European Archives in an Era of Change

Changing Technologies in European Archives

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THE SPECTACULAR DEVELOPMENT AND growth of new information technologies and their application to nearly all aspects of society are a challenge to archives and to archivists. New information technologies are having a dual impact on European archives as well as on archives in other parts of the world.

On the one hand, the application of information technologies to the management of public administrations and private organizations is introducing records in new media into the archives. Due to their intrinsic and extrinsic characteristics these media are demanding new strategies and approaches to traditional archival principles and practices. New approaches must be found through archival legislation which will guarantee preservation and access to information in new media. Strategies must be found to define the criteria for archival handling of records generated in the new media.

On the other hand, new information technologies are being used in the management of archives and in the description and arrangement of records. This use has led to improved efficiency in archives management and preservation and in the dissemination of information about archival records.

This two-fold impact presents a major challenge to traditional European archival systems with their focus on the preservation of a rich and centuries-old documentary heritage. European archival systems must adapt their structures and professional principles and criteria to the conditions brought about by the introduction and development of new technologies. These technologies will directly affect archival

methods, the documents and their handling, as well as the management of the institutions responsible for the preservation and dissemination of the information in the documents.

The Second European Conference on Archives, held in Ann Arbor, Michigan, in the spring of 1989, assessed the developments and improvements of information technologies and their impact on archives. One of the recommendations of the conference was to increase computer applications within archives and to study the impact of new technologies on archives.[1] This article summarizes the impact of new technologies on archives in Europe and describes computer applications being used in various European archives.

The Impact of New Archival Media

European archives are challenged by the existence of new archival media in a number of basic ways including the impact of these media on legislation, preservation, and archival theory. We would like to focus in this article on the impact on legislation and archival theory before we discuss applications of new technology within European archives.

Impact on legislation. Throughout the 1970s and 1980s several European countries amended their archival legislation to meet the challenge of new media.[2] The definition of the record, hitherto restricted in most countries to include only written documents, was modified to include records in various media. In these amendments the traditional definition of a written document

was replaced by language such as "information recorded on any type of medium." In most cases, a list of new media follows such a definition with special emphasis given to electronic records.

New legislation has been written to regulate access to records and computer files in order to protect the liberties of individuals and their rights to privacy. Privacy rights can be violated because of easy access and distribution of computer data and because of the ease of interconnections or linkage of electronic data. Sweden has addressed these problems by attempting to achieve a consistency in all legislation related to records including the Swedish Freedom of Information Act, Secrecy Act, Data Act, and newer archival legislation. The Swedish Archival Act states that records should be preserved, organized, and administered in order to provide for the right of free access by the public, for the informational needs of administrative and judicial bodies, and for scholarly research.[3]

In certain countries the computerization of public records has led to a modification in archival legislation in order to protect the evidential value of records in new media. This legislation was necessary because, according to the administrative tradition of most European countries, evidential value was recognized only in those documents which were properly validated and in which information was recorded on traditional media.[4]

Impact on archival theory. European archival theoretical principles and archival practices have not undergone significant change over time. This is the case even though public administrations and private

[1]"Conclusions and Recommendations" in *Proceedings of the Second European Conference on Archives*, ed. Judy Koucky (Paris: International Council on Archives, 1989): 112-114.

[2]*Archivum. International Review on Archives* 28 (1982) reviews archival legislation 1970-1980. Archival legislation was amended during the last two decades in Denmark (1978, 1979), the Federal Republic of Germany (1975), Spain (1985), and Sweden (1978).

[3]Claes Gränström, "Legal problems of access to Machine-Readable Archives," *Archivum* 35 (1989): 219-227.

[4]Hermann Bannach, "Archiv und Registratur auf dem weg in die informationsgesellschaft: die Reform des Registratur wesens und die einfuhrung der elektronischen Burokommunikation in der Länder verwaltung," *Der Archivar* 39 (1986): 291-312.

organizations in Europe are in a continuous process of change and even though they are implementing new information technologies. However, in the last two years the need to review and analyze archival principles has been recognized. This is due in part to the internal and external characteristics of records being generated by new technologies. The National Archives of Italy and the University of Macerata held an invitational meeting in May 1991, devoted to analyzing archival theory in light of new information technologies. The basis for the discussion at the Macerata meeting was a paper written by Charles Dollar on the impact of information technologies on archival principles and methods.[5] In October 1991 a seminar titled "The Impact of Information Technologies on Information Handling in Office and Archives" was held in Marburg, Germany, with the purpose of continuing this discussion and of making the information available to a greater number of professionals.[6] These discussions could be expanded to include other sectors of society. Archivists should not overlook the information available from the private sector, such as banks and business organizations, which have had more experience in the application of technologies and the resulting impact on archival systems.[7]

The Application of New Technologies to Archives Management

European archives have accumulated experience in recent years in applying new technologies to the management of archives. Computer applications for archives management have been developed as new technology has developed. The first projects that were undertaken were specific applications for discrete areas of archival and records management. Even today applications generally cover only partial aspects of archival management. However, a global approach is needed.

The introduction of microcomputers, the increased affordability of computer equipment, and the vast supply of user-friendly software have led to the greater use of computer applications. With even unskilled staff able to use computer software, the previous disadvantages of implementing computer applications have dissipated. Yet, despite the diminishing costs of computer hardware and software, the cost of investing in a computer application remains high. A great many computer application programs and projects have been initiated, but often in the process of their implementation the technology changes to such an extent that the projects must be dropped altogether. As a result, in recent years many countries have changed their strategy regarding the use of computer applications. They have abandoned specialized and partial projects in favor of establishing plans for the general computerization of a whole national archives system. In this way a more advantageous cost-benefit ratio is achieved. In some countries, such as Spain, it was decided from the onset to develop both integral computer systems that include and can interrelate the different archival tasks and a national archival information system.

Efforts to design general archival information systems. A number of national archives and professional archival associations are working to create national archival information systems or at least to control the proliferation of computer applications in archives. In the National Archives of France, which had been working for years on a number of partial applications, two

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[5]Charles Dollar, *The Impact of Information Technologies on Archival Principles and Methods* (Macerata: University of Macerata, 1992) in press.

[6]The seminar was sponsored by the Archivschule Marburg, Institut für Archivwissenschaft, and Fachhochschule für Archivwesen.

[7]*Bulletin du Comité des Archives d'Entreprises*, no. 7, International Council on Archives (Paris, 1984), reviews the progress and current situation of archives in several important business organizations as a result of the implementation of new technologies in the management of the organizations.

important developments have taken place.[8] A department of Organization and Computer Systems has been established in order to improve the coordination between different projects and to develop consistent methodology and suitable management of computer projects. A private study was commissioned in order to establish a general computerization scheme. The purpose of the study was to define user requirements and to establish priorities in terms of projects, hardware, logistics, and human and financial resources.[9] Germany shares a similar experience with France. Based on a number of state-of-the-art computer applications, Germany is currently considering a general computer system for the Federal Archives.

In the United Kingdom, the Public Record Office is focusing on the development of a Records Information System (RIS) which describes records to the item level. The Society of Archivists has established a task force to design an integrated system for Archives Services Management. This system will cover user monitoring, repository management, preservation, appraisal, and staffing, accounting, and other tasks in the area of archives administration.[10]

Portugal, through the Computer Division of its Portuguese Archive Institute established in 1988, is also working on a national archives system. The ARQBASE project is the basic instrument used in the creation of the Archival Information Network. The institute is also working on the implementation of standards and techniques for the various repositories that are part of the Portuguese Archival System. Both Italy and Sweden are developing national databases of archival information to improve access to documents.

Spain has developed the National Archives Information System which includes a database (CARC) currently storing information from 30,000 archives services in thirty of the fifty Spanish provinces. This database is accessible through a national information network.[11] On the basis of the bilateral cultural agreement between Italy and Spain, the Archives Joint Commission launched a project for the creation of a computerized guide to documentary sources relating to the history of both countries. One interesting aspect of the project is the standardization undertaken to define the description elements, criteria, and tape exchange format. The resulting database, GUFU, was formally exchanged with Italy and presented to the public in November 1991.

Applications of optical and imaging technology. Although there is much interest among European archivists in the potential offered by optical and imaging

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[8]One of the partial applications developed by the National Archives of France is the user system of the Centre d'Accueil et de Recherche des Archives Nationales (CARAN) which has provided researchers with a fully computerized system of information access and control. This system has improved monitoring of the use of records and has provided improved access as well. The CARAN has recently established a remote records reservation system through the MINITEL service which provides researchers with further benefits. See Gérard Ermisse, "L'Informatique au CARAN," *La Gazette des Archives* (1988): 128-132.

[9]J.P. Brunterc'h "La evolución de la Informática documental en los Archivos Nacionales Franceses: Balance de veinte años de experiencia," *IRARGI, Revista de Archivistica* 3 (1990): 55-82.

[10]Public Record Office, *The 32nd Annual Report of the Keeper of Public Records on the Work of the Public Record Office 1990* (London: Public Record Office, 1990) and from information provided by Michael Cook.

[11]Margarita Vázquez de Parga, et al., "La Base de Datos de Fuentes Documentales para la Historia de España e Italia . . .," *Second Conference on automated records* (Torremolinos, Spain, 1986): 377-386; Enrica Ormani, "La guida delle Fonti per la Storia dell Italia y della Spagna," (Paper delivered at the 4th Congreso Internazionalle sul tema, Informática e Regolamentazione, Roma, 1988); and Margarita Vázquez de Parga, "La base de datos archivísticos e históricos: hacia el Sistema Nacional de Informatización de Archivos," *Actas de las Primeras Jornadas españolas de documentación automatizada* (Madrid, 1984): 849-857.

technology, there are few examples of these "new technology" applications in European archives. A few archives, however, have begun such state-of-the-art applications as digitizing records and optical disk image storage. These initiatives are possible because of the wide supply and relatively low cost of equipment. These are very simple systems consisting of a data entry station (microcomputer with scanner), workstation (microcomputer with a high resolution monitor), and a link to an optical disk server. As these initiatives are just beginning, their general scope and impact are still quite small.

The Municipal Archives of Utrecht, in close cooperation with Wang Netherlands, has developed the Archives Information System (ARIS) for the digital storage of images to be used in processing notarial protocols. ARIS consists of a software package developed by Wang Netherlands for processing and retrieving information. It is adapted to the detailed description of the notarial records contained in registries. This system uses standards established by the Dutch Archives Council. The significance of this project is that the ARIS software may be used in conjunction with the Wang Integrated Image System (WIIS) which allows linking of digital images to a descriptive database. The image of the record displayed on the monitor is often far better than that of the original record.

Also worth mentioning is the Intelligent Management of Information Project of the Swiss Federal Archives which is part of a national research program in collaboration with the Institute of Cognitive and Semantic Studies at the University of Geneva and the Institute for Studies in Artificial Intelligence in Lugano. This is a prototype project combining modern methods of natural language processing and expert systems techniques:

The main aim of the project is to make possible the retrieval of relevant information from a mass of stored documents by defining and constructing a prototype computer system which will use artificial intelligence techniques to extract from a document submitted for archiving a formulistic [sic] representation of its content, which will be stored with the document and will allow a user who is not specialized in information science to search for and retrieve the information he requires.[12]

France and Scotland are also working on projects to digitize and store information from their Civil Register Offices.

Computerization of the Archivo General de Indias

The commemoration in Spain of the Quincentennial of the Discovery of America initiated the development of a general computer system for the historical archives of the Archivo General de Indias using the most advanced technologies for processing and preserving images.[13] Consequently,

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[12]National Research Fund of Switzerland, "Specification and Prototyping of a System for the Intelligent Management of Information (Bern: 1989): 5, as cited in a paper delivered by Andreas Kellehals-Maeder to the International Council on Archives Automation Committee, Bern, October 1990.

[13]More information about this project can be found in Ministerio de Cultura, Dirección General de Bellas Artes y Archivos, *Computerization Project for the Archivo General de Indias* (Madrid: 1990); Pedro González, "El proyecto de informatización del Archivo General de Indias," in Actas del II Congreso Iberoamericano de Informática y Documentación (Mar del Plata, Argentina: 1988): 409-412; Pedro González, "Historical Documentation and Digital conversion of images at the Proyecto de Informatización of the Archivo General de Indias, Sevilla," *Microform Review* 18 (1989): 217-221; Pedro González, "Proyecto de Informatización del Archivo General de Indias" in *Actas de las I Jornadas de Archivística de Euskadi, IRARGI, Revista de Archivística* 3 (1990): 261-281; See also José Luis Becerril et al., "Computerization Project for the Archivo General de Indias," and Pedro González, "Fuentes Archivísticas y Reproducción de Documentos en España," in *Proceedings of the Quincentennial Conference. Archives and Records for Studying the Hispanic Experience in the United States,*

exactly two centuries after its founding, the Archivo General de Indias (AGI) has the chance of becoming a pioneer among the world's archives. The Spanish Ministry of Culture, IBM Spain, and the Ramón Areces Foundation have joined forces to provide the AGI with a computerized information system which will satisfy the needs of our times while at the same time respecting and following the guidelines laid down by the AGI's founders during the Age of Enlightenment. Using modern technologies and various media, the project is developing a comprehensive software system for the processing of historical documents held by the AGI. The basic objectives include contributing to a wider and deeper knowledge of the documents, and, of equal importance, halting the rapid deterioration caused by increased handling of the original documents in the research room.

The intention is to use this project as a pilot for the future computerization of the remaining historical archives of the nation. Besides the main objectives stated above of improving both the preservation of original documents and their dissemination to users, comprehensive objectives of the project are to:

- Create an integrated, automated processing system;
- Create an information system that contains and interrelates all the descriptive information about the archives;
- Create an optical disk processing, storing, and preservation system for images;
- Contribute to the preservation of the

original records by allowing researchers to consult digital images instead of original records;
- Contribute to the dissemination of information by copying disks, through electronic publication and remote consultations;
- Conduct further research into the use and application of new technologies for processing historical records;
- Provide tools for the improved retrieval and display of records;
- Create a user management system capable of monitoring use of the records and providing statistics on use;
- Develop a "user friendly" system by creating a user interface that will enable easy access to the system that may be used by unskilled users;
- Enter all descriptive information about the holdings of the AGI (approximately eight million digitized pages stored on optical disk);
- Create a pilot system which the Ministry of Culture may transfer to other archives, both national and international.

Basic project description. The goals of the project are to design and develop a computerized system for "integrated" management of different archival functions, that is, an information and reference system, an optical digital image system, and a users management system. The goal of the Ministry of Culture is to extend the project to the rest of the state archives. In order to achieve as flexible a system as possible, and one which is easily transportable to other archives services, we have designed the architecture as a distributed processing system. The different functions are carried out on modules or subsystems of a single integrated system. A local area network links the different servers for each function and the stations of the users, both researchers and archivists. The database and user management server is a medium sized

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1987 (Columbus: Ohio State University Press, 1991) in press. The Quincentennial Conference was organized by the American Historical Association at the Library of Congress. See also Pedro González, "Computerization Project for the Archivo General de Indias," in *International Conference: Archiving and disseminating historical Machine-readable data* (Leiden: 1990).

computer (AS-400) and the other servers and the users' stations are microcomputers from the upper end of the PS/2 range. The connection between the different functions is made via a linking interface which can receive the message generated by the user interface and send it to the appropriate server. The server then generates a reply which will in turn pass through the linking interface to the user's screen.

Users management system. Researcher services currently dealt with manually will also be computerized. This includes researcher accreditation, statistical research control, access control and work in the research room, document movement, and requests for original documents or for copies.

The information and reference system. The information and reference system provides access to original archive documents by searching a database containing all necessary descriptive information. Bearing in mind the distinctive attributes of archival records and the specific needs of users, we developed a database management system that could create a single information system to handle all descriptive information required by the archives service. This system took into account the future requirements and conditions in drawing up the data structure, i.e., the catalog of descriptive elements suitable to the archives' needs. Under the system, information retrieval is possible by three main routes: the call number of the element that physically identifies the document; the hierarchical structure of the archives (all units of description—archives, sections, subsections, series, etc.—are linked by this hierarchical structure); and descriptors or key words. This is a relational database management system using SQL as the information access tool.

All descriptive information in the archives has been transferred to electronic media. By the end of 1991 nearly all AGI finding aids will be on electronic media as well.

Optical Digital Image System. As we have stated, our project aims at integrating all archival functions; therefore it entails much more than the mere scanning of documents and their storage on optical disk. However, it is clear that digitizing is the most immediately impressive part of the project. This is due to the possibilities it offers for conserving and providing access to documents, as well as the state-of-the-art technology used and the spectacular results obtained.

Two facets of this project should be considered at greater length. The first is all the functions related to document digitizing including the preparation of material to be digitized, the digitizing itself, image processing for enhancement and compression, and storage on the optical disk. The second is what we call the visual information archives: the use of images of the documents for direct on-screen reference and for obtaining reproductions.

Document digitizing and storage. The selection of documents for digitizing uses various criteria, such as user statistics, the documents' state of conservation, or the availability of descriptions. Several archival operations are necessary to prepare the documents for the scanning room. A team of thirty scanner operators are working two shifts. By the end of 1992, eighty-nine million pages, or 10% of the holdings of the AGI, will have been scanned. It currently takes one minute per page to carry out all the scanning operations: placing the document carefully, giving exact instructions as to page format, checking the image on the screen, compressing it, and recording it on an optical disk. We use a Rank Xerox scanner to digitize images on optical disks with one hundred points per inch and sixteen grey levels. This scanner can work at 400 points per inch and 256 grey levels.

Digitizing documents that are several centuries old presents us with problems that must be solved if we are to offer reasonable image quality to the user. The problems
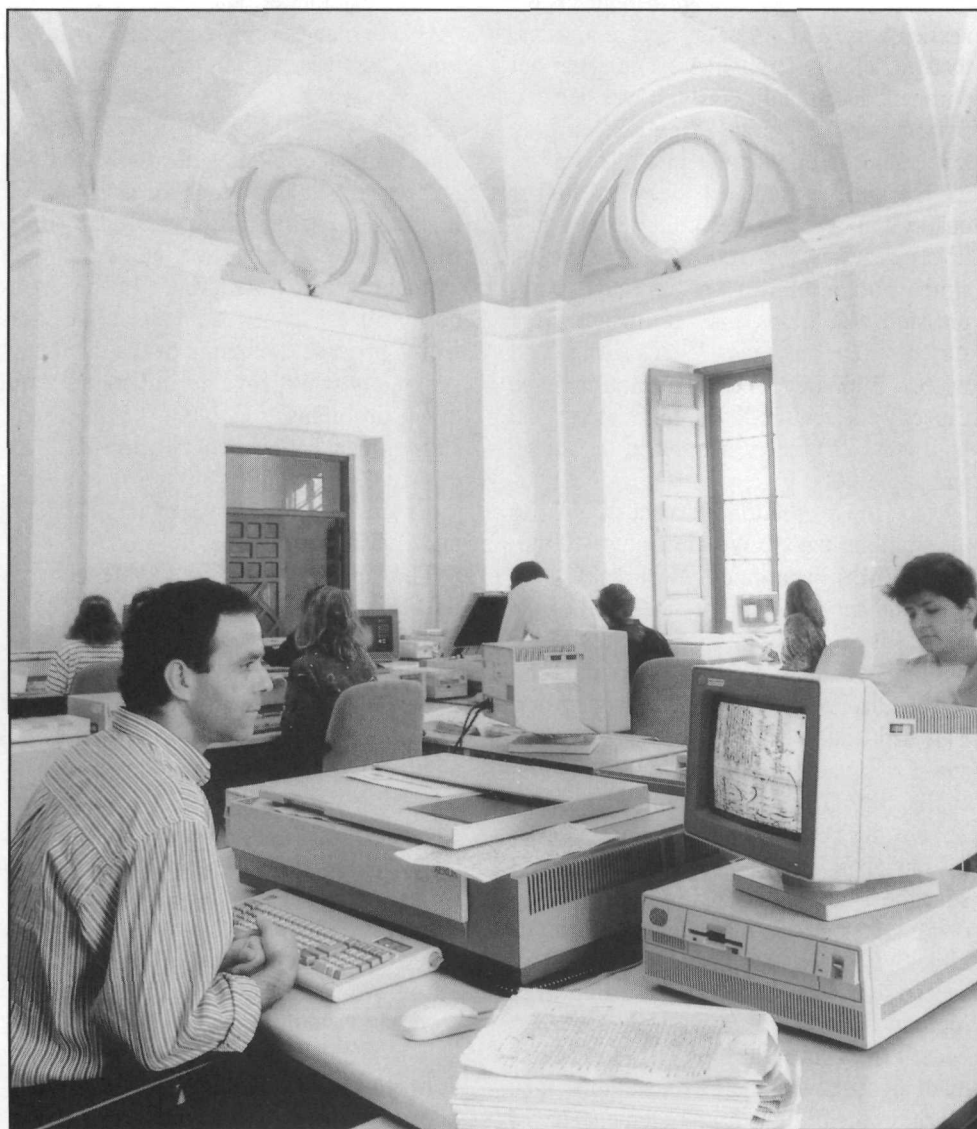
Digitization hall in the Archivo General de Indias

arise from the intrinsic value and the age of the documents, some of which are in loose sheets while others are in bound books or stitched bundles. The documents can never be put into the scanner with an automatic paper feeder but require scrupulously careful handling by the operator. It also means that the time needed for the job is multiplied by unavoidable human intervention in the work. This sometimes leads to a high cost for the data input.

The age of the documents presents other technical problems such as stains, faded ink, and bleeding through of the ink. Most digital processing systems use only black and white, avoiding grey levels, which makes

for more economical storage. However, we needed a very high quality image and one that was clearly legible. After carrying out pertinent acceptability tests, it was decided that we would digitize using sixteen grey levels and 100 points per inch. This gives us the proper trade-off between higher quality and storage space. Using sixteen grey levels requires that more information be stored and results in less efficient compression algorithms than if images were stored using only two levels (black and white). With grey levels, enormous storage capacity is required: approximately 350 kilobytes (Kb) for an average screen image and some 3000 gigabytes (Gb), or 3 terabytes (Tb), for the total project of eight to nine million pages. We are using 940 megabyte (Mb) Panasonic optical disks.

Document display. The final goal of the project is to substitute direct access to the original document with high-resolution on-screen displays or reproduction on paper. This will lead to better conservation, greater speed of access to information, and wider availability of the information.

Two different lines of research and development have been completed so that researchers can be confident of having conditions that will make their work much easier; these conditions include speed of access, improved legibility, and improved reproduction. The user will also be able to benefit from several of the image enhancement algorithms in their workstations, such as the possibility of enlargement or of zooming in on parts of the image. One of the keys to success for the system will definitely be the facilities offered by the user interface for carrying out user image enhancement operations.

The first line of research is based on prior digitization with grey levels that make it possible to provide the users with a set of functions so that they themselves can select the range of tonalities that best suit each image they are trying to read. Several functions allow the user to separate levels, to

blacken each letter, and to separate it from the background. The process is done in real time at the user station and gives spectacular results.

The second line of research is somewhat more complex and aims at giving individualized treatment to each type of ink degradation, using specific algorithms to compensate for the degradation as much as possible. Many of the methods used are based on local algorithms which process each zone of the document separately while considering contrast and other problems which may be present. Techniques have been developed to facilitate "browsing" through documents; these are apart from the conventional zoom and rotation techniques.

The images sent through the network will be stored in the user work station so that the user can work at the local level, browsing, consulting, reading, or copying pages. Here we came up against a problem due to the enormous storage capacities required by such a large quantity of digitized images. We have not managed to find a "juke-box" able to handle as many disks as we wished and have therefore had to introduce a degree of human intervention into the system. The disks required by the user are inserted by hand by an archives employee. However, we continue to look for a juke-box or a robot able to handle several thousand disks.

Document reproduction. Document reproduction will be either in hard copy or in deferred printing. Hard copy will be made directly from the image displayed on the screen with the legibility enhancers introduced by the processing algorithms used at that moment. Deferred printing is done directly by the system following a request sent through the User Management System. Deferred printing can provide reproductions of entire volumes or selected pages from them. In this case the images will be reproduced in the form in which they were digitized without any sort of legibility enhancement.

Current state of development. The integrated system is almost completed and will be installed in the Archivo General de Indias in the coming months. Several months ago a prototype was installed in the AGI in order to experiment with the system and to study the degree of acceptability by researchers. The user management subsystem has been operating in the AGI since 1988 and in 1991 was installed in five other national archives.

The whole system will be transferred to the Archivo General de Simancas and the Archivo Histórico Nacional next year. Documents related to America kept in these two national archives have been digitized during 1991 and are integrated into the storage system at the AGI. Six million pages have already been captured, the average capture speed being 300,000 pages per month. Ninety per cent of the descriptive references for records in the Archivo General de Indias and descriptive information on 90% of the American documents in the Archivo General de Simancas and the Ar-

chivo Histórico Nacional have been integrated into the reference system. The work on digitizing records continues.

Conclusion

European archives are influenced by the development of new information technologies, either by the integration of records in new media or by the application of new technologies to their management. New technologies are having an impact on several aspects of archival theory and practice. Although various archives are reacting to this situation with different approaches, there is a general need to develop integrated information systems and general automation plans for the archives. This involves the need to develop new approaches to description together with the establishment of description standards as a first step towards the development of compatible systems in order to facilitate information exchange. It follows that new approaches to professional archival training are also needed to meet these new circumstances.

Changing Technologies in European Archives

Abstract: The development and growth of new information technologies and their application to nearly all aspects of society are challenging European archives. New technologies are having an impact on several aspects of archival theory and practice through the introduction of records in new media into archives and through the use of information technologies in the management and description of archival records. Although various archives are reacting to this situation by developing partial applications, there is a need to develop integrated information systems and general automation plans for the archives. The authors discuss various partial and general applications and describe the comprehensive computerization of the Archivo General de Indias at greater length.

Changements technologiques dans les archives européennes

Résumé: Le développement et la croissance de nouvelles technologies d'information et leur application à presque tous les aspects de la société sont des défis à relever pour les archives européennes. Les nouvelles technologies ont un impact sur plusieurs aspects de la théorie et de la pratique archivistiques au niveau de l'introduction des documents d'archives sur de nouveaux supports, de l'application des technologies de l'information dans la gestion et la description des documents d'archives. Même si diverses archives réagissent à cette situation en développant des applications partielles, il y a un besoin de développer des systèmes d'informations intégrés ainsi que des plans généraux d'automatisation générale pour les archives. Les auteurs discutent des applications partielles et générales ainsi que de l'automatisation détaillée des Archivo General de Indias.

Neue Technologien in den Europäischen Archiven

Abstrakt: Die Entwicklung und das Wachstum neuer Informationstechnologien und ihre Anwendung auf nahezu alle Aspekte der Gesellschaft stellen eine Herausforderung für die Europäischen Archive dar. Die Wirkung neuer Technologien zeigt sich in verschiedenen Bereichen archivalischer Theorie und Praxis bei der Aufnahme von in neuen Medien zusammengestellten Aufzeichungen in die Archive und bei der Verwendung von Informationstechnologien in der Verwaltung und Beschreibung archivalischer Aufzeichnungen. Obwohl eine Reihe von Archiven dadurch auf diese Situation reagieren, dass sie Teil-Anwendungsprogramme entwickeln, besteht die Notwendigkeit, integrierte Informationssysteme und allgemeine Automationspläne für die Archive zu entwickeln. Die Autoren besprechen verschiedene Teil- und allgemeine Anwendungsprogramme und beschrieben sehr ausführlich die umfassende Computerisierung des Archivo General de Indias.

Technologías cambinates en los archivos europeos

Resumen: El desarrollo y crecimiento de nuevas tecnologías de información y sus aplicaciones a casi todos los aspectos de la sociedad son un reto para los archivos europeos. Las nuevas tecnologías están teniendo un impacto en varios aspectos de la teoría y práctica archivológica a través de la introducción de documentos de los nuevos medios de información dentro de los archivos y a través del uso de informaciones tecnológicas en la administración de los documentos de archivo. Aunque algunos archivos están reaccionando ante esta situación por medio del desarrollo de aplicaciones parciales, existe la necesidad de desarrollar un sistema de información integrada y de planes generales de automatización para los archivos. Los autores examinan varias aplicaciones parciales y generales y describen la computadorización comprensiva a gran magnitud del Archivo General de Indias.