Distr.
RESTRICTED

LC/R.453
25 August 1985

ORIGINAL: ENGLISH

E C L A C

Economic Commission for Latin America and the Caribbean

COMPUTER APPLICATIONS IN THE TRANSPORT AND COMMUNICATIONS DIVISION OF THE ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN

85-8-1253

C O N T E N T S

	Page
SUMMARY	1
INTRODUCTION	3
A. SYSTEMS APPLICATIONS	3
1. Ports Code	4
2. ISIS	4
(a) ADDRESS	4
(b) LOCODE	5
(c) TRANBIB	5
3. TRANDIS	6
4. COMPA	6
B. TEXT PROCESSING	7
1. Research studies and reports	7
(a) Secretaries	7
(b) Professional staff	9
(c) Implications for the Typing Pool	11
2. Correspondence	11
(a) Letters	11
(b) Memorandums and cables	12
(c) Mission and quarterly reports	12
C. CONSIDERATIONS WITH RESPECT TO MICROCOMPUTERS	12
1. Systems applications	12
2. Text processing	13
(a) Performance	13
(b) Software	14
3. Ease of use	15
D. CONCLUSIONS	15
1. Internal impacts	15
2. External impacts	16

SUMMARY

The Transport and Communications Division was one of the first in the Economic Commission for Latin America and the Caribbean (ECLAC) to incorporate the computer as a regular tool to be used in support of its work program. Over the years, it has developed six major systems applications: a Ports Code file, the ECLAC ADDRESS system, a trial application of the United Nations Location Identifier Code, a Transport Documentation Information System for its own internal use, and a Microcomputerized Freight Yard Control system for small railways. All of these systems represent traditional applications of the computer.

More recently, the Division has innovated in the use of text processing to improve both the quality of its documents and the efficiency with which they are produced. Professional staff members as well as secretaries employ text processing very effectively in their daily work. In the case of research reports, this has brought about a dramatic reduction in the need for the services of the Typing Pool to produce copy ready for reproduction, since the virtual elimination of retyping permits the Division to handle all phases of document preparation with its own resources. Significant gains have also been made with respect to various forms of correspondence.

The Division originally employed only terminals connected to the minicomputers located in the Computer Centre. The acquisition of two microcomputers has permitted these two forms of processing to be compared, with the result that the microcomputer has shown itself to be cabable of handling all the Division's present or planned computer applications, and to be especially appropriate for text processing. In its future activities with counterpart organizations in Latin America and the Caribbean, the Division will emphasize the use of microcomputers as a cost-effective aid for improving the efficiency of transport planning and operations throughout the region.

INTRODUCTION

The Transport and Communications Division was one of the pioneers in ECLAC in the use of computers for substantive applications. This initiative goes back more than ten years to a time when all work was done in batch mode with punched cards as the primary input medium, and computer time was rented on an hourly basis at what was then the Technical University of Chile. By 1978, the growing number of activities in which the Division was applying computers led it to become the first substantive division to use one of its research assistant posts to recruit a programmer assistant, so that its work would not be handicapped by a shortage of human resources in this area that even then was starting to make itself felt. Today, the Division continues to innovate in computer-related activities, having been chosen to conduct a pilot project for the use of text processing in the preparation of research studies and reports, as well as certain types of correspondence.

A. SYSTEMS APPLICATIONS

There are four principal systems that the Division has developed in support of its work program: the Ports Code file, several applications of the ISIS information retrieval system, the Transport Documentation Information System (TRANDIS), and the Microcomputerized Freight Yard Control system (COMPA).

1. Ports Code

The Division's first significant use of the computer was related to the publication of the ECLAC Ports Code. At the beginning of 1975, the ECLAC/Organization of American States joint Transport Program had determined that the efficient management of information by port authorities and transport ministries in Latin America and the Caribbean, especially with respect to the production of maritime transport statistics, required the development of a scheme for coding ships' ports of call that would avoid problems of multiple names for the same port, misspellings of names, and inconsistent abbreviations used to shorten lengthy names. The first code of its kind in the world, it later served as the basis for the design of the United Nations Locations Identifier Code (LOCODE) sponsored by the Economic Commission for Europe's Working Group on the Facilitation of International Trade Procedures. In order to publish these codes in a form that could actually be used by people engaged in data collection, it was necessary to arrange them alphabetically in a number of ways, a task that, if done by hand, would have been not only tedious but also prone to error. It was thus a natural idea to put all the essential information onto punched cards and use the computer to sort it into each required order. The printed output from this process contained

appropriate page headings so that it could be used directly for the reproduction of a finished document - perhaps ECLAC's first example of a computer-produced publication.

The resulting scheme was received with great enthusiasm in the region. Over the years the file has grown to include more than 1 000 ports, as additional locations have been added to the list. Recently, the Ports Code file was transferred to microcomputer, where it has undergone extensive revision to make it absolutely compatible with LOCODE, as part of the Division's policy of fostering the adoption of standard data coding schemes throughout the region.

2. ISIS

Also in 1975, the Canadian International Development Research Centre made available to ECLAC's Latin American Economic and Social Documentation Centre (CLADES) the International Labour Office's ISIS information retrieval package, as a tool to facilitate the creation of bibliographic data bases. Since the Transport and Communications Division had long been interested in the subject of classifying and organizing transport documentation, and was even then cooperating with the World Bank in a joint project to index the technical reference libraries of several transport planning offices in the region, an exploration of the possibilities of using ISIS in its own work was clearly indicated. The Division therefore was pleased to be able to assist CLADES with the installation of the package and so become familiar with its capabilities.

Recognizing that ISIS could indeed be applied to a variety of activities in which it was interested, the Division decided to support the system on a continuing basis. When it hired a programmer assistant in 1978 to fill one of its regular budget posts of research assistant that was then vacant, it chose the programmer assistant who had been working in a project post in CLADES to help install ISIS. The Division then continued to provide support for all ECLAC ISIS applications, steadily refining the system to make it more efficient and more responsive to the conditions under which it was applied in ECLAC, until the UNESCO version of ISIS was installed at the beginning of 1983. Even after this version was adopted and responsibility for system maintenance was shifted to the Computer Centre, the Division assisted in overcoming several problems that arose.

The principal ISIS application developed by the Division was an address file for the distribution of documents (ADDRESS). Other important applications were LOCODE and the initial work on a transport bibliographic data base (TRANBIB).

(a) ADDRESS

The Division's first application of ISIS was for the management of names and addresses of key persons and positions in the various public and private organizations with which it maintains relations -either by correspondence or in person- together with some additional information useful or necessary for identifying the reason for being interested in that address and what (if any) documents or publica-

tions it receives. This system in effect replaced a file kept on index cards, which were not easy to update and could not be effectively searched to find all addresses having some specific characteristic, or used to produce address labels for dispatching documents and publications.

Some initial investigation of such a system had already been done earlier, but when the decision was made to produce a bimonthly bulletin on Facilitation of Trade and Transport in Latin America (Boletin FAL), an effective means for distributing it on a regular basis became urgent. Thought was given to the Addressograph machine then used to distribute documents and publications, but it was soon clear that a computerized system would be both much more flexible and far easier to maintain. The first two issues of the Bulletin had to be addressed by hand, but by the time the third appeared, the initial version of the ADDRESS system was ready for testing. It was eminently successful from the outset, when it was used to send out some 750 copies of the Bulletin with the first computer-generated labels ever produced by ECLAC.

Refinement of the system continued to the point where, in 1979, the Executive Secretariat decided to use ADDRESS for distributing all documents and publications produced by the ECLAC system. To facilitate the implementation of this decision, two staff members from the Division were assigned to set up a special task force with the objective of revamping the entire distribution process and incorporating all lists of recipients into ADDRESS. This group finished its work in 1981, when responsibility for the ADDRESS function was returned to the Documents and Publications Service. At about the same time, for economic reasons ADDRESS was reprogrammed from ISIS, which was then operating on a rented IBM computer at the Chilean State Computer Company, to another system running on the PDP-11 machine in the ECLAC Computer Centre.

(b) LOCODE

As mentioned above, the United Nations Locations Identifier Code was to a large degree an outgrowth and extension of the scheme designed for the Ports Code. After the ground work for the Location Code was completed, the ECE's Trade Facilitation Adviser asked the Division to experiment with ISIS to determine if this system, which was readily available in Geneva, would be suitable for managing the data base needed to maintain the Code. LOCODE was the name chosen by the Division for the resulting pilot file, and this same name was later adopted by the ECE Working Group responsible for the Code as the formal abbreviation.

(c) TRANBIB

The rapid growth of the Division's library of specialized transport documentation made it imperative that these holdings be recorded in some form of catalog, so the information can readily be found when needed. Work with ISIS indicated that this would be the logical system for such a purpose, an appropriate record format was devised and a small sample of documents was coded for entry into the

data base. It was soon determined, however, that neither data entry nor on-line searches were practical unless they could be performed on a terminal located within the Division area. Since ISIS operates in IBM computers while the terminals installed in the Division only connect to the Computer Centre's PDP-11, a system called TRANDIS was developed for this machine.

3. TRANDIS

The Transport Documentation Information System (TRANDIS) was designed with the help of CLADES as a simplified and truncated application of the ECLAC Common Bibliographic Format employed by CLADES, ECLAC's Library, the Caribbean Documentation Centre in the ECLAC Subregional Headquarters for the Caribbean, and the Latin American Demographic Centre (CELADE). Bibliographic analysis, data entry and production of printed output are performed by a documentalist assistant hired to fill one of the research assistant posts in the Division. Specialized training of this staff member was also provided by CLADES. In the computer, the LEADS data base management functions are used for information retrieval, and the TECO text editor together with the RUNOFF text formatting program are used to generate printed output of catalogues and indexes.

Implementation of TRANDIS commenced in 1981, but entry of documents on a production basis was not begun until mid-1982, when the Division's first terminal was installed. Since then, more than 1 300 documents have been incorporated. Toward the end of 1982, the Division and the Latin American Railways Association (ALAF) joined forces in a cooperative effort to demonstrate the feasibility of setting up a regional reference network for transport documentation. Under this arrangement, ALAF makes up coding sheets with data on its railway documentation, while the Division performs data entry and returns catalogues containing the information. ALAF has so far added more than 1 950 entries to the data base.

4. COMPA

The most recent application the Division has undertaken is a Microcomputerized Freight Yard Control system (COMPA) being developed in conjunction with the Chilean Southern Railway. For many years, the Division has been working with ALAF to improve information systems used by the latter's members but, for the most part, the results of these efforts have been readily applicable only by the larger lines. With a view toward aiding the smaller companies that make up the majority in this region, an application was sought that would be within their grasp both technically and financially, and at the same time would constitute a significant tool for better management of rail operations. It was decided that these criteria could be met by a simple system for managing the location and contents of freight wagons standing in classification yards, provided this system could be implemented on a microcomputer.

As the design specifications for COMPA were being considered at the beginning of 1983, it was learned that the Chilean Southern Railway was interested in computerizing the management of its Alameda freight yard in Santiago. An agreement was therefore made with the

Railway under which it would provide a real situation around which to design the system, while the Division would install COMPA and support it until fully operational. Initial installation was completed in mid-1984, but the full-scale trial application soon showed that the commercial database management system around which COMPA was implemented gave such slow response time that certain yard movements were held up significantly at crucial moments. Although it was thus necessary to reprogram the system completely in a language that could be compiled, the trials showed that the essential system logic was correct and could be used intact for the new version.

B. TEXT PROCESSING

The systems just described are traditional applications of the sort that once constituted almost the only use of computers. Recently, however, a new use has grown up around the function of text processing. United Nations Headquarters has made considerable progress in this area in the past few years, but its introduction in ECLAC has been slower. Nonetheless, because the principal product of nearly all ECLAC's research activities is a printed document, anything that helps to improve the efficiency of the production process should be seriously considered for adoption.

Once again, the Transport and Communications Division was an innovator in this activity. As early as 1981, experiments showed convincingly the need to adopt text processing, so in May 1982 certain extrabudgetary resources at the Division's disposal were used to acquire two terminals for connection to the PDP-11. The benefits from these two with respect to increased productivity were so immediately apparent that in October 1982 two additional terminals, two microcomputers and a printer were purchased (again, all from extrabudgetary funds). This equipment has since been used for the preparation of all research studies and reports, as well as for some types of correspondence.

1. Research studies and reports

Increased productivity in the processing of documents is perceived not only by the secretaries but by the professional staff as well, and is reflected in the significantly reduced amount of work sent to the Typing Pool.

(a) Secretaries

The production cycle for a document in the Transport and Communications Division is probably the same as that followed by any of ECLAC's substantive divisions. Typically, a first draft is prepared and circulated internally for comments and suggestions. Once these are received and incorporated into the text, the document is retyped, perhaps for reproduction as a Restricted Distribution document that will be used as a working paper in a conference or sent to outside individuals and organizations. In either case, further comments and suggestions are likely to be forthcoming, again requiring that the

text be retyped. It is then edited, after which it must be typed yet a fourth time to prepare it for reproduction as a Limited or General Distribution document, or printing as a sales publication.

It is easy to determine the amount of work involved in all this typing. For example, just prior to the acquisition of its first terminals, the Division completed a study performed jointly with the ECLAC office in Brasilia, the Brazilian Government's Economic and Social Planning Institute (IPEA) and its Transport Planning Enterprise (GEIPOT). The final document, Cargo transport between Brazil and the Andean Group countries, Vols. I and II (E/CEPAL/L.263 and Add.1), contained a total of 472 single-spaced pages. Although some of the material was reproduced by Ricoh from other documents, approximately 250 pages were original material that had to be typed and proofread at least four times. The Typing Pool calculates that a typist can produce up to 16 single-spaced pages per day, depending on the quality of the draft supplied, and that two people can proofread as many as 40 pages per day. The Pool would thus have required a total of 62.5 person-days for typing and 50 person-days for proofreading the four versions of the document.

Clearly, these rates of production cannot be applied directly to the work of secretaries in the Division, where two of the versions were typed. Both circumstances and distractions, such as answering the telephone, are quite different there from those in the Pool. However, the Pool did in fact type the Cargo transport material twice on stencil, once as an Internal Distribution version for comments and once for its final Limited Distribution version.

Had this document been prepared using text processing, the results would have been dramatically different. Assuming that the Division's secretaries would have typed the first version of the text into the computer, the time required up to that point would have been approximately the same as if it had been done on a typewriter. From then on, however, the two procedures change completely. When comments are being incorporated into a revised text, only the modifications must be made and checked. The remainder of the material is left alone, which not only speeds up the revision but also tends to improve the overall quality of the document because there is less hesitation about introducing repeated minor changes that probably would not be made to a typed draft, in which a whole page might have to be redone.

Conference documents are also easier to produce this way. In general, they must be distributed at least six weeks in advance of the conference date, so that participants will have time to study them. When they are typed, the text must be finalized as much as a month prior to the distribution date, to allow time for preparation of the stencils. Using text processing, such documents can be worked on to within just a few days of that date, which gives greater flexibility to an always tight schedule.

Text processing gives a psychological benefit to secretaries that can hardly be measured but that greatly increases the efficiency with which they work. Typing the same material over and over again

inevitably produces a negative reaction: "But I've already done this three times before!" This attitude tends to delay the work and make it less accurate. With text processing, only changes must be typed after the document is initially put into the computer, so the tedium of repetition is avoided.

(b) Professional staff

The benefits from text processing more than justify its introduction when it is only done by the secretaries. If the professional staff also uses it, the benefits are even greater. Today, although nearly everyone in the Division uses terminals extensively, it is the professionals who spend the most time on the computer, as shown in the following table of weekly computer usage:

	Number who use	Total hours used/week	Average hours used/person
Professionals	5	140	28
Research Assistants	3	66	22
Secretaries	2	40	20

If the author of a document writes it directly on the computer, the secretary no longer has to do this job. That means the secretary has more time for other work such as introducing changes to the document or ensuring that it is formatted and ready for reproduction. The author's time is also spent more efficiently. For example, one of the special advantages of using the computer to process documents is its ability to "cut and paste" text. Most people, while writing a research paper, have new ideas as they go along that must be inserted in the material already written. When drafting by hand, the author must squeeze these thoughts into inadequate space between lines, put them in the margin, or perhaps physically cut the sheet apart to add extra paper. However it is done, it takes time. What is worse, it almost certainly leads to the author's asking the secretary to type up a clean draft - so that the whole procedure can be repeated.

With text processing, the author is freed from these inconveniences. It is easy to go back and insert new text or move existing text to a different part of the paper. Rephrasing can be done with the utmost simplicity. The author is thus insulated from the largely mechanical details of writing and can concentrate on ideas and how they can best be translated into words. Clean drafts may be printed at any time, either double spaced for comments or single spaced so that the overall progress of work can be judged in relation to what is expected in the finished document. This is especially important when a document contains complex tables or formulas.

Furthermore, it is often necessary for the professional to work within very close time limits when preparing a document that will be used in a conference. If such a document is to be typed on stencil, it must be finalized as much as a month in advance of its distribution date. With text processing, greater flexibility in scheduling

is possible while still observing the deadline, both because lengthy retyping is avoided and because only parts that have been revised need to be proofread again, and not the entire document.

For example, work began early in 1982 on the first Spanish version of the Manual for the application of the TIR Convention (E/CEPAL /G.1258) for presentation to the first South American Conference on Highway Transport in Montevideo. One of the members of the professional staff was writing a first draft for revision by the Director of the Division. The draft could not be finished before the Director had to leave town on a rather lengthy mission, yet on his return, he would have only four days to review the text and have it reproduced before the start of the conference.

Realizing that it would not be feasible to revise the text and type it on stencil in four days, the Director asked the author to write the draft on the computer. The author had never before used a terminal or a text editing program, and could not work in his own office with all his reference materials at hand because the Division had not yet acquired its first terminals. Nonetheless, he was able to learn the fundamentals quite rapidly and enter the document as requested. Despite the extensive changes the Director made on his return, the Manual was reproduced in time for it to be presented at the meeting as scheduled.

The primary consideration in the use of text processing by the professionals, of course, is that they be able to type, which is not always the case. In the Transport and Communications Division, however, five of the six professionals do type, and have always composed their text on the typewriter because it is faster for them than writing in longhand. Unfortunately, there are not yet enough terminals for all, so the secretaries must still perform a certain amount of text entry for those professionals who cannot do their own. This situation is alleviated somewhat when one or more professionals are away on mission, which allows the available terminals to be rotated among users. Nonetheless, between the professionals, the secretaries and the research assistants, someone's work is frequently being held up while that person waits for access to a terminal.

It has been the experience of the Division's staff that text processing is "habit forming." This means that, once a person has started to use the computer for documents preparation, the ease and efficiency of the work make the typewriter seem extremely primitive. Four of the Division's professionals in particular have found it literally traumatic to go back to a typewriter, on which they cannot immediately correct, revise, and rearrange their work, and control its final appearance. They are extremely conscious of the fall-off in productivity they suffer when drafting on a typewriter, in comparison with a terminal.

(c) Implications for the Typing Pool

Because the Division's professionals and secretaries both now use text processing, the secretaries can cope with the work load much more effectively than they used to. During the last two summer vacation periods, one secretary was able to cope with the work while the other was away, whereas in previous years it was necessary to hire temporary help to avoid having work come virtually to a halt. More importantly, the Division no longer requires the services of the Typing Pool, which in the past often dedicated a significant portion of its time to the Division's documents. When one of these was a conference document with a deadline for distribution, the Pool would often have to reschedule other work, which resulted in a certain amount of disruption and hence inefficiency. In 1982, just as it was adopting text processing, the Division sent a total of 977 pages to the Pool for typing. Professional use of text processing throughout the entire document cycle grew dramatically thereafter, as evidenced by the fact that in 1983 only 71 pages were typed by the Pool, and since then none at all.

It is interesting to note the Transport and Communications Division has only two secretaries, whereas other ECLAC divisions of similar size need three to handle their normal work loads. This perhaps explains its former heavy dependence on the Pool. If the Division had not introduced text processing and were now forced to hire a third bilingual secretary because the Typing Pool could not provide adequate support, the annual cost to the United Nations would be on the order of $23 000.

According to figures developed by the Computer Centre, the average total annual cost of a terminal work station connected to the PDP-11, including purchase and maintenance both of the terminal and of a proportional share of the central computer equipment over a seven-year depreciation period, is approximately $2 283. It would thus be possible to acquire 10 terminals for the cost of one secretary. While it is obviously misleading to equate secretaries and terminals, we have found that certain trade-offs are indeed involved.

2. Correspondence

Another use of text processing in the Division is for the preparation of letters, memorandums, cables, mission reports, quarterly reports, and similar types of communications.

(a) Letters

To date, the lack of a letter-quality printer with a sheet feeder keeps the Division from preparing finished letters by text processing, but drafts of letters are regularly made. When sending out invitations to meetings and seminars, a computer terminal and printer in the Executive Secretariat are used to produce the multiple copies necessary, since the results are more satisfactory than those obtained from a repeating typewriter.

(b) Memorandums and cables

The two special programs for producing memorandums and cables allow the authors of those forms of correspondence to produce their own final copies directly from their computer files, rather than having to give drafts to the secretaries for typing. Again, the gains in efficiency are significant, especially when the Director of the Division approves the text by viewing it on the terminal. In that case, the memorandum or cable is reproduced only once, in final form. If the text requires clearance by the Executive Secretariat or other office, any changes requested can be introduced and a clean copy prepared immediately, an important consideration when a delay in dispatching a cable could be critical.

(c) Mission and quarterly reports

Although no special programs exist for preparing mission and quarterly reports, the Division has developed a standard format file that everyone uses to simplify writing these administrative communications. Again, the professional staff member produces a final copy that needs no further work by the secretary.

C. CONSIDERATIONS WITH RESPECT TO MICROCOMPUTERS

In addition to four terminals connected to one of the PDP-11 minicomputers in the Computer Centre, the Transport and Communications Division has two microcomputers that can be operated either independently or as terminals to the PDP-11. It has thus been possible to compare the relative merits of both types of equipment. Although each has its place, the microcomputer is the preferred medium for most applications that do not require the sharing of data bases among many users or rely on existing programs written for a particular machine. This point of view seems increasingly to be shared by other divisions as the number of microcomputers installed in ECLAC increases rapidly.

1. Systems applications

Only COMPA of the applications described in section A was designed from the outset to operate in a microcomputer. However, the Ports Code has already been converted to this medium, and an additional machine is now on order for use in statistical applications such as the analysis of data regarding conditions under which merchant ships are chartered for a single voyage to carry freight to and from Latin America and the Caribbean. Some previous studies of these data required a mainframe computer to carry them out.

The Division is convinced that the low cost and great flexibility of microcomputers make them preferable for the kinds of systems it is likely to develop. These machines, with their low cost, steadily increasing capabilities, and powerful, commercially-produced software available for many standard types of applications, are ever

more attractive alternatives to the larger minicomputers and mainframes that just five years ago were the only way to meet most users' requirements.

2. Text processing

In the production of research studies and reports, the Division prefers microcomputers both for their performance and for the text processing software they can operate.

(a) Performance

Central computer resources are designed to be shared among many users. Nonetheless, they are not infinitely divisible, but rather are assigned first to one user and then to another. When few people are working, the time required for this rotation cannot be noticed. As additional people connect, however, the delay in response becomes increasingly perceptible until it constitutes a definite obstacle to both thought and work. This is especially true for professionals doing text processing, as they must frequently refer back to what they have just written, only to find that the computer has not yet responded by displaying it on the terminal. The result is not only personal frustration but also a loss in efficiency. Even the length of time it takes to rewrite a screenful of text can be disturbing.

Another problem is computer shutdown. If this happens on a minicomputer or mainframe, a great deal of time can be lost waiting for the system to become ready for use again. As before, the result is both frustration and reduced efficiency.

The Division's experience with microcomputers has been much better in both respects. In the case of response time, the one-to-one basis between user and machine makes the microcomputer's reaction instantaneous. When a microcomputer shuts down due to electric power failure, it is ready to operate again as soon as ECLAC's emergency generator is started, usually no more than five minutes. If an electronic failure occurs, it affects only one machine; others can continue to operate. In fact, though, the microcomputers have proven to be much less prone to malfunction than the terminals.

The diskette units have given complete satisfaction. They are relatively slow, but this can be partly overcome with a disk emulator program if sufficient memory is available. In terms of storage capacity, diskettes are adequate for documents of medium length (the present document, for example, occupies little more than 10% of the disk it is stored on). Longer documents can be divided into sections among several diskettes, just as they are frequently split among several files on the PDP-11. Diskettes have the advantage that they can be switched instantly from one machine to the other, thereby ensuring that work on a critical document can continue if something happens to the first machine.

(b) Software

The real advantage of the microcomputer for text processing is in the area of software. The majority of the Division's work is done in Spanish, and thus far it has not be possible to obtain a text processing program for the PDP-11 that will handle this language well. It is therefore necessary to rely on the combination of a text editor and a text formatter, which does not permit previewing a document on the screen the way it will appear when printed, and has no automatic "widow and orphan" control. As a result, final formatting for reproduction of a long document becomes a seemingly interminable iterative process of producing a listing, checking for an isolated line at the top or bottom of a page, going back to the editor to correct the situation, and then producing another listing to check the effects of that change on the remaining pages.

In contrast, there are several extremely good text processing programs available for microcomputers. A few of them show the Spanish letters directly on the screen. Those in the catagory of "what you see is what you get" display the document almost exactly as it will appear in print, no matter how complex, which allows the author to see just what his final product will look like. This paper is being prepared with such a text processor.

The commands needed to obtain versatility in a text processor are not exactly simple. In this respect, a text processor and a text formatter are essentially the same. Since the processor is functionally integrated between editing and formatting, however, the user is faced with only one program to learn. Secretaries especially find text processors easier to operate than the combination of text editor and text formatter, because they can immediately see the effects of what they are doing and are thus encouraged to experiment with a command until they understand it fully. RUNOFF commands, on the other hand, are seldom completely understood.

Considering the preponderance with which microcomputers are used for text processing, the question has arisen as to whether it might not be better to acquire dedicated word processing equipment. The Division is convinced that the answer is no, for two reasons. First, other types of software such as electronic spreadsheets and data base managers must often be employed. More importantly, and of greater relevance for ECLAC in general, the last few years have demonstrated that advances in microcomputer software and hardware are occurring at an increasingly rapid pace. If dedicated equipment were acquired, budgetary constraints would force that equipment and its associated software to be kept for a considerable length of time, during which it would not be possible to take advantage of changing technology. By using general purpose microcomputers, on the other hand, third-party add-on hardware can be acquired for a fraction of what a whole new machine would cost. Fierce competition among software producers tends to keep prices down and leads to constant improvement in their products, thus making it possible to replace text processing programs as better and more versatile ones appear on the market.

3. Ease of use

More user intervention is required with a microcomputer than with a minicomputer or mainframe, especially where diskettes are concerned. This does not seem to be a problem so far, even when dealing with high-capacity hard disks, which must periodically be backed up to diskette. Perhaps because users are so intimately associated with their machines, they tend to be more conscious of the need to manage their disk space wisely and carefully. The ability to ensure absolute privacy of sensitive materials is a further positive factor for the microcomputer, since a diskette containing the information can simply be locked up to keep it out of unauthorized hands.

The microcomputer operating system is similar to that of the PDP-11, at least insofar as the average user is concerned. Other software may well be easier to use, as has already been noted in the case of text processing programs.

A good example of the relative ease of applying microcomputers can be seen in the office of the Regional Advisor for Latin America of the International Maritime Organization (IMO), who is stationed at ECLAC. The Advisor's first association with computers was through a connection to the PDP-11. Then, in 1983, he obtained one microcomputer for his office and another for a project, which he used on a temporary basis. Both the Advisor and his secretary quickly learned to operate these machines for text processing, and also set up a data base of maritime authorities in the region with whom IMO maintains regular contacts. They report that they have had much better success with text processing on the microcomputers, which respond faster, cause fewer problems with file handling, and are back on line more rapidly in the event of power outages, especially when these occur while someone is working on a weekend. Finally, ready availability of the same kind of equipment in other countries is an important consideration, since a conference can be serviced with a rented machine, and only the diskettes themselves need be transported.

D. CONCLUSIONS

The results of the pilot program in the Transport and Communications Division have been wholely positive, and have had an important impact both within ECLAC itself and on the Division's relations with its counterpart organizations in Latin America and the Caribbean.

1. Internal impacts

The internal effects of the Division's experience with microcomputers are seen most graphically in the increasing numbers of these machines that are being installed in other divisions. Their versatility, reliability and one-to-one relationship make them very attractive for first-time computer users. While they clearly have not yet achieved the overall computational power of minicomputers and mainframes, the variety and quality of software available for them permit their use in an extraordinarily wide range of cost-effective applications.

Microcomputers excel in the area of text processing, where the Division has encountered no negative aspects whatsoever. They have amply repaid the investment made in them, both through potential and realized monetary savings and through improved ability to comply with the work program using the human resources available. Since salaries are the single largest item in the budget of the United Nations, it is vital that staff work as efficiently as possible in order to help meet growing demands on the Organization in a time of severe economic constraint. In his letter of 25 June 1984 to the Executive Secretaries of the Regional Economic Commissions regarding the program budget for 1986-1987, the Secretary General made the following point:

> "... we must pursue as strongly as ever our commitment to maintain and improve the efficiency and effectiveness of the Organization and to ensure optimum utilization of resources. I am convinced that more can indeed be achieved with resources already available."

2. External impacts

Although the Transport and Communications Division will continue to innovate in computer applications within ECLAC, the principal focus of such activities must now be outward toward counterpart organizations in the countries of Latin America and the Caribbean. Especially where microcomputers are concerned, experiences with this versatile machine for solving internal problems point up possibilities for doing the same in transport ministries, public enterprises and private companies in the region.

COMPA, the first external microcomputer application, is already being used to help manage the main freight yard of the Chilean Southern Railway, and plans are being made to adapt it to another railway in the near future. When the World Bank completes the microcomputer version of its widely-respected Highway Design Model, thus making it readily available for the first time to countries having only limited computer resources, and perhaps more cost effective in general than the present mainframe version, the Division will act in conjunction with the Bank to provide training and support in this region.

Maritime transport is another field in which great opportunities exist for the use of microcomputers. Shipping lines in the developed countries already employ them in a wide variety of shipboard applications ranging from cargo loading optimization to equipment monitoring, and competitive pressures make it imperative that national lines in Latin America and the Caribbean do the same. A further area of importance, and one in which ECLAC's intervention may prove decisive, is the preparation of cargo manifests by computer for transmission in machine-readable form to port authorities in advance of the ship's arrival. Heretofore, a lack of standardized procedures and relatively high equipment costs have kept such preparation from being readily feasible in the developing countries. With today's powerful and low-cost microcomputers, however, many of the former obstacles are obviated.

While the possibilities for effective use of microcomputers in transport have barely been touched upon, this region must be careful not to rely blindly on applications of technology formulated in and for the developed countries, but must rather adapt them as necessary and convenient to local economic and social conditions. The Transport and Communications Division can make a significant contribution to this process by passing on to its counterpart organizations the expertise it acquires through experience. For this reason, it must continue to innovate in its own internal activities, in order to maintain a "hands-on" knowledge of the rapid changes in the microcomputer field. The present economic crisis in Latin America and the Caribbean, which will not soon disappear, demands practical, proven solutions rather than theoretical panaceas. To the extent that the Division can make tested technical contributions to progress in the transport sector, it is helping to provide the leadership that the governments of this region expect from ECLAC.