Paraguay

Centro Nacional de Computación
Universidad Nacional de Asunción
Avenida España 1098
Casilla Postal 1439, Asunción
SPCPI (see appendix B)

Peru

Centro de Cómputos
Universidad Nacional de Ingeniería
(UNI)
Avenida Tupac Amaru s/n
Casilla 1301, Lima
Centro de Cómputos
Universidad Católica del Peru
Fundo Pando, Pueblo Libre, Lima

Puerto Rico

ADSEI (see appendix B)
Centro de Sistemas Científicos de
Puerto Rico
Autoridad de Carreteras
Calle Parque, Santurce

Uruguay

CONADI (Comisión Nacional de
Informática)
Oficina del Servicio Civil,
Montevideo
Computrónica
Andes 1193, Montevideo

Venezuela

AVICE (see appendix B)
Prof. Jorge Baralt
Universidad Simón Bolívar
Caracas

APPENDIX D

UNIVERSITIES AWARDING FORMAL
DEGREES IN SOME AREA OF DATA PRO-
CESSING OR COMPUTER SCIENCE

Argentina

Universidad de Buenos Aires, Facultad
de Ciencias Exactas
Universidad de Buenos Aires, Facultad
de Ingeniería
Universidad Tecnológica
Nacional—UTN (Buenos Aires)
Universidad de La Plata
CAECE (Buenos Aires)
Universidad Argentina "John F.
Kennedy" (Buenos Aires)
Universidad Argentina de la Empresa
(Buenos Aires)

Brazil

Pontificia Universidad Católica—PUC
(Rio de Janeiro)
Universidad Federal de Rio de Janeiro
Universidad de São Paulo—USP
Universidad Federal Fluminense
Universidad Federal de Minas Gerais
Universidad Federal de Rio Grande do
Sul
Universidad Estadual de Campinas
Universidad Federal de Paraíba

Colombia

Universidad Nacional (Bogotá)
Universidad de los Andes (Bogotá)
Universidad del Valle de Cali
Universidad INCCA (Bogotá)
Instituto Politécnico de Medellín

Chile

Universidad de Chile (Santiago)

Universidad Católica de Chile
(Santiago)
Universidad Técnica del Estado—UTE
(Santiago)
Universidad de Concepción

Cuba

Universidad de La Habana

Guatemala

Universidad de San Carlos
(Guatemala)

Mexico

Universidad Nacional Autónoma de
México (México, D.F.)
Instituto Politécnico Nacional (México,
D.F.)
Instituto Tecnológico de Estudios
Superiores de Monterrey—ITESM
Universidad Iberoamericana (México,
D.F.)

Peru

Universidad Nacional de
Ingeniería—UNI (Lima)

Uruguay

Universidad de la República
(Montevideo)

Venezuela

Universidad Central de Caracas
Universidad "Simón Bolívar"
(Caracas)

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Key: Because many of the entries have common sources, an abbreviated notation is used to indicate the ones used most frequently.

Amsterdam:

World Conference on Computer Education, August 24–28, 1970 (Proceedings of the IFIP Conference held in Amsterdam, The Netherlands). Edited by B. Scheepmaker and K. L. Zinn. Distributors for Europe: Walters Noordhoff, Groningen, The Netherlands; distributors for the rest of the world: Science Associates/International, New York, N.Y. Published 1971.

AVICE:

Asociación Venezolana de Ingeniería de Computación Electrónica. The Venezuelan Association for Electronic Computation Engineering publishes a yearly memoir, *Ingeniería de Computación*, starting with 1967. The reports are available from AVICE, Apartado de Correos 2006, Caracas.

CIADI:

Anales del Primer Congreso Iberoamericano de Informática (1^{er} CIADI, Mayo 28–Junio 3 de 1972) (Proceedings of the Conference held in Buenos Aires, Argentina). Organized by the Sociedad Argentina de Computación (SAC) and sponsored by UNESCO and IBI-ICC (Intergovernmental Bureau for Informatics—International Computation Center). Publishers: SAC, c/o Mauricio Milchberg, Cerrito 264, 4^o Piso, Buenos Aires.

Comp. y Sist.:

Computadoras y Sistemas. A monthly data processing journal published in Buenos Aires by Ediciones Experiencia, Cangallo 935, 2^o Piso, Oficina 211 Buenos Aires.

Cuernavaca:

The Role of the Computer in Economic and Social Research in Latin America (National Bureau of Economic Relations, New York, 1974). Edited by Nancy D. Rugles. A selection of the papers presented at the conference on the role of the computer in economic and social research in Latin America, held in Cuernavaca, October 25–29, 1971. Sponsored jointly by the National Bureau of Economic Relations, Colegio de México, Instituto Torcuato di Tella, and the Fundação Getulio Vargas.

Economía y Desarrollo:

Bimonthly journal published by the Instituto de Economía, Universidad de la Habana. Numbers and subscriptions are available from Instituto Cubano del Libro, Departamento de Exportación, Apartado 605, La Habana 1.

Florence:

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Jerusalem:

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Rio:

Computer Education for Development (Based on the Rio Symposium on Computer Education for Developing Countries, August 1972, Rio de Janeiro). Sponsored jointly by the Brazilian Academy of Science and the IBI-ICC. Edited by Claudia Bussell. Publisher: Ao Livro Técnico, S.A., Av. Presidente Vargas 962, 6° Andar, ZC.58, C.P.3655, Guanabara, Brazil.

Sloan:

The Sloan School of Management, M.I.T., publishes a working paper series which has included some works on computation in Latin America. Copies may be obtained from Ms. Patte MacPherson, Sloan School of Management Working Paper Series, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, Mass. 02139.

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