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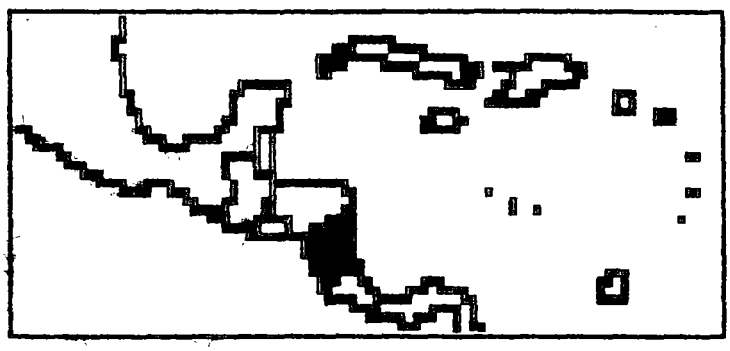
# FEASIBILITY STUDY OF A NATIONAL INFORMATION SYSTEM ON HUMAN SETTLEMENTS FOR THE MINISTERIO DE VIVIENDA Y ASENTAMIENTOS HUMANOS, GOVERNMENT OF NICARAGUA



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This report has been prepared by Dr. T.J. Cartwright, Consultant to the International Development Research Centre (IDRC), Canada, in August 1987.

The report is based on information provided and sources consulted in the course of a visit to Nicaragua; however, the opinions expressed herein are those of the author and do not necessarily reflect those of any other individuals or agencies.

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# FEASIBILITY STUDY OF A NATIONAL INFORMATION SYSTEM ON HUMAN SETTLEMENTS FOR THE MINISTERIO DE VIVIENDA Y ASENTAMIENTOS HUMANOS, GOVERNMENT OF NICARAGUA, AND THE INTERNATIONAL DEVELOPMENT RESEARCH CENTRE (IDRC)

This feasibility study was commissioned by the International Development Research Centre, Ottawa, at the request of the Ministerio de Vivienda y Asentamientos Humanos of the Government of Nicaragua. The terms of reference for the study were as follows:

> . . . to carry out a study of the feasibility of establishing a national information system for the Ministry [Ministerio de Vivienda y Asentamientos Humanos] . . . [and] to assist the Ministry to rewrite the proposal for submission to the [International Development Research] Centre. . . .

In fulfillment of these terms of reference, the present report and attached Project Proposal are respectfully submitted.

The Mission is grateful to the Ministro de Vivienda y Asentamientos Humanos (Cro. Miguel Ernesto Vijil Icaza) and his staff for their keen interest and kind assistance throughout the Mission. Particular thanks are due to Cro. Mario Murillo (Infor BAVINIC) for his kind assistance in arranging meetings and providing documents.

While he is indebted to these and other individuals and agencies for much of the information contained in this report, the responsibility for any errors or omissions contained herein remains that of the author.

## 1. BACKGROUND

The Ministerio de Vivienda y Asentamientos Humanos (MINVAH) is the chief government agency in Nicaragua responsible for planning and implementing national policy in respect of housing and human settlements. The Ministry was created in August 1979 out of the fusion of the Banco de la Vivienda de Nicaragua (BAVINIC) and the Vice-Ministerio de Planificacion Urbana (VIMPU). MINVAH currently consists of a central administration (including a Centro de Informacion); two Directorates-General, each divided into three Directorates; nine regional offices (delegaciones regionales); and two state corporations (empresas), each with a variety of subsidiary operating units. Total staff in the Ministry (including the regional offices) is about 1,500; see Table 1.1.

The organization and functions of the six Directorates are briefly as follows:

Direccion General de Vivienda y Desarrollo Urbano

1. Direccion de Planificacion Sectorial, which is responsible for monitoring and coordinating public investment in human settlements on a national basis.

2. Direccion de Desarrollo Urbano, which is responsible for promoting and monitoring urban/regional land-use planning throughout the country.

3. Direccion de Investigaciones Tecnicas, which is responsible for carrying out research on various aspects of human settlements.

Direccion General de Finanzas

4. Direccion de Operaciones, which is responsible for all aspects of the management of public housing on a national basis.

5. Direccion de Seguimiento y Control de Proyectos (DISCEP), which is responsible for preparing feasibility studies for and then monitoring the financial performance of all development projects funded by the Ministry.

6. Direccion de Finanzas, which is responsible for budgeting and accounting throughout the Ministry.

Table 1.1

CURRENT MINVAH PERMANENT STAFF, BY DIVISION

| Division | Number of Staff | |
|---|---|---|
| **Direccion Superior** | 9 | |
| Division Legal | 11 | |
| Auditoria Interna | 12 | |
| Division Informacion y Proteccion Economica | 27 | 59 |
| Secreteria General | 6 | |
| Centro de Informacion | 8 | |
| Division Recursos Humanos | 9 | |
| Division Administrativa | 68 | 91 |
| Direccion General Vivienda y Desarrollo Urbano | 4 | |
| Direccion de Planificacion Sectorial | 15 | |
| Direccion de Desarrollo Urbano | 21 | |
| Direccion de Investigaciones Tecnicas | 12 | 52 |
| Direccion General de Finanzas | 4 | |
| Direccion de Operaciones | 13 | |
| Direccion de Seguimiento y Control de Proyectos | 16 | |
| Direccion de Finanzas | 19 | 52 |
| Delegaciones Regionales (6) | 461 | |
| Zonas Especiales (3) | 51 | 512 |
| Total, excluding state corporations | | 766 |
| Corporacion Constructadores de Vivienda (COVIN) | | 770 |
| Infor BAVINIC | | 17 |
| Consultec BAVINIC | | 16 |
| Suministros BAVINIC | | 56 |
| GRAND TOTAL | | 1,525 |

Source: Payroll records and interviews with MINVAH staff.

The regional offices (delegaciones regionales) are located in each of the six regions of the country plus the three zonas especiales, which are located along the eastern (Misquito) coast in the less developed part of the country. In some regions, there are also "zonal" offices (delegaciones zonales) in the larger towns and cities. The purpose of the regional offices is to provide the interface between MINVAH and the beneficiaries of its various housing programs. Thus, the main functions of the regional offices are to plan, allocate, coordinate, manage and regulate public housing in their respective regions and to collect regular loan repayments from the beneficiaries. Regional offices also have more general responsibilities for research and planning in their regions but these inevitably take second place to the operational need to run the public-housing program. Regional offices vary in size from ten to fifteen staff in the smaller regions to nearly two hundred in the largest (Region III, which includes Managua).

There are also two state corporations (empresas) which form part of MINVAH: namely, COVIN and BAVINIC, each of which works on a fee-for-service basis for other parts of the Ministry and occasionally for other government agencies as well. COVIN (Corporacion Constructadores de Vivienda) is a consortium of twelve agencies that together provide the institutional framework for implementing a national policy of industrialized housing. Each of the six regions has its own branch of COVIN capable of undertaking the construction of standard houses out of prefabricated parts. There is also a number of COVIN factories turning out prefabricated components (including building components like cement slabs and wooden rafters as well as finished products like doors and windows). COVIN also has two support agencies -- one of which, EPROVIN, provides the design and specifications for all houses in each project. This information serves not only as the basis for the contractor's scope of work and bill of quantities but also for managing production in COVIN manufacturing plants.

BAVINIC, the other state corporation within MINVAH, consists of a number of staff functions inherited from the old Banco de la Vivienda de Nicaragua, including computer services (Infor BAVINIC), consulting engineering (Consultec BAVINIC), and commercial development. Of these, Infor BAVINIC effectively functions as the computer department for the rest of the Ministry, providing not only data-entry and data-processing services but also assistance in systems analysis and system design as well as a limited amount of user training. Infor BAVINIC has a staff of about fifteen people, of whom four are qualified computer graduates (licensiados).

Thus, the Ministry is no stranger to computerization, although the applications to date have been by and large of a fairly traditional nature. MINVAH has two computer systems of its own and regularly leases time on a third. These three systems are described briefly below:

### IBM System 3/10

This system includes 60 Mb of disk storage, several tape drives and a high-speed lineprinter; however, it has been out of order since September 1986. Repair is no longer regarded as cost-effective and most applications that were run on the system have now been transferred to the System 34 described below.

### OSM Zeus3 Microcomputer System

This is a multi-user system with three terminals and two printers. The CPU is based on a proprietary Z-80A emulator running the MUSE operating system (said to be a superset of MP/M, the multi-user version of CP/M) and provides 64 Kb of random access memory to each user. The only storage device is a 10-Mb hard disk with a 20 Mb streamer-tape backup system. There are two Wyse and one Qume terminals and the printers are an old Centronics and an Epson FX-285. The system is equipped with interpreted BASIC ("Business BASIC"), and a few standard CP/M programs (such as Calcstar).

### IBM System 34

To make up for the loss of capacity caused by the breakdown of the old System 3, Infor BAVINIC now leases time on a System 34 located in the Ministerio de Transporte to run a small number of programs. These programs are all custom written in RPG-II or COBOL and do not use specialized packages for accounting or database management.

Time on other computer systems has also been arranged when required for unique applications, such as questionnaire processing and analysis. In addition, EPROVIN (part of the state corporation COVIN) has two Sharp PC-1500 hand-held microcomputers (each with 16 Kb RAM and printer), which are used for simple engineering calculations. Sometime soon, MINVAH also expects to receive an Apple Macintosh computer from the Government of Italy as part of an international-development project.

For the time being, MINVAH has about half a dozen computer applications underway. Briefly, these are:

### Public Housing Management

A computerized database on public housing throughout Nicaragua was established in 1986. This database contained approximately 10,000 records and included information on each property and its occupants (but not on loan repayments). Printouts were obtained just before the breakdown of the System 3 in September 1986; since then, however, the database has not been updated and no further use has been made of it. Apparently, this program and database have not been transferred to the borrowed System 34.

### Accounting and Payroll

A basic accounting system for the Ministry is currently running on the borrowed System 34. Data on income and expenditure are entered into the computer and monthly reports (which currently run to about 140 pages) are provided to the Direccion de Finanzas. The system has about 250 codes in the chart of accounts at the present time. A separate payroll program for MINVAH staff runs on the Zeus microcomputer. The program is custom written in interpreted BASIC and manages approximately 2,000 records. (In fact, this is the only application currently running on the microcomputer.) A second payroll program runs on the borrowed System 34 looks after the payroll for contract staff employed on all the various MINVAH projects. Neither payroll program is directly integrated with the accounting program.

### Bibliographical Information Network

Through the initiative of the Centro de Informacion in MINVAH, a project is underway to create a bibliographical information network on human settlements in Nicaragua (red nacional de information en vivienda y asentamientos humanos). Ten agencies have agreed to participate and are working on coding their holdings using a common format (hoja de analisis documentario). In the case of MINVAH, holdings amount to some 8,000 items; other agencies may have more or less. The system now being tested is modeled on the widely used ISIS system and is designed for eventual computerization (although no decisions have yet been made regarding suitable hardware).

### Project Specification and Costing

CPCE (Contrataccion, Presupuesto, Control y Ejecucion) is another database management system. The database contains specifications and costs of all prefabricated building materials produced by COVIN -- which are estimated to number in excess of 20,000 items. With the CPCE program, EPROVIN can quickly and easily translate housing-project designs into exact bills of quantities, proposed production schedules, and detailed cost projections. The program is custom written in RPG-II and runs on the borrowed System 34.

### Inventory of Urban Infrastructure and Facilities

In cooperation with the Government of Italy, MINVAH has begun a project (Diagnostico Inter- y Intra-Urbano or DIIU) to establish a computerized inventory of human-settlements infrastructure and facilities throughout Nicaragua. The project has reached the stage of pilot studies in three different locations, one in each of the three western Regions (II, III and IV). An Apple Macintosh microcomputer is to be provided to the project to assist with publication of the inventory. The initial phase of the project ends early in 1988 but renewal for a further two years is anticipated to allow for completion of the inventory on a national basis.

Thus, MINVAH has already had significant if somewhat traditional experience with computerization. The experience is significant because it has involved a variety of uses in different parts of the Ministry in non-trivial data-processing functions. Several of the databases, for example, contain tens of thousands of records. However, the experience has been essentially traditional in the sense that it has made use of custom-written programs rather than specialized packages and because programs have not provided for interactive, on-line access by end-users. These issues will be explored further in the next section of the report, which assesses the opportunities for building on the experience and resources of the Ministry towards a more comprehensive and integrated information system on human settlements in Nicaragua.

## 2. ASSESSMENT

Computerization is not a process that is either universal or monolithic in nature. Indeed a process that is appropriate for one organization or in one kind of environment may be quite inappropriate in other cases. Before prescribing a strategy of computerization for any organization, therefore, it is important to diagnose an organization's needs and operating conditions. To this end, a number of important conclusions can be drawn from the foregoing description of the Ministry and its activities.

First, opportunities for computerization in MINVAH are not dominated by any single use or user. In the case of a bank or an airline company, for example, there is likely to be one major use of computers (account management and passenger reservations respectively) that overshadows all others. In the case of MINVAH, it is clear that there is a variety of possible computer applications, some perhaps deserving more priority than others but none of them completely dominant.

Second, the nature, sources and use of data by the various departments and corporations in MINVAH are also very diverse. Some data are economic and financial in nature, some are social and legal, and some are scientific and technical. Similarly, some data have to be gathered in the field while others can be obtained from reports and documents; some data concern Ministry operations while others are quite independent of what the Ministry does. Moreover, some data require only minimal processing (e.g. finding and printing), while other data may require complex arithmetical manipulation and presentation. In short, data-processing needs in MINVAH are very varied.

Third, the structure of MINVAH is relatively decentralized. Most of its programs and projects are implemented through the regional offices and the state corporations. Each of these is in turn subdivided into a variety of zonal offices (in the case of regional offices) and functional entities (in the case of the state corporations) -- where in turn most of their work is carried on. The result is that MINVAH staff and other resources are distributed to reflect this decentralization. It also means that good communications and standardized procedures play an important part in the efficient operation of the Ministry.

Based on this assessment of MINVAH, an effective information system is going to be have to meet the following criteria:

Incremental design: The information needs of the Ministry are too varied and too complex to be anticipated in their totality in advance. (Indeed, perceived needs may well change as a result of preliminary experience with the strengths and weaknesses of computerization.) An information system for the Ministry should thus be designed in stages. Start with some clear and present information requirement and design an appropriate response -- bearing in mind the possible need to integrate that response with and adapt it to other needs in the future. Implement that system and then go on to the next issue -- bearing in mind the new opportunities created by the existence of capabilities already established.

Decentralized access: Given the decentralized structure of MINVAH, it is desirable to provide access to computers in the regional offices and the state corporations. Not only will this provide additional resources where they may be most useful. It is also more efficient for data that are to be computerized to be entered into computers as early in the process as possible. This reduces the time required for any subsequent processing and the possibility of errors in the data. It is also easier to persuade people of the value of entering data into a computer and keeping the data up-to-date if they can see some tangible benefit from it, even if it is only the avoidance of duplication. A great deal of time and effort spent on data entry at the end of a long data-processing "chain" may hardly seem worthwhile if all the computer can do is print the data back again (albeit in a neat and orderly table). Even naive users know that computers are more than glorified typing machines.

User friendly progam interfaces: Given the need for frequent updating of many MINVAH databases and the advantages in speed and convenience of interactive use, it is desirable for programs to be designed for on-line use by staff who are not computer specialists.

It is possible to achieve most of these objectives with terminals connected to a central system, but that is probably not the most appropriate "architecture" for an organization like MINVAH. For one thing, the geographical dispersion of some users (e.g. in regional offices) might make the costs of connection quite high. While information transfer is important for the Ministry, in most cases communication need not be instantaneous. If it takes a few days rather than a few minutes for reports to come in from a regional office, for example, it is not a disaster. On the other hand, the Ministry has already experienced some of the disadvantages of centralized systems: for example, its obsolescence, its lack of flexibility, its need for specialist programmers, its high cost of maintenance, its lack of redundancy, and its risk of complete paralysis in the event of a breakdown. Finally, while a central computer can offer more power and more speed than distributed processing, the latter is becoming more and more cost-effective as time goes by -- particularly in relation to the scale of computing needs in MINVAH. Moreover, for some purposes, this difference is more than adequately compensated for by the much greater variety of off-the-shelf software.

For all these reasons, the feasibility of a system of stand-alone microcomputers will be considered here, all of them compatible with each other and capable of exchanging data and programs on diskette, by direct connection or by modem using a common carrier (like the telephone). The study will propose a number of distinct computer applications for implementation in their own right although with the potential for subsequent integration into a larger "system of systems". Priority will be given to high-impact applications with easy implementation and which build on the existing experience in the Ministry. Special attention will be paid to the need for training and the design of user-friendly interfaces for non-specialist users. In short, this study will propose a new and more decentralized approach to computerization in the Ministry, an approach in which users accept more responsibility for their own data-processing requirements and the role of computer specialists becomes more that of consultants and trainers than purveyors of data-processing services as such.

## 2.1 Management of Public Housing

Since 1979, MINVAH has delivered nearly 50,000 individual housing units of different kinds ranging from site-and-service schemes to complete housing units (see Table 2.1). Through its various departments and agencies, MINVAH is responsible for the entire process of building and delivering these units, including preliminary design and site selection, feasibility studies, financial arrangements, detailed specification of materials, construction supervision, allocation of units to occupants, regulation and (in some cases) maintenance, and collection of regular loan repayments over periods of up to twenty years.

By general consensus, the most problematical part of the this process is the last: administration, regulation and collection of payments in respect of delivered units. These functions are the responsibility of the regional offices and the Direccion de Operaciones. The Ministry is now at the point where its existing manual methods are no longer adequate to the task. Among the problems are:

Arrears are extensive but the Ministry does not know how extensive. Inflation, particularly in the last two or three years, has had the effect of discouraging people from paying any debts on time. In some cases, the real value of monthly payments (e.g. NC$ 50, or CA$ 0.01) is less than the cost of collection. Even when payments are made, it can apparently sometimes take weeks for amounts to be properly credited.

Occupancy records are unreliable; so regulation of use and control of resale is correspondingly inhibited.

Table 2.1

PUBLIC HOUSING INITIATIVES IN NICARAGUA, 1979-1986, BY REGION AND TYPE OF UNIT

| Region | Population (1985) | Site-and-Service | Self-Help Units | Core Housing | Finished Houses | Total Units | % Tot |
|---|---|---|---|---|---|---|---|
| I | 321,142 | 3,493 | 673 | 1,192 | 926 | 6,284 | 13 |
| II | 570,546 | 4,534 | 873 | 0 | 2,525 | 7,932 | 17 |
| III | 867,395 | 15,723 | 810 | 0 | 4,894 | 21,427 | 45 |
| IV | 585,953 | 2,127 | 622 | 0 | 494 | 3,243 | 7 |
| V | 313,689 | 84 | 322 | 0 | 243 | 649 | 1 |
| VI | 420,938 | 542 | 1,260 | 1,603 | 649 | 4,054 | 9 |
| ZE 1 | 102,666 | 49 | 245 | 0 | 1,725 | 2,019 | 4 |
| ZE 2 | 52,616 | 333 | 278 | 0 | 0 | 611 | 1 |
| ZE 3 | 37,119 | 0 | 0 | 1,020 | 121 | 1,141 | 2 |
| Total | 3,272,064 | 26,885 | 5,083 | 3,815 | 11,577 | 47,360 | 100 |
| % Total Initiatives | | 57 | 11 | 8 | 24 | 100 | |

Notes: Data include initiatives completed up to June 30th, 1986. Site-and-service units or lotes are primarily for urban areas (urbanizaciones progresivas), while core housing units or techos are mainly for rural areas (asentamientos campesinos). Self-help units usually include provision of serviced lots as well as suitable building materials (banco de materiales). "ZE" stands for Zona Especial and refers to the three easternmost regions of the country.

Source: Population data are from the Annuario Estadistico de Nicaragua, 1985 (Managua: INEC, 1986). Data on housing initiatives are taken from Direccion General de Vivienda y Desarrollo Urbano, Dirreccion de Planifacacion Sectoral, unpublished table marked "Cuadro No. 4" and dated October 1, 1986; table corrected for an apparent error in the number of site-and-service units provided in ZE 3.

Ownership records are unreliable. Not only does this cause difficulties the Ministry. For the individual owner too, poor records may adversely affect his or her security of tenure as well as the extent of protection afforded by insurance against fire or other damage.

As noted above, a start was made on a limited database for managing public housing in 1986 but, for a number of reasons, it has not had much use. For one thing, the computer it was running on is no longer available; however, the database could have been transferred to the borrowed System 34, as other MINVAH programs were. More important, therefore, may be the fact that the printouts were difficult to read and the database too time-consuming to keep up-to-date.

It has not been possible in the time available to make a detailed design for a public-housing database management system; but a few general suggestions may prove useful. First, it is not necessary to computerize all housing records at once, even if that is the eventual goal. A workable and useful system can be established that includes only some types of housing and/or some regions of the country (e.g. all completed houses or all units in Region III). Second, in order to make maximum use of such a system as well as to help ensure that it is kept up-to-date, it is important to provide computer access in the regional offices. In this way, data will be entered into the computer as early in the collection process as possible. Third, it will probably prove wise to structure the system in terms of several distinct but interrelated databases rather than one large one; for example, there might be a database dealing with the housing units, another database for their occupants, a third database containing details of loan transactions, and so on. In short, the design of a database management system for public housing is going to be a critical element in its eventual effectiveness.

## 2.2 Bibliographical and Documentary Information Systems

The Centro de Informacion in MINVAH is responsible for maintaining and operating both the Ministry's library and information centre and its internal archives. As described above, the Centro de Informacion has already launched a project to codify its approximately 8,000 library holdings in accordance with a system which is being used by nine other libraries in Nicaragua and which is in turn based on an internationally used system bibliographical system (ISIS). At the same time, the Centro de Informacion has begun the process of storing and cataloguing MINVAH archives, although this project is not as advanced as the bibliographical network.

Both these projects are suitable for computerization. There exists ready-made, off-the-shelf software for database management (ordenacion de bases de datos) designed for applications just like these. Indeed, in the particular case of ISIS, there is now a version (Micro/ISIS) that runs on microcomputers -- although the advantage of using a database management package that is less specialized and more widely used (such as dBaseIII) is that more people will know how to use it and thus be able to access the database on their own machines at their own convenience instead of having to rely on the resources of the Centre for the service.

Thus, in contrast to the public-housing example discussed above, most of the systems design work for bibliographic and archival information systems has either been done already or is quite straightforward. (No detailed study of the proposed database design was possible in the time available; however, it may be noted that the present structure provides more than forty different fields for each separate document. It may be worth settling for a much simpler structure in order to get a working information system in place as soon as possible.) The critical thing that is still missing is a computer to run it on. When this becomes available, the results will be of benefit to everyone working in the field of human settlements in Nicaragua, including not only MINVAH staff but also everyone else who uses the system.

## 2.3 Financial Planning and Analysis

In both the Direccion de Planificacion Sectoral and the Direccion de Seguimiento y Control de Proyectos (DISCEP), the Ministry does a lot of financial planning and analysis. Among their various activities are pre-feasibility and feasibility studies, project evaluations, cost-benefit analyses, cash-flow projections, investment strategies based on internal rates of return and other criteria, comparative assessments of sectoral performance, etc. Moreover, the usefulenss of studies like these can be enhanced with more sophisticated techniques like shadow pricing, sensitivity analysis, and others.

These kinds of data-processing are ideally suited for "electronic spreadsheets" (hojas electronicas). To the user, a spreadsheet appears to be not so much a computer program as a sort of "word processor for numbers". With the help of various "templates", a spreadsheet can be adapted to all sorts of financial planning and analysis (as well as a great many other kinds of applications), in which the user has only to enter the base data and then let the computer make all the necessary calculations and then display the results. There are several off-the-shelf software programs (such as Lotus 1-2-3 or Supercalc4) that provide these capabilities, as well as other related functions (such as graphical display of data as well as simple database management functions).

Here too there is little preliminary design work that needs to be done. "Programming" a spreadsheet consists of little more than transferring to the spreadsheet the desired format and formulas for standard kinds of analyses and then entering the base data in the appropriate "cells" in the table. All that is needed to get started is access to the appropriate hardware and software plus a little help in setting up some preliminary templates. The results will help to strengthen the research and management capacities of MINVAH and thus its ability to deliver programs on time and within budget.

## 2.4 Accounting and Payroll

As noted, the Ministry already has a computerized accounting and payroll system in operation in the Direccion de Finanzas. The purpose of strengthening capacities in this area would be to make the system more flexible and useful by providing a fully integrated environment for general ledger, accounts payable, accounts receivable, inventory and payroll; by bringing the system on-line; and by providing for a wider variety of report and search capabilities.

Here too there is a variety of off-the-shelf software that can provide the capabilities required, although choosing the most appropriate software for MINVAH needs will be more problematical here than in the case of the spreadsheet software. Thus, the wisest course of action may be to begin not with a new system but by transferring the existing programs and databases to the new hardware and getting them on-line. Next, choose an appropriate accounting package with fully integrated modules and convert the two payroll systems to the new software. Finally, bring the other accounting functions over to the new system.

## 2.5 Project Design and Specification

MINVAH has developed a sophisticated system of industrialized housing, including design, manufacturing and construction. At the centre of this process is the design and specification of housing units, which is provided by EPROVIN (part of COVIN, the state coporation responsible for housing construction). The Ministry has already taken a major step towards computerization in this area by creating the CPCE (Contrataccion, Presupuesto, Control y Ejecucion) program and database for detailing and costing housing units and project proposals.

However, the actual design, drawing and detailing of housing units is still being done manually. The result that much of the flexibility inherent in a system of more than 20,000 different building components is not being fully realized: with minor variations for cultural and climatic differences, EPROVIN is currently working with only seven basic housing models, ranging in size from 43 to 102 square metres. While it is technically possible to build a great many different types of houses from so many building components, EPROVIN does not have the resources to provide the detailed drawings and calculations necessary to support a wider range of models.

This kind of capacity could easily be provided by off-the-shelf CAD (computer-assisted design) packages like Auto-CAD. Packages like these can store drawings electronically, allow them to be modified or "edited" on screen, display several drawings "on top" of each other to make sure things fit where they are supposed to, and so on. All of this makes the task of designing and drawing a great deal easier. Moreover, computer-assisted design is ideally suited to situations where there are standard components, the details of which can all be stored electronically and called up whenever they are needed.

## 2.6 Other MINVAH Computer Applications

The priorities identified above represent only some of the many possible applications of microcomputers to human settlements. (A more complete and annotated list is provided in an Appendix to this report). Two points need to be made in this connection.

Word processing is an application with obvious utility throughout the Ministry. Nevertheless, word processing has not been specifically referred to in this report on the assumption that computer users who find they can benefit from word processing will do so without it needing to have any priority in this project. Suitable software (including Spanish versions of Wordstar and Word Perfect) is readily available in Managua.

Second, although physical-planning applications have not been given priority in this report, computerization is being introduced in this area too. With the cooperation of the Government of Italy, MINVAH has begun work on a computerized inventory of urban infrastructure and other facilities. When it is completed, this inventory will form a useful part of a human-settlements information system. Similarly, other computer applications in the field of physical planning will no doubt be identified.

## 2.7 Implications

There are at least two important organizational implications in the computer strategy outlined above. These are: the changing role of the MINVAH computer unit (Infor BAVINIC) and the need for signficant investment in staff training.

Up to now, Infor BAVINIC has operated just like a conventional data-processing department. That is, when computer processing of any kind is required, Infor BAVINIC does it. Users explain what they want done and provide the data to be processed, but the actual computation carried out by Infor BAVINIC (either on their own or borrowed systems). One of the implications of the strategy proposed here is that this traditional relationship between users and experts should be changed. On the one hand users would become responsible for doing their own data-processing. On the other hand, Infor BAVINIC would assume the role of consultant, teacher and systems manager rather than computer operator. These changes need to be recognized and reflected in organizational and staffing terms, if they are not to be unsettling for those concerned.

The introduction of computer literacy to MINVAH on the scale proposed here represents a major undertaking. As a general rule, it makes sense to train an average of three people for each available microcomputer -- more than that and people are unlikely to have enough access to keep their skills current; less than that and the computers are unlikely to be fully utilized. Given the scope of applications proposed above, therefore, this may imply training between 50 and 75 staff members to a level sufficient to enable them to operate one or two software packages. Some staff will also want more than this.

Training on this scale will represent quite a challenge for MINVAH in general and Infor BAVINIC in particular. Motivation for computer training is usually high, as people recognize that it will probably make their work easier and themselves more marketable. Nevertheless, it is important for senior management to recognize the full extent of the commitment, organizational and individual, that is required for this kind of technological transformation of the workplace. Among other things, MINVAH staff must be provided with suitable training materials (which means materials in Spanish) and enough access to computers to be able to learn and practice their new skills. Perhaps most important of all, staff should be convinced that senior management understands and supports the new technology.

## 3. CONCLUSION

The purpose of this report has been to discuss the feasibility of a national information system on human settlements for the Ministerio de Vivienda y Asentamientos Humanos (MINVAH). The conclusion presented here is that such an information system is indeed feasible, as long as the system is designed in a way that is appropriate to the resources and needs of the Ministry. In particular, this means adopting a strategy of computerization that is incremental, decentralized and user-friendly. The result may well be a "system of systems" rather than a single, comprehensive information system, but the effect will be the same: more effective and more efficient organization of information in the Minstry.

MINVAH is by no means ignorant of computers and their capabilities. At least half a dozen major applications are currently underway. The key steps in transforming this experience into the elements of an information system are to give users more responsibility for and control over their computing needs, to provide them with a broader range of computer capabilities, and to facilitate data communication between different users and different programs. This will require three main inputs: technical assistance, computer equipment, and staff training. These are the components of the attached Project Proposal.

This report has proposed five priority areas for improving information processing: public housing, bibliographic data, financial analysis, accounting, and computer-aided design. In each case, better information will have both direct and indirect benefits. First, better information will be of direct benefit to present and future beneficiaries of MINVAH programs. Second, this will be of indirect benefit by helping justify extending the principle of improving information systems to other areas of MINVAH activity -- perhaps even to other government agencies.

It seems almost a truism to say that better information leads to better decision-making; yet that may also be an over-simplification. Better information does create an opportunity for better decision-making but the first does not guarantee the second. Indeed, information sometimes shines a harsh light. Knowing more about what is <u>happening</u> may reveal how little we know about what we are <u>doing</u> about it! In other words, it is one thing to have information and another thing to know how to use it. Information systems can provide answers but they may also ask questions. But that too may ultimately be a good thing.

Appendix: SELECTED MICROCOMPUTER USES AND THEIR POTENTIAL APPLICATIONS TO PLANNING AND MANAGEMENT OF HUMAN SETTLEMENTS IN NICARAGUA

## 1. WORD PROCESSING (WP)

POTENTIAL USES: Report-writing, letter-writing, preparation of forms, drafting of legal documents, etc.

SPECIAL HARDWARE: None required, although users may eventually want laser printers for producing documents of typeset quality.

SOFTWARE SOURCES: Numerous commercial and non-commercial WP packages are available, including some programs with features like the ability to create customized form letters (usually called "mail-merging"), to display text in several columns, to perform simple arithmetic operations, to provide limited text-management features (such as sorting), to access spelling-checkers and/or thesauruses, to manage footnotes and prepare indices, etc. There are also (usually separate) packages for page layout and graphics, particularly for use with laser printers. The most widely used WP package is probably Wordstar, although it has none of the features just mentioned except mail-merge and a spelling-checker.

COMMENTS: Training in the basics of WP is readily available, including some teaching programs (or "tutorials") that are available as computer programs on disk. More elaborate applications (such as mail-merge and use of standard "boiler-plate" text) may require more extensive and more customized training.

## 2. DATABASE MANAGEMENT SYSTEMS (DBMS)

POTENTIAL USES: Numerous, but particularly in connection with land management, property-tax administration and rent collection (ground-rent and housing rental).

SPECIAL HARDWARE: None required, although large databases (from 200 Kb up) are faster to retrieve and easier to manipulate if a hard disk is available. (Hard disks should in turn be provided with a suitable backup system). The entry of prepared data can also be significantly speeded up by use of an optical character reader (OCR), prices of which are now below US$ 2,000.

SOFTWARE SOURCES: Numerous commercial and non-commercial DBMS packages are available. dBaseIII+, Rbase 5000 and Paradox are popular widely used commercial packages with their own programming languages and limited "relational" capabilities. To optimize the use of such complex packages, it may be desirable to get "utility" packages for these programs to help prepare screen/report forms and compilers to speed program execution. For simple tasks, on the other hand, a simpler file management program (like pfsFile) or an "analytical" DBMS (like Reflex) may be preferable.

COMMENTS: Computerized DBMS can facilitate almost any kind of record-keeping and record-processing, including administrative uses like personnel, documents, maps, equipment, vehicles, supplies, etc. as well as more substantive applications related to land, buildings, road maintenance, traffic signs, street lighting, water valves, manholes, etc.

### 3. ACCOUNTING, BUDGETING AND FINANCIAL ANALYSIS

POTENTIAL USES: Program and project budgeting; accounts management; feasibility analysis of financial schemes such as revolving funds and other housing finance schemes; bills of quantities (BOQ) for construction projects; etc.

SPECIAL HARDWARE: None required, although again a hard disk may prove useful for larger files. (However, note that most spreadsheet programs operate entirely in memory; so maximum file size is limited by available memory or RAM, not disk capacity.)

SOFTWARE SOURCES: Straightforward budgeting and financial analysis can be done with a standard spreadsheet package (like Lotus 123, Supercalc4 or their non-commercial counterparts) or even a database management program. However, more complicated accounting operations (such as payroll, purchasing, accounts payable, etc.) may require more specialized software, probably from commercial sources.

COMMENTS: Spreadsheet programs like those cited above are among the most flexible programs available. While their most obvious application is to financial matters, they can be used for almost any kind of simple arithmetic analysis: see also item 5 below.

### 4. STATISTICAL ANALYSIS

POTENTIAL USES: Research and planning; monitoring for compliance with regulations and by-laws; population projections; forecasting demand for services; survey research and questionnaire processing; etc.

SPECIAL HARDWARE: None required but: (a) some of the more sophisticated commercial software requires a hard disk; and (b) for large datafiles it may be desirable to add a "mathematics co-processor" (like the Intel 8087 or 80287) in order to speed processing times.

SOFTWARE SOURCES: Commercial and non-commercial packages are widely available, although (in this case) the latter do not usually offer the same level of performance as the former. Two of the most widely used commercial packages are SPSS and SAS. There are also ready-made "templates" (or "overlays") for spreadsheet packages to handle simple or specialized requirements. The United Nations Fund for Population Activity (UNFPA) and the Population Council in New York both have non-commercial microcomputer software especially for demographic analysis.

COMMENTS: Although these packages are not always the easiest and most friendly to use, both SPSS and SAS are widely used on mainframe computers. Thus, when they are available, data from such sources may well be provided in a form that is already suitable for processing with these packages.

## 5. COMPUTER MODELING FOR INFRASTRUCTURE PLANNING AND DESIGN

**POTENTIAL USES:** Site and service schemes; housing needs assessment; water-distribution and sewage systems; transportation networks and systems; economic and financial models for cost-recovery; etc.

**SPECIAL HARDWARE:** None required, although it may be desirable to enhance the basic equipment with a "mathematics co-processor" (like the Intel 8087 or 80287) in order to speed processing times.

SOFTWARE SOURCES: Microcomputer software is available for planning and designing housing programs, road networks, street lighting, water-supply systems, sewage systems, electrical power lines, and so on. Software for these purposes can be obtained from commercial sources (like the Danish Hydraulics Institute) and non-commercial sources (like the World Bank, the United Nations Development Programme, the United States AID Agency, and the US Department of Transportation).

COMMENTS: Thanks to the availability of ready-made software packages, microcomputers make it feasible for ordinary planners to apply sophisticated mathematical techniques to the design and optimization of infrastructure systems, techniques which they might not otherwise have the time or resources to employ.

## 6. SCIENTIFIC AND ENGINEERING ANALYSIS

POTENTIAL USES: Analysis of building materials and structures, including soils, earthworks, posts, piles, foundations, and beams for buildings, roads and bridges; engineering calculations for hydraulic and electrical-power systems; energy-use profiles for buildings or projects; etc.

**SPECIAL HARDWARE:** None required, although it may be desirable to enhance the basic equipment with a "mathematics co-processor" (like the Intel 8087 or 80287) in order to speed processing times.

**SOFTWARE SOURCES:** Among commercial software products, Eureka (for example) is a generic program for processing mathematical formulas. Less suitable but still helpful for this purpose are standard spreadsheet packages like Lotus 1-2-3 or Supercalc4. Non-commercial sources are available through selected universities, international professional associations, etc. It is also possible for users with experience of high-level programming (BASIC, Fortran, Pascal, C, etc.) to write their own programs for this purpose if the appropriate interpreter or compiler is available on their system.

COMMENTS: Microcomputers can encourage, expedite and standardize the use of more sophisticated techniques for the numerous scientific and engineering calculations involved the design and construction of housing and all kinds of urgan infrastructure, including specification, monitoring and testing.

## 7. COMPUTER-ASSISTED DESIGN (CAD) AND GRAPHICS

POTENTIAL USES: Design, layout and specification of plans for all kinds of construction, including houses, building, roads, bridges, etc.; preparation of drawings and graphics operating manuals, training materials, etc.

SPECIAL HARDWARE: Effectively requires special peripheral equipment for data input (e.g. a digitizer) and output (e.g. a plotter). Enhanced colour capabilities are also an obvious advantage for this kind of application. A mathematics co-processor will also speed computationally intensive operations (such as rotation or "zooming").

SOFTWARE SOURCES: Full-scale computer-assisted design (CAD) software is largely commercial, although prices tend to vary more than differences in capabilities would seem to warrant. AutoCAD is probably the most widely used commercial package, but there are packages with more extensive features (such as full three-dimensional capacity). On the other hand, there are some simpler but still very useful programs available, including drawing programs like Dr. Halo (commercial) and PC-DRAW (non-commercial).

COMMENTS: For serious engineering and architectural design work, there are also dedicated CAD mini-computer systems available. However, as an initial step, microcomputers can provide an impressive level of capability, especially when allied with the appropriate peripheral equipment.

## 8. MAPPING, SURVEYING AND GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

POTENTIAL USES: Research and planning; land administration; property management; roads and traffic management; etc.

SPECIAL HARDWARE: Here too special peripheral equipment for data input (e.g. a digitizer) and output (e.g. a plotter) is an advantage. Colour capabilities are also useful.

SOFTWARE SOURCES: There are several commercial programs for mapping and GIS available for microcomputers (e.g. PC-MAP) and the United Nations Centre for Human Settlements (Habitat) has a non-commercial package called Urban Data Management Software (UDMS) which offers basic physical-planning capabilities. Programs for doing standard survey calculations and drawing simple property surveys for housing plots are harder to find but can be programmed on microcomputers using BASIC or other high-level languages if these are available.

COMMENTS: At current levels of technology, full-scale GIS capabilities really require a dedicated mini-computer system. However, as an intitial step, both to familiarize staff with computer applications in this area and to provide basic operational support, microcomputer-based systems can be very useful.

### 9. URBAN ADMINISTRATION AND MANAGEMENT

POTENTIAL USES: Land registration and assessment; billing for taxes, utilities and services; licensing and revenue collection; municipal budgeting and accounting; inventory; payroll; maintenance administration (street cleaning, refuse collection, etc.); building and vehicle management; and so on.

SPECIAL HARDWARE: None required.

SOFTWARE SOURCES: Standard software packages (like dBaseIII+ and Lotus 1-2-3 or similar) are quite suitable. Simple non-commercial programs are also available (e.g. for building and vehicle maintenance), or they can readily be developed by users familiar with BASIC or other appropriate programming languages. If more sophisticated capabilities are required (e.g. to monitor energy consumption in buildings or street-lighting systems), commercial microcomputer software is available.

COMMENTS: Applications like these can help maximize use (through efficient scheduling), minimize costs (e.g. through energy conservation), prevent break-downs (e.g. by planning regular service programs), and reduce losses (through improved collection of revenues) -- often to the point where the capital costs of computer equipment can be recovered in less than a year. Moreover, as soon as data start to be processed electronically at local levels, the data can quickly and easily be made available to higher authorities for regional and national planning purposes.

### 10. PROJECT MANAGEMENT

POTENTIAL USES: Project design; construction supervision; monitoring work plans; etc.

SPECIAL HARDWARE: None required, although complex projects are easier to manage if a hard disk is available. (Hard disks could in turn be provided with a suitable backup system.)

SOFTWARE SOURCES: There are standard microcomputer programs available for project management (like TimeLine or Harvard Total Project Manager, for example).

COMMENTS: In addition to helping to monitor project performance and costs, the better software packages also provide features such as delay costing and optimum resource-reallocation routines that can be invoked partway through a project.

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