Applications and transfer of information technology in veterinary research in developing countries: the Nigerian experience

S.N. Chiejina [*], B.B. Fakae

Department of Veterinary Parasitology and Entomology, University of Nigeria, Nsukka, Nigeria

Abstract

An overview and analysis of the current status of information technology (IT) and its role in animal health research and development (R & D) projects in developing countries have been undertaken. This study is based mainly, but not exclusively, on the Nigerian situation and experience, which are considered to be typical of those in the majority of developing countries where IT is still in its infancy, and few individuals and institutions engaged in R & D projects have access to computing and modem, reliable telecommunications facilities. The analysis has emphasised the following: the limited impact of IT on large-scale field projects; the major factors militating against its successful acquisition, application and transfer; short- and long-term needs and priorities for IT; IT inputs for effective implementation of field projects and exchange of R & D information. Of the numerous factors which have hindered the growth and transfer of IT in much of the developing world, the most important are: (1) weak science and technology (S & T) base; (2) shortage of highly skilled front-line scientists, technologists and information professionals; (3) inadequate financial resources. Experience gained from three field projects highlighted the fact that although IT inputs, such as computers, are vital for the efficient management and rapid communication of research information, careful planning of projects, adequate financial and logistic support, availability of skilled manpower and basic infrastructural facilities are indispensable for the effective utilisation of the inputs. A promising and cost-effective method of transfer of IT inputs to those countries which can hardly afford them at present is through the establishment of institutional research links between developed and developing countries. Successful partnerships usually provide, among other things, computing facilities and manpower training for the latter and opportunity for genuine research collaboration. This form of IT transfer is an important step towards increased application of IT inputs in R & D projects, creation of the much needed inventory of databases and information systems on animal health projects in developing countries.

* Corresponding author. Present address: Department of Life Science, University of Nottingham, Nottingham NG7 2RD, UK.

Only then can meaningful exchange of R & D information, in an acceptable format and at affordable price, be realised within and between them. A possible role is envisaged for the major international organisations such as the Food and Agriculture Organization of the United Nations and the United Nations Educational, Scientific and Cultural Organization in ensuring the success and sustainability of these developments.

Keywords: Developing countries; Information technology; Nigeria

1. Introduction

Information technology (IT) may be defined as the acquisition, processing, storage and dissemination of information by a microelectronics-based integration of computing, telecommunications and video (Longley and Shain, 1989). Computing provides the capability for enhanced storage and rapid processing of information, telecommunications provide the capability for dissemination and exchange of the information, and video provides the facility to display and visualise the information. In technologically advanced countries recent developments in IT have been so rapid and their impact so far-reaching that there is virtually no aspect of life that has not been fundamentally affected by it. Nowhere are these advances more noticeable than in teaching, learning and scientific research, where computers and software packages are widely available for audio, video and data communications and there is easy access to, and rapid exchange of information through on-line local, national and global information networks.

This is in marked contrast to the situation and practice in developing countries, where, with a few exceptions (Ramani and Garg, 1988), economic and technological under-development and associated constraints have hindered the development and exploitation of IT in higher education in general and in scientific research in particular. In many of these countries only relatively few individuals and institutions involved in animal health research and development (R & D) have ready access to computers and modern, reliable telecommunications facilities. However, the extent to which IT has developed and is being applied in these countries is likely to vary markedly, given their socioeconomic and cultural diversities and differences in standards of educational and technological development. There is also the added problem of lack of a ready source of information on the current status of IT in most of the countries. Therefore, a comprehensive account of the application and transfer of IT in the whole of the developing world has not been attempted. Rather, we have limited ourselves to the situation in Nigeria, which, we believe, is similar to those in the majority of developing countries where IT is still an 'emerging technology'. The emphasis has been on the current status of IT and its impact on animal health R & D, some common constraints on its acquisition and transfer to end-users, and present and future needs and priorities in animal health R & D projects.

2. The current situation and constraints

In Nigeria the use of computers in teaching and learning at all levels of education as well as in research is still in its infancy. Although computer science, micro-electronics and video technology are important and growing disciplines in many institutions of
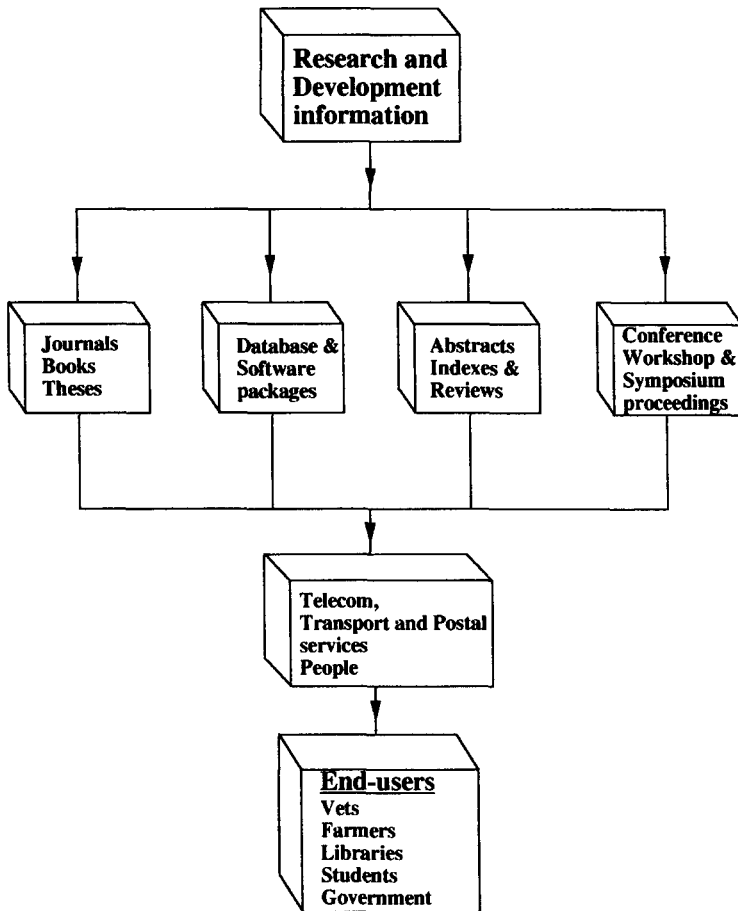
Fig. 1. Methods and channels of communication of R&D information to end-users in developing countries. Adapted from Lambert and Lambert (1991).

higher learning, and an increasing number of individuals and departments at these establishments own microcomputers, the integration of computing and telecommunications into a distinctive local or national data communications system is yet to be realised. Moreover, many of the available personal computers (PC) are not user-friendly and few have sufficient RAM and disk space to handle available modern software packages, especially those on CD-ROM. Minicomputers and mainframes are far and few between, and no local or national information networks are in existence.

Consequently, few of those involved with animal health R & D and with communication of the results of such work to end-users are in a position to utilise modern tools of IT. Thus, the acquisition, processing and exchange of information on veterinary research projects in the country are achieved through conventional methods and channels (Lambert and Lambert, 1991), which require minimal IT inputs such as computers (Fig. 1). In practice, many of these communication channels rarely work, are slow, relatively

expensive, or are restricted in their availability. However, a few large libraries and organisations provide computerised literature searches for researchers in their locality on a fee-paying basis. Unfortunately, this service is not only highly limited, but is relatively expensive and so contributes little to the alleviation of the current chronic research information famine in the country.

This has inevitably had a negative impact on many R & D projects in the country, particularly with regard to co-ordination of project activities and exchange of research information. Two nationally coordinated field projects dealing with the epizootiology of bovine trypanosomosis and rinderpest are notable examples. Four universities and two research institutes are involved in these projects. Each is equipped, among other things, with field transportation, a microcomputer installed with CIA (Gardner and Altman, 1994), EPI INFO (Forster and Sullivan, 1989) or other software packages. The primary objective of these projects is the creation of a comprehensive national database on the epizootiology of the two major epizootics, as a basis for informed planning of future national control schemes and laboratory-based studies. Although many data have been collected by many of the participating centres, the primary objective is yet to be achieved, nearly 5 years after the inception of the projects.

However, a third major national livestock project (Anonymous, 1992) was considerably more successful. This project also set out to create a comprehensive national database on the following aspects of the nation's livestock resources: (1) estimates of population densities and distribution of all classes of farmed–meat animals, including cattle, small ruminants, pigs, poultry, rabbit, giant rat (*Cricetomys gambianus*) and snails; (2) the common naturally occurring diseases of these animals; (3) animal husbandry and production systems, vegetation and land use; (4) marketing systems and socioeconomic indicators. The 2 year survey, which was a joint venture between a foreign consulting firm and Nigerian veterinary, agricultural and technical personnel, achieved all its objectives and provided detailed and up-to-date information on all the above parameters. This information is held in the National Livestock Resources Survey Database (Anonymous, 1992). The developed country input in the partnership was, however, substantial and included aspects of the initial planning and manpower training, aircraft and crew for the systematic reconnaissance flights employed in aerial mapping and surveys, geographical information system (GIS) software, data processing and the publication of the four volumes of the major research findings (Anonymous, 1992).

One of the lessons to be learnt from these projects is that the success of such large-scale field projects in developing countries may not depend entirely, or even to a major extent, on the supply of IT inputs. Careful and detailed planning, adequate financial and logistic support, skilled manpower and basic infrastructural facilities must exist before such inputs can be effectively utilised. Some of the most important factors militating against the acquisition of IT, its effective application in R & D projects, and transfer within and between developing countries are shown in Fig. 2. These revolve around three interrelated factors:

1. poorly developed science and technology (S & T) base and shortage of skilled front-line indigenous engineers, information professionals, scientists and technologists. This inevitably results in over-reliance on foreign sources for virtually all aspects of IT, including even databases and software packages. There is currently a
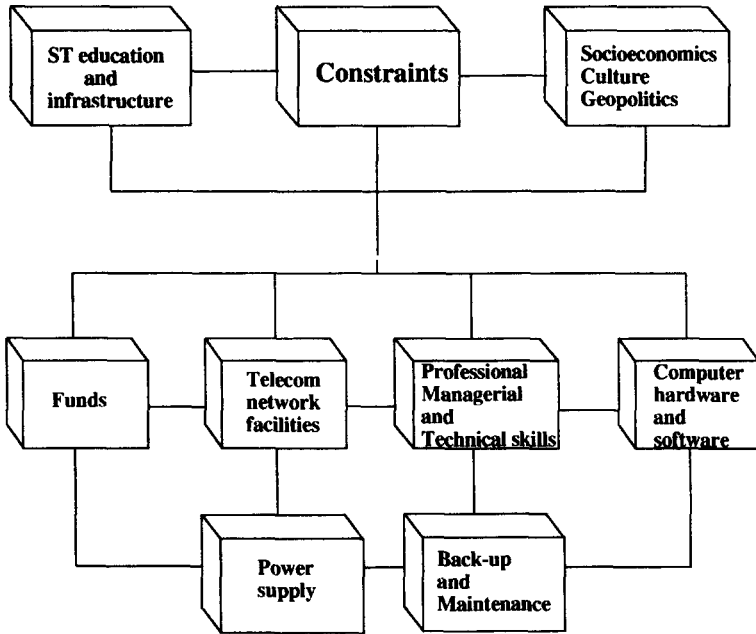
Fig. 2. Constraints on the acquisition and exchange of IT and research information in developing countries.

high level of computer 'illiteracy' and technophobia among indigenous personnel involved in R&D work in many developing countries, arising out of lack of access to, or familiarity with, the use of computers.

2. Unreliable telecommunications and municipal, especially electric power supply, services. It has been estimated that, by the turn of the century, 10% of the world's
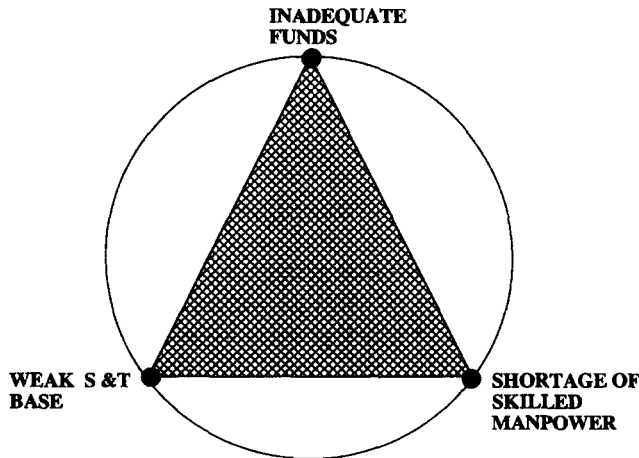

Fig. 3. The vicious circle of technological underdevelopment and dependence.

electricity will be consumed by computers (Thurgood, 1994). Few developing countries currently have enough electricity generating capacity to guarantee adequate and uninterrupted power supply (USP) essential for the efficient functioning of computers and other component systems of IT.

3. Lack of financial resources either to embark on the necessarily long-term development of indigenous S & T base and IT infrastructure or to acquire, in the short term, the urgently needed IT inputs (Forje, 1994). Many developing countries are therefore trapped in a vicious circle of IT under-development and dependence (Fig. 3).

3. Present and future needs and priorities

IT has become extremely mobile as well as versatile and international in its scope and application, a situation catalysed by the increasing importance of on-line national and global information network systems and the introduction of more powerful and relatively inexpensive clones of computers and interactive multimedia software packages. There seems little doubt, therefore, that the future will witness even more reliance on IT for learning, teaching and research. As very few developing countries have currently established, or have the resources to establish, an indigenous IT capability, no significant progress in the transfer of IT within and between them is feasible in the short term. They, especially the poorest among them, are therefore likely to depend on foreign transfer of IT, at least in the short to medium term, for their requirements. Their dilemma is how to embrace this fast-developing technology in the face of ever-dwindling resources and at the same time accomplish their other equally, or even more pressing, developmental projects, particularly in the fields of agriculture, education, health and social services. The best way forward is for each country to clearly identify its own peculiar short- and long-term needs and priorities for IT in the context of their overall national socioeconomic and S & T developmental policies and to evolve appropriate strategies for achieving them. This may involve making a difficult choice and distinction between what they want, what they need and what they can afford.

A recent, promising development which has contributed somewhat to the alleviation, in the short term, of the problem of research data management and exchange, word processing and literature searches in some universities in Nigeria is the establishment of centralised or common computing facilities for a number of departments and faculties, which have research links with counterpart institutions in developed countries or with local industry. Such shared facilities, which are usually of simple configuration, consisting of a PC with a floppy disk drive, printer, an optional CD-ROM drive (Fig. 4), a USP source and a limited range of software packages, should be adequate for the current computing needs of most livestock projects in developing countries. Ideally, the machines should be rugged, user-friendly and easily upgradeable; they should have sufficient central storage capacity to handle CD-ROM software formats and to be able to cope with the expected large number of potential users. They should consume as little electricity as possible and have a mechanism to automatically switch themselves off when not in use and during very low or wide fluctuations in power supply. Such a
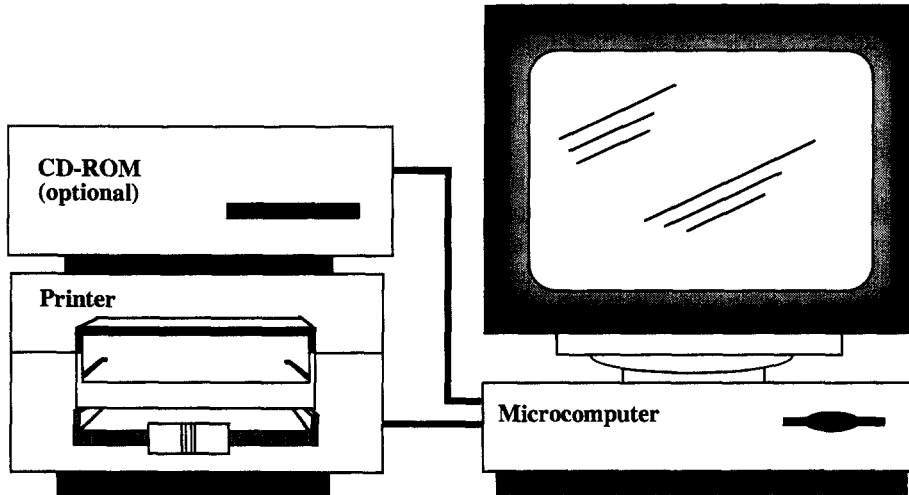
Fig. 4. Stand-alone personal computer configuration.

machine obviously does not yet exist, and if developed would probably be too expensive for users in developing countries. In practice, many good-quality desk-top computers currently on the market would be suitable in many cases. Indeed, many of the large numbers of PCs manufactured within the past 5 years and which are lying idle in factories and warehouses in developed countries, probably never to be used because they have been rendered 'obsolete' by the phenomenal pace of advances in hardware and software technologies, would also be suitable for the currently not too demanding needs of developing countries.

These bilateral arrangements have been found to be a cost-effective means of transfer of IT inputs from developed to developing countries. They provide not only practical training and experience in the use of computers for personnel from the former but also rare opportunities for meaningful research collaboration. With time, and as more of such units, funds and infrastructural facilities become available, local, e.g. intra-university, networks linking all the host computers in each establishment to a server, would become feasible and worth while. This in itself would be an important step towards the exchange of databases and other research information and possibly also the establishment of an inventory of information systems devoted to animal health R&D in developing countries. Most of the existing inventories do not provide this information. Where some information is provided, the databases listed therein, such as CARIS, of the Food and Agriculture Organization of the United Nations (FAO), Rome (De Lavierter, 1994), can apparently be accessed only on-line, a facility which is not readily available in most developing countries. In some countries the cost of an on-line search lasting 10–15 min can be as high as £15 sterling (Lambert and Lambert, 1991). Few, if any, end-users in developing countries can afford, or will be willing to pay, even a fraction of this amount to access any kind of database on a regular basis. International organisations such as the FAO and United Nations Educational, Scientific and Cultural Organization may have a

role to play in assisting these countries to ensure the success and sustainability of these developments in IT transfer.

4. Conclusion

Although the long-term IT developmental objectives of developing countries vary, the early and successful achievement of the objectives will, in every case, depend to a large extent on how quickly and successfully the identified drawbacks and constraints are addressed. For the majority of countries, progress is likely to be evolutionary and will require substantial financial and technical support from developed countries, especially with regard to manpower training and development, modernisation of telecommunications and the blending of the latter with computing to achieve reliable local and national networking capabilities essential for access to global information networks. However, any innovations must form an integral part of the overall national S & T developmental programme and have a strong indigenous character and content, if they are to be sustainable and relevant to the needs of the developing country concerned.

Acknowledgements

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