

The developing countries and the CR-ROM

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Abstract – The use of on-line data bases in developing countries is discussed, as well as the access to data bases on CD-ROM disks. The two access methods are compared by the costs they generate and the functionality they may offer in this environment.

Certain not readily perceived characteristics of the CD-ROM are exposed increasing the understanding of the potential of this new technology when applied to information delivery systems.

Several facts learned during the development of an information dissemination project for Latin America and the Caribbean using CD-ROMs in the Pan American Health Organization are presented. In addition, some initially unsuspected consequences of the application of CD-ROMs in developing countries are also discussed.

1 Background

The implementation of an experimental project in the Pan American Health Organization (PAHO) to disseminate health related information on CD-ROMs has shown how important this technology may become for developing countries.

The project was initially conceived to overcome problems derived from PAHO's limited financial resources when it became necessary to expand the computer capabilities installed at Bireme.

Bireme, the Latin American Center on Health Sciences Information, is a PAHO center located in Sao Paulo, Brazil, which maintains a

bibliographic data base on public health called LILACS (Literature Latinoamericana en Ciencias de la Salud).

For twenty years Bireme has been building the LILACS data base with bibliographic references to non-conventional documentation produced in Latin America and the Caribbean regions.

For the Latin American and Caribbean countries the importance of a data base such as LILACS stems from the fact that it is a source of bibliographic information on public health intimately related to the problems affecting the region. It can therefore provide vital information about subjects no longer addressed by researchers in the more developed countries.

The growth of LILACS, which currently contains 64,000 references, demanded an expansion of the computer facilities in Bireme. At the same time it was necessary to find ways to make the information contained in the data base widely available to all countries in the region.

Since most of the references were generated by a network of small documentation centers throughout the region, the lack of easy access to LILACS was beginning to weaken the enthusiasm of the participants in that cooperative effort toward building a truly regional data base.

A proposal was then made by Bireme for the expansion of its computer facility including a large increase in storage capacity and the installation of full data communication capabilities. The proposed enhancements also demanded a much larger and more powerful central processing unit (CPU).

When the new hardware configuration requirements for Bireme were determined, it became clear that there were not enough funds available for the computer expansion without even considering the other related costs.

Among other things, these other costs include hardware maintenance and the cost of a larger staff for software and data communication support. These costs could be considerable since this type of technical support must be performed by specialists who are not only difficult to find but also very expensive.

Luckily this situation took place when the CD-ROM technology was just beginning to offer PAHO another possible alternative for solving BIREME's problem.

The CD-ROM is a small plastic disk which can contain about 550 megabytes of data and is inexpensively produced like the popular compact disk used for music.

It is important to bear in mind, however, that everything discussed in this paper relates to the type of data base LILACS represents. LILACS is a medium size data base containing bibliographic references which are reasonably stable and increase at a moderate rate. A more volatile data base can be placed on a CD-ROM, but one must not forget that the disc cannot be changed, that it takes some time to produce new versions, and that they are usually shipped by mail.

CD-ROMs offer some very important advantages, but they do not represent a solution to every information delivery problem.

2 The On-Line Model for Information Dissemination

BIREME's request for additional funds to expand its computing facilities followed the traditional on-line data base model for information dissemination.

The decision made to experiment with CD-ROMs in response to BIREME's request was motivated by PAHO's lack of resources, but it also led to the re-evaluation of the convenience of the on-line data base model for information dissemination in developing countries.

Some of the considerations thereafter were made while the experimental CD-ROM project was being defined. Other considerations have come to light during the two year duration of the projet.

2.1 The Initial Investment

As PAHO discovered, the first difficulty created by the on-line model when adopted in developing countries is the large initial investment required.

Given the same storage capacity, the cost of a computer configuration more than doubles if data communication capabilities are also installed.

Mainly due to the required processing speed to support concurrent data base accesses and data communications, the cost of the computer's central processing unit (CPU) must be increased significantly.

The need for permanent availability combined with the requirement of a good response time throughout the network demand not only a redundant

system with capacity to spare, but also a very skilled team of technicians to support it.

Therefore, the installation of an on-line data base system requires a large initial commitment of funds, and must be expected to generate high recurring costs.

Ultimately, the price of the information delivered will be a function of the overall operating costs plus the pay back share of the initial investment made in the central site. This means that the network price structure may be too high for individual users, specially when there is not a large market of information consumers available to pay for network services.

2.2 The Information Delivery

In the developed countries, the cost of telecommunications caused by the on-line information dissemination process is marginal. It is only taken into consideration for defining price policies.

In the developing countries, however, the cost of the telecommunication component is not only a considerable share in the information consumers' total expenditures, but it is also at the core of most of the problems affecting the on-line data base model.

To gain access to any remote data base, a user must pay up front for a terminal and a modem plus the corresponding initial registration fee, if any.

Assuming that a telephone line is available at the user's location, the day to day usage cost of an on-line data base will consist of the access fees, the connect time, and the use of the line, charged by the telephone company according to the duration of the call.

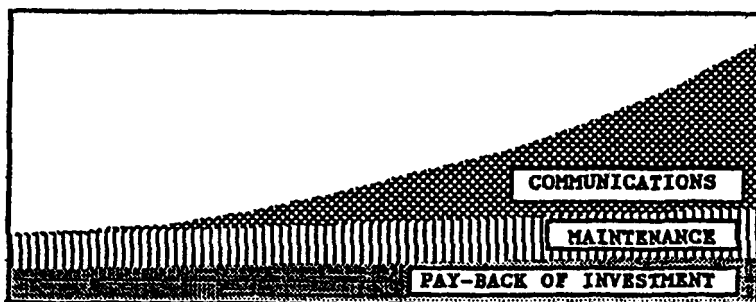


Figure 1 – Typical curve of costs of an on-line information delivery system in function of the number of users and the volume of data delivered

In the developing countries the use of public telecommunication systems is usually very expensive in comparison to the local cost of living. Furthermore, few of those systems offer reasonable quality.

The unreliability of the public telecommunications system, frequently interrupting a call, may turn out a simple remote data base search into an expensive nightmare of repeated unsuccessful access attempts.

The technical deficiencies of the public systems are not the only contributors to the unfavorable situation for a developing country. Its educational system at all levels make minimal, if any, use of on-line data bases in support of their student's work due to the problems already described.

Therefore, the educated population, which could become frequent users of on-line data base systems, is not at all familiar with them. This situation results in general inexperience in handling searches in remote on-line data bases.

Then, when the demand for information becomes unavoidable, the inexperience of those infrequent users will result in excessive search time, increase the telecommunications cost considerably.

All those problems and costs combine to make individual users of on-line data bases in developing countries a rather small group. Consequently, in the absence of a reasonable market, there are almost no local private on-line information providers.

The very small national market for on-line information in developing countries forces the local governments to intervene, since the private sector does not have incentives to establish information services to benefit the community.

The growth of the local use of foreign data bases residing in the developed countries sometimes brings with it a sophistication of solutions well beyond the local level of development.

2.3 The Role of the Governments in Developing Countries

In general, the poor return on investments offered by the lack of a local profitable market, sometimes forces the governments in developing countries to participate directly in their own economies as private enterprises to ensure that a certain product or service is locally available.

The alternative of simply becoming a consumer of less expensive imported goods or services, already amortized by a large worldwide market, may seem attractive but it will certainly demand more scarce hard currencies.

Typically, to start a new state-owned enterprise, the governments resort to foreign donations, grants, and favored or commercial loans. The huge international debt of the developing countries shows outcome of those operations.

Later, when the result of the initial investment is in operation, most governments do not have ways to make it self-sustaining because the local market is small and its customers can barely afford the price of the product or service offered.

Simply put, the governments not only have to make the initial investment, they also have to cover all of the recurring costs of the installation. As operational expenses are seldom covered by external donations, grants or favored loans, they have to come from the government itself or from the consumers. The telecommunication services are an example of the second case, which explains why they are so expensive.

Even though structured information of public interest is in general very important everywhere, but it is not perceived as being capable of generating badly needed immediate impacts in a developing economy, consequently it rates low priority among national policies.

Since the funds remaining in the national budget after the payment of the external debt barely allow for the maintenance of essential services in the hands of the governments, the chances of survival of information dissemination projects are bleak, to say the least. For this reason, even if a government finds external resources to build on-line information systems, they will seldom have the means to maintain them properly.

2.4 The Use of International Databases

The access to international data bases from developing countries can be seen as a mixed blessing. Besides the high costs charged in hard currencies which are multiplied by the problems already discussed, the practice brings with it both positive and negative factors.

The opportunity to learn through the mistakes already made by a more advanced society is invaluable. It may offer a developing country the opportunity to seek more promising alternatives to do the same things,

diminishing the probability of failure. Unfortunately this is seldom what happens.

The solutions found in more developed countries for the problems a developing country is facing or will face in the future are certainly of capital importance also.

Governments sometimes feel, with good reason, that the magic solutions may require a technology, a process, or even a product or service well beyond the reach of the local development stage. In such cases the solution may actually increase the pressure on the country's always troubled balance of payments. There may also be other apprehensions of a cultural nature.

The delicate political problems many developing countries are now facing in regard to the establishment of trans border data flow policies are also an important concern.

Undoubtedly, the access to international data bases is indispensable for any country willing to participate in the community of nations which the world has become. Many countries, however, exercise this option cautiously.

In most cases, international data bases are only accessed when the nature and actuality of the subject justifies their use. Even then they are accessed by specialized government agencies functioning as intermediaries between the on-line data bases and the local users.

3 The CD-ROM Alternative for Information Delivery

The CD-ROM, Compact Disk Read Only Memory, which is produced exactly as the increasingly popular audio Compact Disk, can store about 550 megabytes of data. It differs from the audio CD only in respect to the additional levels of error correcting codes used to minimize the occurrence of errors in the digital signal.

A single disk, which costs only a few dollars to replicate in quantities, is capable of storing an amount of text equivalent to that contained in almost 1,000 books of 200 pages each, or the equivalent of about 1,500 floppy disks. CD-ROM disks are small, lightweight, and extremely robust. A portable personal computer equipped with a CD-ROM reader can provide massive amounts of information virtually anywhere.

This amazing new media can overcome, as will be seen, many of the difficulties created for developing countries when on-line data base systems

are used. This is specially true for the reasonably stable information contained in most of the reference data bases of general interest.

Actually, stable reference data bases stored in CD-ROMs can easily be distributed through an array of geographically dispersed centers by mail, opening a wide range of possibilities for knowledge dissemination, without the support of telecommunication systems.

Following the same pattern of analysis previously applied to the on-line data base model, the analysis of the CD-ROM model will also start from the initial investment necessary to implement the technology.

3.1 The Initial Investment and Recurring Costs

Considering the total storage capacity of a CD-ROM disk it is clear that a small minicomputer or even a large microcomputer can manage a data base of similar size provided only that they are equipped with enough disk capacity.

Of course the central site computer where the data base is maintained should have a storage capacity greater than 550 megabytes because it has to handle numerous other operations in addition to make searches.

Since no remote data communication is required, the response time for data base operations is not a matter of concern. In this sense, the central computer power may be a fraction of that employed to handle the same data base under an on-line environment.

The net result is a much less expensive central system configuration requiring an initial investment smaller by orders of magnitude when compared to that required by an on-line system.

Consequently, due to the greater operational simplicity, the recurring maintenance costs of the installation will be much smaller, as will the amortization costs of the initial investment. Then, if only the central facility is taken into account, the CD-ROM model will demand a much smaller initial investment and much less expensive maintenance.

As already pointed out, the price of the information will depend in part on the cost of the central site's maintenance combined with the pay back of the initial investments. In the case of the CD-ROM model, the amount charged to the users will be significantly reduced.

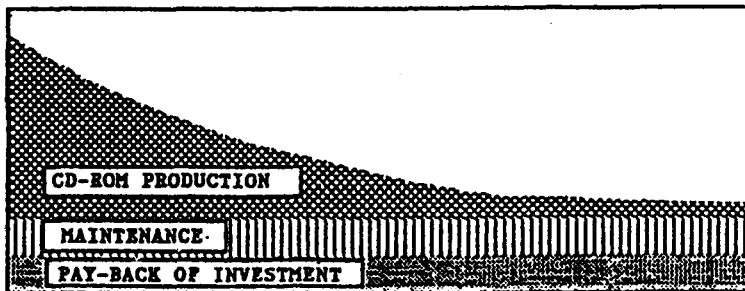


Figure 2 – Typical curve of costs of a CD-ROM information delivery system in function of the number of users and the volume of data delivered

3.2 The Information Delivery Process

The information delivery in the CD-ROM model comprises the creation of a master disk containing the data base, the replication of the CD-ROM disk copies and their distribution bundled with required retrieval software.

The CD-ROM master is cut according to a formatted standard magnetic tape containing the data base to be delivered. This service is provided by several commercial companies also involved in the replication of disks.

The process for mastering and replication of CD-ROMs are identical to those performed to produce audio CD disks. Therefore, any producer of audio CDs can provide the required services.

The mastering tape may be recorded by the central site computer or by an independent premastering equipment.

When a separate premastering facility is utilized to generate the tapes needed for the CD-ROM master's preparation, the initial investments in the premastering facility and its respective maintenance must be proportionally included in the delivery cost.

The approximate cost of an independent CD-ROM premastering facility runs around US \$50,000.00 for the initial setup expenditures and about US \$8,000.00 for maintenance each year..

The production of CD-ROMs encompasses:

1. The conversion of the files of the central data base into a format suitable for access by a personal computer.
2. The test of the converted data base under the microcomputer's retrieval software to be used in conjunction with the CD-ROM. This can be done employing a small subset of the original data base.
3. It is also recommended that performance tests be made by simulating the normal behavior of a CD-ROM reader. Sometimes the relative location of different files over the surface of a CD-ROM can have significant influence on the overall response time of the system.
4. The generation of the tapes in the format required by the external contractors responsible for the preparation of the CD-ROM master.
5. The placement of the order for the preparation of the CD-ROM master and the replication of the required number of disks.

If the mastering tape is produced at the central computer facility, the costs resulting from the conversions and tests described above can be seen as an extension of those of the central site.

A typical pricing scheme for the production of CD-ROMs in the United States is presented in the tables below. The first table shows the price of the production of each master depending on the number of masters to be ordered during one year. The mastering price table also takes into account the total turn-around time for mastering and replicating a batch of disks.

Production Cost of a CD-ROM Master

Masters per Year	Turn-Around Time (days)			
	3	5	10	15
1 - 11	\$4,100	\$3,300	\$3,000	\$2,700
12 - 23	\$3,900	\$3,100	\$2,850	\$2,500
24 - 35	\$3,700	\$2,950	\$2,700	\$2,350
...				
84 - Up	\$2,750	\$2,200	\$2,000	\$1,800

The second table presents the price per disk according to the quantities ordered in each replication batch and also the requested maximum turn-around time.

CD-ROM Replication Unit Price

Number of Disks	Turn-Around (days)	
	3-5	10-15
1 - 50	\$8.00	\$6.00
51 - 100	\$6.75	\$5.50
101 - 300	\$6.00	\$4.75
301 - 500	\$5.50	\$4.25
501 -1000	\$5.00	\$3.75

The third table was constructed from the figures in the previous ones but presents the composite unit cost of a CD-ROM, considering both mastering an replication.

Unit Cost of a CD-ROM (including mastering)

Disks	Mastering	Replication	Unit Price
50	\$54.00	\$5.50	\$60.00
100	\$27.00	\$4.75	\$32.50
300	\$9.00	\$4.25	\$13.75
500	\$5.40	\$3.75	\$9.65
1000	\$2.70	\$2.75	\$6.45
2000	\$1.35	\$2.75	\$4.10

As the last table shows, the costs involved in the production of CD-ROMs decrease when more disks are produced. In a certain sense, this means that the more information is delivered, the less the process will cost. This tendency is clearly the opposite of what happens when information is delivered by telecommunication systems.

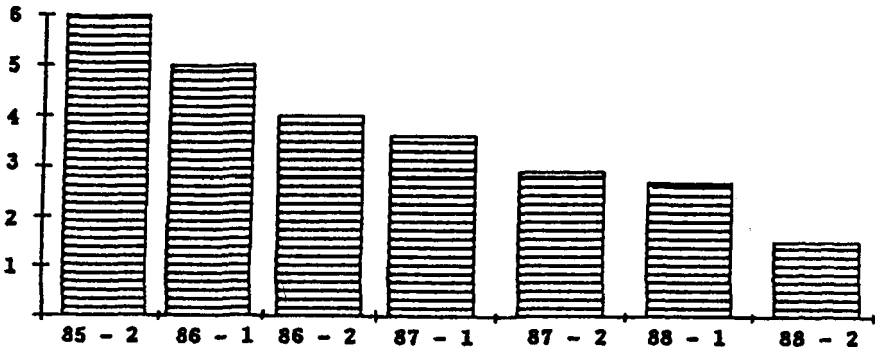


Figure 3 Costs of producing a CD-ROM master, each semester since 1985, in thousand dollars

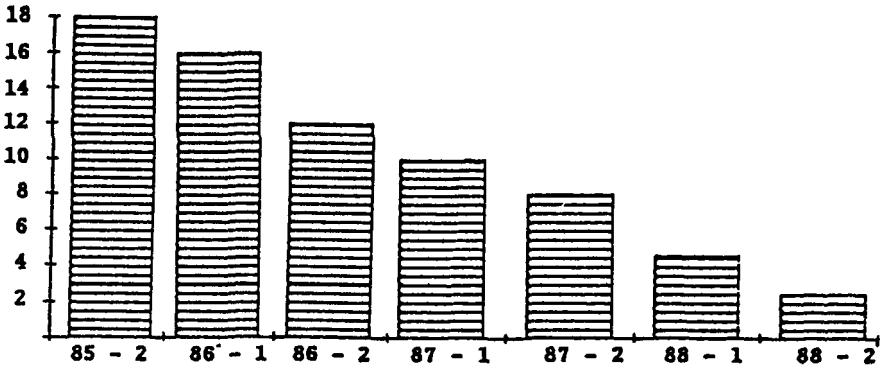


Figure 4 Unit cost in dollars of a CD-ROM, when produced in batches of 100, each semester since 1985.

The cost of the distribution is comprised of the postage of the CD-ROM plus the cost of a floppy disk containing the CD-ROM reader's installation programs.

From the users' standpoint, the CD-ROM model seems to call for a higher initial expense for the local equipment. Instead of a dumb terminal priced around US \$400.00 plus a US \$200.00 modem, each user will need a CD-ROM reader attached to a suitable microcomputer.

In the American market a complete IBM AT compatible microcomputer costs about US \$2,000.00 and a CD-ROM reader adds about US \$600.00 to the equipment's configuration cost. However, given the worldwide proliferation of personal computers, a great number of potential users may only need the CD-ROM reader added on their existing PC system.

Even though a PC configuration will demand more expensive maintenance than a terminal, the higher cost can be entirely justified by its superior functionality.

Another share of the total users' cost imposed by the CD-ROM model which must be considered is the cost of the necessary retrieval software package for the microcomputer which will actually make the information available.

As the CD-ROM cannot be modified, the retrieval software is much simpler than any conventional data base management system (DBMS). Furthermore, since the software only has to handle well defined data structures, a simple program can be developed without the flexibility expected of a complete DBMS.

In addition to looking at the current production costs of CD-ROM disks and the price of CD-ROM readers, it is also helpful to examine the industry trends. The readers, initially priced well above US \$1,000.00, are now available for around US \$600.00 complete with cable, interface board and the software driver.

The cost of the master preparation and the unit price for replication of CD-ROMs are both decreasing very rapidly as can be seen in the tables below.

CD-ROM MASTERING PRICES (each semester)

85/2nd	86/1st	86/2nd	87/1st	87/2nd	88/1st	88/2nd
\$6,000	\$5,000	\$4,000	\$3,600	\$2,900	\$2,700	\$1,500

CD-ROM REPLICATION PRICES (each semester)

85/2nd	86/1st	86/2nd	87/1st	87/2nd	88/1st	88/2nd
\$18.00	\$16.00	\$12.00	\$10.00	\$8.00	\$4.60	\$2.50

The average costs shown in the tables above are based on the assumptions that only one master is prepared each year and also that only 100 disks are replicated with a turn-around time of approximately 20 days (although the maximum turn-around time is now 15 days).

As the CD-ROM is basically produced by the same equipment used to produce audio CDs, the deeper the penetration of compact disks is in the audio consumer market, the lower the production cost of both audio CDs and CD-ROMs will be.

Given this direct relation to the large recorded music market, a reasonably long life can be anticipated for the technology. Experience shows that it always takes a long time to change a well established consumer standard.

4 How the Information Dissemination Models Compare

The costs for a user of on-line information are composed of:

1. A share of the cost of the information.
2. A share of the maintenance costs of the on-line database operation plus the necessary pay-back of the investment.
3. The communication costs.
4. The purchase price of a terminal or microcomputer and a modem plus the cost of their maintenance.

If the CD-ROM model is adopted, the cost for a user will be composed of:

1. A share of the cost of the information identical to that of the on-line model.
2. A share of the maintenance costs of the reduced central site plus the pay-back cost of the smaller initial investment.
3. The production cost of the CD-ROM disks, a share of the pay-back of the investment made in the mastering facilities (if not included in the central site), plus the distribution costs. The cost of the retrieval software distributed with the database should also be added if required.
4. The purchase of a microcomputer equipped with a CD-ROM reader and the corresponding maintenance.

The major differences in cost come from the proportional cost shares generated by the installation and maintenance of the central data base and from the cost of information delivery process.

Clearly, the initial investment and the maintenance of a central facility set up with a minicomputer and without data communication capabilities are much less expensive than a facility equipped with a sophisticated transaction processing mainframe computer.

The total cost difference in this class of expenditure will vary according to the size of the data base and the actual number of its potential users.

For each particular case, the cost, must be evaluated for the specific set of variables that apply.

It is worth noting, however, that, if only the central data base is considered, this share of the total cost for the CD-ROM model is independent of the number of users. Conversely, the size an maintenance costs of an on-line installation will grow as the number of users increases.

Nevertheless, the more striking disparity comes from the information delivery cost represented by the telecommunications in the on-line model in contrast to the disk production plus mail distribution in the CD-ROM model.

As the previous tables indicate, one can conservatively assume that the cost of mastering a CD-ROM will be approximately US \$2,500.00 and the unit price for its replication will be about US \$4.00.

The cost of mailing the finished disks is sufficiently small, considering the other costs involved, to be ignored.

Based on the CD-ROM storage capacity of 550 megabytes, one can estimate the information delivery cost differential between the two models in question by taking into account a specific data base or data bases, the potential number of users and their respective geographic locations.

Since many variables are involved, and each one of them must be determined for every particular case, only the behavior of the cost curves will be analyzed.

To compare the costs of the information delivery generated by both models, it is useful to imagine a global cost incorporating the total number of potential users and the amount of data each of them receives.

For the on-line model, the information delivery cost curve departs from the recurring cost curve and will grow continuously as a function of the increase of the number of users and the volume of data delivered.

The equivalent cost curve for the CD-ROM model displays the opposite behavior. It will start at a level defined by the sum of the smaller fixed costs originated by the central site, the recurring costs of the premastering facilities, and the production cost of 100 disks (minimum). From that level, if one plots the production cost of the CD-ROM as function of the volume of data and the number of users, which in fact means number of disks, one will find that the total cost decreases as the number of disks increase.

In attempting to justify a project in terms of costs and expected returns, these considerations have only to be combined with the costs incurred at the users' site.

The price of a microcomputer equipped with a CD-ROM reader is still higher than that of a terminal and a modem. Furthermore, the CD-ROM user may also have to pay a share of the cost of the retrieval software.

The factors that initially seem very unfavorable in terms of users' costs for the CD-ROM information delivery model, in fact are not so unfavorable if the analysis is further broadened.

A terminal/modem setup can be used to access several different on-line data bases just as the microcomputer/CD-ROM reader setup can read several different data bases on CD-ROM disks.

To best determine how those two things compare, one should bear in mind the current cost of a typical CD-ROM data base.

The very well know MEDLINE database is currently available on a CD-ROM for about US \$1,200.00 as a subscription, which includes the shipment of four update disks per year (a new disk every three months) and the retrieval software.

If we calculate the annual user cost for each delivery model considering several data bases, it will be immediately apparent that the cost of the users' equipment can be disregarded when compared with the cost of the information. This can be done by comparing the annual data base charges and telephone bills for the on-line model to the price of the disks for the CD-ROM model.

Moreover, if only one data base is considered, the results are even more shocking.

Consider the case of a user who has to access the MEDLINE data base continuously during 8 hours a day five days each week. If the MEDLINE CD-ROM is used, the user will incur a fixed cost of only US \$1,200.000. If, on the other hand, the user accesses an on-line data base for the same amount of time, anyone who pays a telephone bill every month will readily agree that the access costs will skyrocket.

5 Other Factors to Consider

The great success of the personal computer was mainly due to the fact that it is there, on-site totally under control. Its operation, because it is personal, has no unpleasant consequences for the user or anybody else. Nothing done with it can be traced unless the user wants it traced.

The on-line systems, on the contrary, usually track every user action and typically offer a human interface so poor that frightens the novice user.

Until recently only well trained users would dare to approach a computer terminal and try to deal with its cryptic interface.

Although the human interfaces of on-line data base systems have improved substantially, the sensation of being controlled by the machine is still a clear part of the user's perception. Experience indicates that this "who is in control" situation is one of the most important concerns in the design and development of better user interface software.

Consequently, if novice users are given the opportunity to access a data base through an on-line interface on the same data base on a CD-ROM, they will almost always prefer the CD-ROM access method. In developing countries, where most of the potential users of information are inexperienced, a data base on a CD-ROM, apart from the cost considerations already discussed, will certainly look more attractive.

After some experience is acquired through searching information on CD-ROMs, a user will be much less frightened to approach an on-line data base terminal.

The familiarity gained with the information retrieval process through CD-ROM access will certainly increase the general awareness of its importance, as well as fostering the use of on-line data bases when more updated information is needed.

Thus, because the CD-ROMs are accessed through personal computers they produce the same kind of fascination those machines induce in people in general. This is likely to promote the use of information as well as to provide novice users with the needed experience for accessing on-line data bases.

And last, but not least, CD-ROMs can contain full text, pictures, and sound. These characteristics permit the association of multi-media features to data bases or knowledge bases, making the CD-ROMs even more powerful information delivery devices for a broader audience.

6 Conclusions

Based on the information presented thus far, the advantages of the CD-ROM as media for information delivery in the developing countries can be summarized.

If a government, which is usually the dominant player in information dissemination projects in developing countries, adopts the CD-ROM technology and fosters the establishment of data bases on minicomputers sharing a single mastering facility, the initial setup expenses can be considerably reduced.

The initial investment can be reduced further if the services of a private mastering company are employed.

A smaller initial investment in less powerful, less complicated computer equipment insures that subsequent maintenance costs will be proportionately reduced.

By placing microcomputer/CD-ROM reader sets in educational institutions and providing incentives for of awareness of the general population as to the importance of information. This increased awareness will undoubtedly benefit the future generations.

The user friendliness and constant availability characteristics of the CD-ROM model will certainly attract many users, who otherwise would not be gathering information to enrich their work.

As a result of the small cost of information delivery through CD-ROMs, which decreases as the number of users grows, there will be no reason not to make public many of the centralized data bases currently in the hands of the governments.

It should be noted without further discussion that freedom of choice and, ultimately, democracy have a lot to do with the amount of information a community has access to.

If, in fact, the greater familiarity with the use of information increases the demand for international on-line data bases, the governments can provide the user community with service sites specialized in extracting information from those data bases, as some countries already do.

It is assumed that the national community of CD-ROM users will also have access to existing international data bases on CD-ROM, finally making the desire of the developing countries to internalize foreign data base a reality.

This scheme tends to reduce the expenditures in hard currency because it will only be required in specific cases when very current information is needed, or the information is not available in CD-ROMs. Furthermore, the use of CD-ROM can also benefit the operation of those service centers dedicated to information retrieval from international data bases in ways which are not readily apparent.

Those centers maintained by the local governments, frequently employ specialists to search data bases according to users' requests which are not always clear and straightforward. The clients may know exactly what they want, but they are seldom able to communicate their needs to the specialist in charge of the search.

On one side there is a specialist in some field of knowledge who is not familiar with data base searches while on the other side there is a specialized data base operator not familiar with the field of knowledge in question. This situation complicates further the information retrieval process.

Using the MEDLINE data base as an example, one can first search the CD-ROM version to determine exactly what the pertinent references are. In addition, the user can not only identify the essential key words, but also establish how they are related in boolean expressions.

If more updated information is needed, the same search formulations used for the CD-ROM can be given to the on-line data base operator, who will then be able to immediately obtain the information required without any further clarification.

Considering the political implications induced by the international information flow, as the CD-ROM disk is a solid object with a fixed and previously known information content which anyone may acquire or not acquire, there will be no conflict with any trans border data flow policy.

Finally, although the CD-ROM is the result of an amazing new technology which fits extremely well in the typical developing country environment, it is not a panacea. Care must be exercised in completely defining the information to be delivered (volume, volatility, etc.) and also in anticipating the consequences of its distribution.

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