5 Summary Overview and the Way Forward

Current Realities and Future Challenges

There can be little doubt that for developed and developing countries alike, education has become one of the top priorities for individuals, communities and national governments. It has also become a major area of focus for international organisations, aid agencies and non-governmental organisations. It seems that in a period of rapid change and uncertainty education has become something of a repository for our hopes for the future. There are great expectations about the contribution that education can make in such diverse areas as alleviating poverty; resolving conflict; promoting democracy and good governance; improving economic productivity and competitiveness; safeguarding cultural integrity; enhancing international understanding; and strengthening justice, peace and equality. In general terms, there is a renewed faith in the role of education in helping to create the kind of future in which the majority of people would benefit from an improved quality of life in the economic, social, political and cultural spheres.

It is difficult to fathom the diverse rationales advanced for this renewed faith in education and the expectations associated with it. Indeed, some cynics have argued that there is nothing really new about this. In the past, education has frequently been cast in this same role of repository of our hopes for a better future. Despite undeniable progress and achievements for which education can justifiably take some credit, much of what is wrong in the world today can be attributed to the failure of education to deliver on promises and fulfil expectations. Most developing countries have invested heavily in education in the past, but this has not translated into sustained educational achievements. Instead, their education systems are now in danger of being paralysed by inefficiencies and overwhelmed by a plethora of demands and expectations. The failure to provide equitable access to reasonable quality education for all is perhaps the most evident example of unfulfilled promises. It has often given rise to a sense of betrayal and inequality, which contributes to the social tensions and conflicts that have plagued many societies. It has meant that individuals have not been able to achieve their full potential; communities have remained trapped in underdevelopment, and nations have not been able to make full use of their human resource potential. Ineffective pedagogy and poor quality education have widened the gap between developed and developing countries in educational achievement and outcomes. Similarly, weak management of education systems has resulted in a catalogue of wastage and inefficiencies that have almost crippled some systems and undermined confidence in public education. In the face of such damning indictment, it might well be asked what is the basis for the renewed faith and confidence in education as the main repository of our hopes for the future?

There are at least three lines of argument that can be used to justify such renewed faith and expectations. First, education has brought about very significant achievements, even in the most under-developed societies. In every sector, in every country, there are qualified and trained nationals carrying out essential professional functions and meeting most of the nation's human resource requirements. This is clearly the result of relentless efforts at capacity-building over the years, involving education and training. Moreover, individuals, households and communities have experienced the transforming power of education in terms of improvements in earnings and general quality of life from one generation to the next (inter-generational mobility). At the international level, it can be argued that education has helped to promote better understanding and tolerance across different cultures, political ideologies and economic systems. In short, the world has seen and experienced enough of what can be achieved through education, to justify renewed faith in it. The main challenge for the future is how best to spread the self-evident benefits of education more widely, in order to fulfil the expectations of individuals, communities and nations of the world.

The second line of argument has to do with the growing ascendancy of knowledge and information as the key factors shaping and determining growth and development in the modern world. As the world moves from the old era of industrialisation to this new age of knowledge and information, education has become increasingly important as the key determinant of life-chances and development prospects for individuals and communities everywhere. To a great extent, education has always been an important engine for economic development, social mobility and cultural advancement in society. The age of knowledge and information is ushering in something of a renaissance, which is characterised by a new sense of urgency and radical change regarding the role of education as a repository of our hopes for the future. The twentieth century was characterised by an explosion in knowledge and information, and, more importantly, we continue to witness an exponential growth in the knowledge and information available to us. Given the unprecedented nature of these changes, one thing stands out in this whirlwind world of expanding and changing human knowledge. It is our ability as individuals, communities and nations, to cope with the challenge of constantly acquiring all the changing knowledge and information we need to function, collaborate and compete successfully in every sphere of life. This is not a matter of choice or expediency. It is nothing short of an imperative for survival and development in the modern world! One of the greatest challenges raised by the education renaissance, therefore, is how we should package knowledge and promote learning in a manner which adequately addresses this survival and development imperative. In short, innovations in policies and strategies that relate to the design, delivery and management of education programmes will be at the heart of the renaissance in education.

The third line of argument concerns advances in technology that are fuelling the change from an industrial age to an era of knowledge and information. In general, these advances have made it possible for us to use information and communication technologies in quite novel and revolutionary ways when dealing with knowledge and information. They have enabled us to transform the ways in which knowledge and information can be generated, packaged, transmitted, stored, retrieved, managed, accessed, processed and used. Consequently, we are now more hopeful that with sensible policies, sound strategies and careful planning, we can overcome some of the traditional obstacles that have plagued education. For instance, it may be possible to spread the benefits of educa-

tion to most people, regardless of location and circumstances. It may also be possible to empower individuals, communities and nations to make more informed choices and select from a wider range of options, in deciding how best to meet their own learning needs. Such possibilities have given rise to a renewed sense of optimism about the role of education in shaping the future.

While this renewed optimism may be justified by the kind of arguments outlined above, it should also be noted that education in most countries is fraught with problems and difficulties that pose a serious challenge to its possible role in shaping the future. For all the achievements catalogued over the years, we are still in a world in which close to one billion people are illiterate and over 130 million children cannot have access to primary education. The plight of these millions is increasingly regarded as intolerable in an era of technological surfeit which makes it much easier for information and knowledge to flow rapidly and freely across boundaries. We also live in a world in which the knowledge and information gap between societies and within societies continues to widen in parallel to the existing gap in wealth and development. There are serious challenges relating to this growing equity gap, between countries and within countries, in terms of access to and benefits from education. There are also threats relating to the risk of economic and cultural domination as some societies become richer and others become poorer in the knowledge and information age.

Against this background of current realities and future challenges, this book's main concern has been with the opportunity that we have now to make real and significant changes in education. There is a fundamental sense in which education should learn from the past and envisage the future as it endeavours to serve the present needs and priorities of society in a rapidly changing world. Technology obviously has a major role to play in this education renaissance, but change should not be seen mainly in terms of technology. The starting point for change has to be educational objectives and concerns, with technology being treated as a means to achieving goals in education. This is why the main focus of this book has been on three of the most fundamental challenges faced by many education systems, namely:

- how to spread the benefits of education to all the population, regardless of location and circumstances, in a manner that adequately addresses different learning needs;
- how to promote and safeguard an appropriate level of quality in the content and process of education to cope with the dynamics of change in human knowledge; and
- how to manage a wide diversity of education provisions for greater effectiveness and efficiency as well as to promote better integration of alternative options in the system.

In addressing these fundamental challenges, the primary focus and emphasis has been on issues, principles and practices relating to education. Technology has been considered mainly in terms of the role it can play in facilitating solutions to the problems faced by countries in their efforts to deal with these educational issues. This book has avoided the usual danger of technological determinism, by portraying technology as a tool that serves human purposes in dealing with education, rather than an end in itself to which education must conform. There has a deliberate attempt to outline possible uses of a wide range of technologies, rather than being confined to computers and the latest information-communication technologies.

Making Choices and Assessing Consequences

Perhaps the first and most important advice for policy makers and professionals who make decisions in education is that they should recognise and appreciate what is positive about their existing education system. It is easy to be cynical and over critical about the problems; and the search for solutions is a perennial task. We should not lose sight of what is being achieved in education despite the difficulties and against great odds. Overzealous researchers and reformers are urged to be humble and to recognise that a functioning education system is a miracle of social creation that should not be lightly abandoned. This is very much what Skillbeck meant when he pointed out that 'what goes on, even in the poorest schools, is infinitely more complex than what a computer can do'.

Despite the problems of access, quality and management, positive achievements are a routine feature of most education systems. Every day, and in many ways, young minds are being inspired; skills are being acquired; values are being shaped; characters are being formed, and new generations are being initiated into the universal heritage of human understanding, and introduced to the rich culture of knowledge and skills that can transform lives. The challenge for decision-makers is to develop the kinds of policies and strategies that would make these sorts of positive achievements a reality for the great majority of their citizens, on a routine basis. We need to have a deep understanding of how education systems function to promote these achievements, and where they are failing to meet the expectations of various interest groups. Without this, there is a danger that we may be lured into adopting 'quick fix' solutions to the many problems which undoubtedly exist in education. The main focus should therefore be on educational issues and the kind of challenges that need to be addressed, rather than technological fashion and the desire to be in line with the latest tools.

The second piece of advice for policy makers is that they should acknowledge and accept that the shift to an era of knowledge and information is a reality that cannot be reversed or diluted. There are several dimensions to this shift that pose a challenge for education systems. For instance, the shift implies that individuals will need to be able to take much greater responsibility for accessing and selecting the kind of information and knowledge that addresses their needs. Education systems which remain very prescriptive and restrictive will become counter-productive in the face of such new demands. In much the same way, the desire for continuous learning, as a survival imperative in a rapidly changing world, means that we will have to liberalise the time-bound and place-bound nature of our current education process.

Third, decision-makers need to be acutely responsive to the fact that the new information and communication technologies have the potential to bring about a positive revolution in education. This is already happening in many societies as these technologies impact on the ways in which we package, disseminate and access the wide range of knowledge and information now available to us. There is no getting away from these developments, and every country must make choices about the use of these technologies in education. It is not a matter of whether or not to invest in such technologies, but how and when to do so, in a manner that will best address the challenges facing different education systems.

Fourth, decision-makers would be well advised to be wary of the dangers of technological determinism in attempting to deal with educational problems. There are strong pressures to introduce modern technologies in education. These are fuelled partly by a

fear of being left behind in the information and knowledge revolution that is being driven by these very technologies. This fear is constantly being reinforced by the intensive hype surrounding the use of modern technologies and the apocalyptic fate awaiting societies that fail to invest in them. In this sort of climate decision-makers need to have a sense of realism as well as of urgency. Fear needs to be tempered with hope and confidence if sensible choices are to be made about investing in technology for education.

Finally, it needs to be emphasised to policy-makers that the shift to an era of knowledge and information has given rise to a renaissance in the ideology of education as the main repository of our hopes for the future. This represents a unique opportunity for addressing the fundamental problems and challenges facing different education systems. It is an opportunity that will be squandered if the wrong choices are made, and faith in education is once again undermined by unfulfilled promises and a failure to deliver on expectations. The risk of squandering this opportunity makes it imperative that the role of technology in addressing educational challenges should be considered in the broadest and most holistic context. Sound educational thinking has to take precedence over the glitz of technological gimmickry and the lure of simplistic imperatives.

Against this background of broad advice, there are specific questions that policy-makers will have to tackle as they try to make sensible choices about investing in technology for education. These have been highlighted in various ways throughout this book, and can be summarised in terms of the following examples:

- *Why is the use of technology being considered in the first place?*
  - What is the education problem that needs fixing? (E.g. increased access for certain target groups; improved pedagogy and quality; efficient management of the system, etc.)
  - How much do we know about this problem and all the factors that affect it?
  - What have we learned from past efforts to deal with this kind of problem?
  - How clear is it that the use of technology will make a difference?
  - What are the expectations of different interest groups concerning the use of technology to address this problem?
  - Do we really need to bring in technology as an important part of the solution to this problem?
  - What would happen if we did not introduce technology in this regard?
- *What are the available options, should we decide to use technology in our efforts to address this problem?*
  - What exactly is the technology expected to do in educational terms?
  - What is the range of available technologies (old and new) that could be used to achieve the desired outcome, in educational terms?
  - How wide is the gap between different technologies in terms of their total costs and requirements, as well as their effectiveness in helping to achieve the educational objectives concerned?
  - How well do the different technologies fit in with the current education culture and what people are already familiar with in the society?
- *When is the appropriate time to introduce the chosen technology in education?*
  - What kind of preparatory work needs to be done for the chosen technology to be accepted by various interest groups? (E.g. publicity campaign, conditions of service, etc.)

  - What are the technical prerequisites and requirements for introducing this technology in the education system? (E.g. infrastructure, training of personnel.)
  - What are the financial and budgetary implications that need to be cleared as a basis for introducing the technology?
- *How should the chosen technology be introduced into the education system?*
  - Is it feasible to introduce the technology throughout the system in one go?
  - Is it more realistic to take a phased approach to get it fully implemented?
  - Should the technology be introduced first in pilot or trial form?
  - Should it be confined to certain levels or sub-sectors of the education system?
  - Is it preferable to introduce the technology in model form in a limited number of settings, so that it can be replicated as and when feasible?
- *Who should pay for the various aspects of introducing the technology?*
  - What are the equity issues that need to be addressed in terms of who pays for it and who benefits from it?
  - What is the role of communities in helping to meet the costs involved?
  - Is there a case for involvement of the private sector?
  - How do the costs involved fit in with other investment priorities in education?
  - Is there likely to be any political fall-out over the use of public funds to pay for introducing the technology?
  - How far can the various costs involved be afforded by those who are expected to pay for introducing the chosen technology into education?

These examples of critical questions that policy-makers need to face are simply one side of the investment issue. The other side has to do with the consequences of choices made and decisions taken about investment in technology for education. It is therefore very important that attention should be given to the possible consequences of various choices and decisions. For instance, introducing a new technology in education might require significant investment in new infrastructure, equipment, supplies, training the users, meeting maintenance and other service costs. It could also produce savings and efficiency gains – for example in terms of fewer teachers needed and better use of learning periods. In addition to such direct costs and benefits, the technology might result in new patterns of work for staff; demands for increased remuneration, and changes in the way learners and teachers interact. In general, both positive and negative consequences result from the choices we make about investing in technology for education. These need to be anticipated in an informed manner, and carefully analysed in the later stages of the decision-making process. The main concern should be with whether such choices and their consequences will make for real improvements in education, or simply result in the kind of showcase 'technological solution' which fails to penetrate and transform the education system. There are far too many examples of these kinds of innovations which are enthusiastically cited in the literature, but which often amount to little more than isolated enclaves of 'good practice' that do not take root in the system as a whole. This is yet another example of failure to meet expectations in education. At best these kinds of show-case innovations can inspire us with ideas about what is possible, but we need to ask why so many of them collapse when we try to take them to scale.

The opportunity available now for addressing the fundamental problems of education is far too valuable to be wasted on showcase innovations. This is why policy-makers and their professional advisers have to deal with issues in education and technology from

first principles and in a holistic manner that takes account of education in its broadest sense, now and in the future. There are always difficult choices to make, but this is what bold and responsible leadership is all about. Policy-makers and their professional advisers must therefore resist the temptation to surrender their responsibilities to the technology lobby or the development pessimists. Quick-fix solutions and showcase innovations should never be used as a substitute for the intensive analysis, bold vision, realistic assessment and pragmatic choices that are at the heart of good decision-making.

Shaping a Vision and Cultivating a Climate

All countries, developed and developing, need to have a sense of vision to guide policies and strategies in investments in technology for educational purposes. Many countries are already envisaging a future in which most of their citizens will have unprecedented access to knowledge and information through the exploitation of advantages offered by technology. This kind of vision has become one of the most important driving forces helping to determine the national goals and objectives for education in many countries. For instance, educational goals and objectives in Namibia are being greatly influenced by the vision of a 'learning society'; in Barbados by what has been termed 'EduTecVision 2020'; in Malaysia by the vision of a so-called 'ICT super-corridor', and in the United Kingdom by the vision of a 'knowledge-based economy'. In each of these cases a vision has been espoused by the political leadership and has captured the popular imagination, as well as inspiring professionals in education and other fields. This is a very important stage in any process of major innovation or reform. Indeed, it should be regarded as critical when it comes to making investments in technology that are intended to help tackle some of the most fundamental problems in education.

The first stage in transforming vision into reality is to create a climate in which the right sorts of policies and strategies can begin to take hold and flourish. Policy is essentially to do with priorities and resources for achieving long-,term goals. There will always be many priorities in competition for scarce resources, and much depends on the right climate to ensure that a particular set of priorities is given higher weighting and allocated more resources than others. For instance the idea of investing in modern technologies can be difficult to justify as an educational priority in many developing countries where there are more fundamental problems of too many deprived schools, too many unqualified teachers and too few children at school. In such circumstances it can be difficult to talk about high-cost modern technology, unless a clear link can be made between this kind of investment and the fundamental problems evident to people in society. Yet a climate of crisis brought about by these very kinds of problems can make officials desperate for quick solutions, and cause them to turn to new technology as a panacea. This is often the origin of later disappointment with promising innovations in education.

Strategies are concerned with the most effective and efficient ways of achieving priority objectives. To be of any use, strategies must be feasible and have a realistic chance of being implemented successfully. This means that the conditions and circumstances of the situation must be carefully analysed to determine what is most appropriate. Even with the best strategy it is important to have alternatives that offer a

fall-back position when things go wrong during implementation. What seems very logical and straightforward might turn out to be quite impracticable for all sorts of unforeseen reasons. Similarly, what works well in one setting (country or institution) would not necessarily work in the same way in a different setting. The key point about strategies is that there is no way of guaranteeing that they will work, apart from actually implementing them. This is why it is sometimes prudent for institutions and countries to pilot or try out different strategies on a small scale before making final decisions about major investments in technology for education.

Sharing Experiences, Expertise and Resources

One of the most pervasive consequences of globalisation is the sense of interdependence in the economic, social, cultural and political spheres of development. In this regard, breaking down the barriers to free trade results not only in investment flows and new resources, but also in the greater interaction of social norms, cultural values and political traditions from different societies. There are both positive and negative consequences associated with globalisation, so difficult choices have to be made about opening up the borders of an education system to external influence. In the positive sense it is desirable and enriching for every education system to be open to external influence, in order to learn from others and engage in mutually beneficial exchange. However, in the negative sense this kind of external influence can breed intellectual dependence as well as cultural invasion that might result in an education system being disconnected from its national context.

For instance, many of the benefits of the African Virtual University are quite clear. It can make higher education accessible to many people in Africa who cannot afford the time and cost of full-time university attendance. Learners can get the academic courses of their choice from the best professors in an American university, through the net. They can even gain qualifications backed by an American university without travelling out of their own country. However, this also raises the issue of the role of local professors in terms of job security and intellectual integrity. More importantly, if there is no reciprocal flow of knowledge from Africa to America there is even greater harm being done to the future of education in Africa. This perpetuates the syndrome of Africans as mere consumers, rather than a people with recognised expertise, capable of contributing to knowledge and intellectual development in various fields. The dilemma, therefore, is how can Africa benefit from the considerable knowledge and expertise of others in the field of higher education, without sacrificing its intellectual soul or mortgaging its academic future? Is it possible to share without being trapped into long-term dependency and jeopardising the fragile intellectual capacity that has been built up over the years? These are fundamental policy questions which show that there needs to be more to the African Virtual University concept than the use of new technologies to enable learners in Africa to access courses in American universities.

The point is not that there is anything basically wrong with sharing and learning from others. On the contrary, this is a highly desirable and potentially beneficial way forward in the process of tackling fundamental education problems. What is being argued, however, is that if benefits are to be realised and the possible negative effects are

to be minimised, there needs to be careful analysis and informed decision making. Examples of the areas in which there is considerable scope for sharing expertise, experience and other resources include the following:

- *development of courseware on a collaborative basis by groups of countries to ensure optimum quality and cost effectiveness.* This was one of the recommendations by the Malaysian delegation at the 13th Conference of Commonwealth Education Ministers (13CCEM) in Botswana in 1997;
- *sharing of expertise in the technical areas of installing and maintaining equipment and systems related to various technologies.* This can be through training of personnel and various forms of technical assistance, or simply by contracting out such functions to capable private-sector providers who may also be required to train local staff;
- *training in the preparation of pedagogical materials for self-learning and distance education.* This is one of the areas in which the Commonwealth of Learning (COL) is already providing considerable service to many countries.

Developing Concrete Policies, Plans and Strategies

Ultimately each country needs to address the issues of investment in technology for education in concrete terms. This means sensible policies must be developed, feasible plans drawn up, and effective strategies designed for translating such policies and plans into reality. All of this calls for informed decision-making, and it is this that has been the main focus of this book. The concern has been with the fundamental educational problems facing most education systems, and the role that technology can play as part of the solution to these problems. The contention has been that far too many countries adopt policies and strategies driven by technological considerations rather than by educational requirements. In other words, technological determinism has been far too pervasive in our thinking on change and reform in education. This is not necessarily all negative, since it is sometimes worthwhile putting a few computers into an institution and seeing the various uses to which they are put by staff and students. And some countries have simply been concerned that staff and students should develop a familiarity with new technologies that are rapidly becoming common in the wider society, particularly in the workplace. This has usually been seen as an adequate reason for introducing computers into education institutions. Generally, however, it is now clear that institutions and countries need to shift from this kind of *ad hoc* trial and *laissez-faire* approach to new technologies to a more long-term perspective and a more systematic way of developing policies, plans and strategies. Otherwise there is a danger that education will once again be the subject of disillusionment and a scapegoat for development failures, as promises remain unfulfilled and expectations fail to be met. This is why it is critical that policy-makers and their professional advisers should be clear about the educational purpose underlying any decision to introduce technology into the education system. This has been the central theme of this book, and it provides the best platform on which a genuine dialogue and exchange can take place about investment in technology.

Case Study 6: Information Technology and Education in the Caribbean

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Introduction

Information technology (IT) encompasses various factors. The Information Technology Professional Society of Trinidad and Tobago (ITPS) suggests that IT includes matters concerned with the furtherance of computer science and technology, and the design, development, installation and implementation of information systems and applications. The Information Technology Association of America (ITAA) defines IT as the study, design, development, support or management of computer-based information systems, particularly software applications and computer hardware. Simply stated, IT refers to the dissemination, processing and storage of information, primarily through the use of computers.

Today advanced microelectronics and computer-based information and communication technologies are at the heart of social and economic transformations in industrialised countries. The links between computing and telecommunications have been growing in the Caribbean too. Information gathering, processing, storage and transmission over efficient telecommunication networks will be key elements in enabling the Caribbean to develop into a 21st century information society. Many reforms and improvements are needed in both public- and private-sector education and training institutions to create a work-force that is trained and skilled in IT. IT can improve education and training techniques. It facilitates distance education, making possible active rather than passive learning through the synergy of sound, video, animation, graphics and texts. It can strengthen and expand upon work in the area of computer studies; develop national and regional capability for human resource development; generate and develop adequate means of providing open learning to as wide a cross section as possible of society; satisfy the universal need for intelligence; facilitate computer literacy; complement teaching, and so help to eliminate the idea of 'imperfect teaching'. However, the results of surveys on IT in education[1] show that there is a high and unsatisfied demand for IT professionals. IT skills are in extremely short supply. Dr Kwame Charles affirms that this demand is exacerbated by the international shortage of IT professionals and the threat that this poses to the local IT human resource base.

IT in education is used predominantly for meeting the requirements of the Caribbean Examination Council (CXC) syllabus and similar examinations, and for computer literacy and office productivity (word processing and spreadsheet usage) courses. Little or no emphasis is placed on the teaching of skills required for software development or computer maintenance.

In the past decade Caribbean countries have experienced difficulty in adapting new technologies. Major problems include high costs; inability to obtain access and upgrades, and the re-skilling of the labour force to manage and operate such technologies.

Primary and Secondary Education: Programme Trends in the Private and Public Sectors

Introduction

IT is a resource which can be used to facilitate learning and teaching in all subject areas. Ideally, it should not be tackled in a small number of specifically timetabled lessons in the curriculum, but integrated right across the curriculum to ensure that all school leavers are IT literate. The drive towards IT in education should not be seen as the provision of a Computer Studies option at secondary level. This option should be tailored for those pupils who have a specific interest in the technical perspective of IT with an eye to pursuing further education or employment in the field.

IT in Primary Education

It has at last been generally recognised that computers and IT should be introduced at primary level. Yet the use of IT in Caribbean primary schools is almost non-existent. Few countries have been able to set up the infrastructure needed to train young children in the use of IT products.

Five per cent of government-run primary schools in Trinidad teach IT programmes.[2] In the few cases where IT is used, it is employed either as an administrative tool or as an aid in the various subject areas. In Trinidad there is a general problem of lack of adequate security in primary schools, so computer equipment is kept in the Principal's office under 'lock and key' and used only for administrative functions, whereas IT should be used to stimulate and encourage learning.

There has been an attempt to provide four primary schools in Tobago (Bethseda, Golden Lane, Mt Gomery and Belle Garden) with internet access. These schools are being renovated to accommodate the necessary equipment, as part of a project by the Telecommunications Services of Trinidad and Tobago (TSTT) to provide 33 schools with free internet access. However, due to the high cost, TSTT could not offer this to all the schools; others get access to the internet at a 50 per cent rebate. This development has been slow because the schools are unable to meet the 50 per cent cost requirement. They hope that corporate citizens will 'adopt' a school and provide them with a number of access hours, bearing in mind that they have to pay only half of the full cost.

In Trinidad the Government has embarked on a project to equip all primary schools with computers to ensure that everyone leaving the education system is computer literate. The Government has set up an Internet Learning Centre to provide computer training to teachers. It is hoped that eventually such a facility will be established in each community; however, problems related to existing infrastructure need to be resolved. In the few cases where computers are already in schools, Quadra Mac 605 systems are used. These machines have limited hard drives and are outdated. Teachers and students use them for computer aided programmes.

In Belize[3] just six of 245 government primary schools (2.45 per cent) teach IT programmes. The figure for private-sector education is higher: six of 32 existing primary schools (18.75 per cent). Most of the funding to provide existing infrastructure was obtained from international sources. There has been co-operation with local and foreign internet and IT service providers to give free internet access to primary and secondary schools.Yet Belize faces similar problems regarding a lack of trained IT teachers, infrastructure maintenance and resource facilities.

St Lucia[4] does not yet use IT at primary level. 25 per cent of government secondary schools and 33.3 per cent of private secondary schools have IT facilities, but IT programmes are not compulsory. Funding for IT is obtained from the Government, private donations and school fund-raising programmes. Here too outdated computers are an obstacle to learning; there is a need for proper maintenance, and for the creation of a body or institution to facilitate updating, problem-solving and the implementation of IT programmes in schools. Internet access is provided to schools with IT facilities.

Generally, IT is still severely under-utilised and there is much scope for development in the primary education system throughout the region. Stand-alone personal computers (PCs) with the provision for dial-up internet access are most commonly found in primary schools. However, it has been recognised that IT should be introduced extensively at primary level, and that it should not be limited to mere computer literacy, but should include such skills as project management, database management, data communications and networking that are needed to widen the IT base for future professionals.

Noteworthy of mention is the EDUTECH 2000 project being implemented by the Government of Barbados, designed to make all primary school students computer literate by the year 2000. If other countries in the region were to adopt such policies, similar strategies would certainly be needed for IT and human resource development.

IT in Secondary Education

As the progression of IT from primary to secondary level occurs, students begin to explore IT and manipulate applications, so usage at this level is far more widespread. IT subjects are included in CXC ordinary and advanced level examinations[5] and cover a range of issues. Students must learn

- to take a business's financial records (prepared manually) and computerise them;
- to write a computer programme using training in Basic and Pascal Programming;
- about hardware and software systems and networks.

An increasing number of schools in Trinidad and Tobago are pursuing courses in IT.[6] Student enrollment for CXC IT examinations increased from less than 100 in 1993 to almost 600 in 1998. GCE Ordinary level enrollments increased from 400 to nearly 500 over the same period. However, at GCE Advanced level, enrollments seem to have fallen since 1993. Yet analysts affirm that the increasing number of secondary school students pursuing courses in IT bodes well for the future of the industry in Trinidad and Tobago as it shows that interest in the field begins before university. There is, of course, a need to create IT appreciation much earlier than secondary school.

Many secondary schools in the region are equipped with computer labs and software to satisfy the requirements of the CXC syllabus. They have realised that such equipment is a valuable asset and have begun to offer adult literacy classes in the afternoons and at weekends. Thus maximum use is made of the computer facilities outside the traditional school hours of 8 a.m. to 3 p.m.

Some secondary schools are even contemplating establishing web pages, but this is fairly expensive and schools (e.g. Bishops Anstey, Tobago) have only been able to design the page.

In Belize, more attention has been paid to IT at secondary level than at primary level. IT programmes are taught at 75 per cent of both government and private schools, and

are compulsory. Students are taught basic computer knowledge and use of applications like word processing, spreadsheets and database, together with programming in Basic or Pascal. Most schools offer RSA and CXC external examinations. Harry Noble, of Belize Information Technology Systems Ltd., affirms that IT should have a greater impact in education generally: few schools use IT as a teaching tool. He cited Mopan Technical High School as an example to emulate. This institution uses IT as a multimedia teaching tool to simulate experiments in science.

Education sectors in the region may be inspired by the example of St Kitts, where every secondary school is equipped with computers. However, there are only five secondary schools on that island. The Grenadian Government has embarked upon a programme to equip all secondary schools with computer labs.

Proposals for IT in Schools

The deployment of IT in primary and secondary schools should be governed by a dynamic strategy which entails

- *initial teacher training and in-service training:* In order to introduce IT as a cross-curriculum teaching and learning aid in both primary and secondary schools, appropriate courses should be provided for all teachers, since they will be affected by the necessary changes in curriculum and methodology. This entails the establishment of suitable courses for student teachers and teachers in service. With regard to initial teacher education, it is important that all new graduates have received adequate training in the use of IT in education. This implies that the necessary courses must be introduced into the B.Ed. and other related programmes of study. With regard to in-service training, two kinds of courses should be conducted:
  1 for teachers who lack the necessary background, but who wish to teach the Computer Studies option at secondary level. A suitable evening diploma course can be designed;
  2 for all teachers on the use of IT as a teaching and learning resource within their areas of specialisation. These courses can be conducted gradually, on a yearly basis, anticipating at each step the requirements for the following year;
- *courseware development and evaluation:* New computer-based material does not necessarily obviate the use of other kinds of material. All courseware has to be designed, developed, customised and evaluated in line with curricular content. Its purpose is to help the teacher convey the message more effectively and the student to learn more efficiently and holistically.

  There is a spectrum of development between traditional, paper-based courseware and state of the art multimedia, computer-based learning environments. More sophisticated courseware becomes available from international sources, and must be evaluated and customised to local needs. Other courseware must be developed locally, especially for subjects with a local or regional dimension;
- *curriculum development:* The gradual introduction of IT in education should be seen as a catalyst to assess and upgrade the curriculum throughout the education system. The extent to which the curriculum is revised depends on the pedagogical philosophy adopted as a matter of policy. IT can be introduced in schools simply as a tool to support 'chalk and talk', or it can be viewed as the platform for radical change in curricular activity to support group-work and fast and easy access to

knowledge in its various forms. A middle path would be gradual adaptation in the curriculum according to the training of teachers, and the education system as a whole. A directorate should be established in each country's Department of Education to carefully design and monitor the evolution of the curriculum;

- *system installation and support:* As developments in technology are occurring rapidly, the purchase of systems should be incremental and upwardly compatible. It is vital that the purchase of systems does not encounter bureaucratic bottlenecks which will force the purchase of the 'latest old technology'. In time a scheme should be adopted to allow retooling and redeployment of outdated equipment. The investment made to install the initial IT infrastructure in schools must be maintained over the years to periodically augment and upgrade the facilities;
- *research, monitoring and evaluation:* IT adoption is the first step. Ongoing research must be conducted to monitor, evaluate and direct the process. The introduction of IT in education is only justified if the benefits alluded to earlier are achieved. The University, in collaboration with local Ministries of Education, should support a team of educationalists to foster links with international institutions working in this field. Local initiatives should be kept in perspective of achievements abroad.

These activities must be integrated, and simultaneous with the refurbishment of schools and the computerisation of school administration.

Tertiary Education: The University of the West Indies (UWI)

The tertiary level of education seems to be taking the greatest strides, with IT a major component of the curriculum. At the University of the West Indies (UWI), for example, it is being used in distance education, increasing access to all UWI programmes for students who have difficulty attending a campus. IT is enabling communication among the different segments of the University, and with other institutions within and outside the region. Further, all business education courses have an IT component. It is being used as a tool in Data Analysis, Engineering, Health Services, Architecture (geographical mapping and imaging), Hospitality (as a facilitator for menu planning and clothing design), the Social sciences (for analytical purposes), and the Arts (for record keeping and word processing).

UWI recently[7] hosted a conference on educational technology, at which the Vice-Chancellor, Professor Nettleford, spoke of the UWI/CARICOM/UNDP initiative to provide IT training to faculty and students. Other speakers focused on the new paradigms for education; the possibilities and pitfalls of education technology; technology as a learning partner; the influence of technology on leadership and management; global access to library and information resources, and internet or web-based education. Several presenters from North American and British universities explained how their online courses function. They are developed on the internet, using 'web course tools' or 'course management systems', which guide the instructor to create his or her own course. Students can register for the course online; pay for it by credit card; access course material (textbooks, lecture notes, tutorials, tests, etc.) at any time and from anywhere in the world. Global teams of students work on team projects without ever meeting or knowing each other. Evaluation and student tracking can be done online so that the instructor is always aware of how the students in his or her 'virtual' class are

doing. The internet is creating a new kind of tertiary institution – 'Laptop University' commented Dr Kwame Charles.[8] Entrance requirements include the possession of a computer – preferably a laptop or notebook – internet access and competence in the major application software in general use. Information and communications technology (ICT) will revolutionise education (from primary to tertiary level) as it is revolutionising work, business and life in general.

UWI Institute of Business (IOB)

At the Institute of Business (IOB) the concept of ICT is applied, yet full use is not made of the technology. Much of the documentation is sent via mail. Facilitators are sent to the respective countries for approximately two weeks for discussions with students. Upon the facilitator's return, communication continues by means of the internet.

UWI distance learning

In 1997 UWI's Distance Education Centre (UWIDEC) introduced its Distance Learning Programme to meet the learning requirements of the people of the Caribbean. Students may pursue several university programmes at a distance and are not required to attend the physical site of the campus.

In order to widen access to their programmes, UWI has made use of a variety of educational methodologies: self-study printed materials supported by audio and video cassettes where applicable; face-to-face tutorial sessions, and interactive audio teleconferences. Computer assisted learning packages, e-mail, and access to the world-wide web are currently being developed by UWIDEC.

The programme serves 17 Commonwealth countries in the Caribbean and covers Anguilla, Antigua and Barbuda, The Bahamas, Belize, British Virgin Islands, Cayman Islands, Dominica, Grenada, Jamaica, Montserrat, St Kitts and Nevis, St Lucia, St Martin, St Vincent and the Grenadines, Trinidad and Tobago, and Turks and Caicos.

Perhaps one of the most common reasons given in favour of this form of instruction is that it is an excellent opportunity for bridging the gap between urban and rural education. Throughout the region, many of the facilities are located in urban areas, and major sections of the population are deprived of the opportunity to pursue an education at either primary, secondary or tertiary level. Greater use of distance learning methodologies would allow the region to educate more of its citizens and narrow the gap between urban and rural education. The result would be the creation of a *total quality region* and the attainment of sustainable development.

In view of the rapid increase in the amount and cost of traditional academic instruction, the increasing globalisation of the economy and culture, and the growing role of information-age tools, distance education is becoming a viable option for pursuing academic qualification. However, due to the constraints on accessibility and affordability, designers of course material within and outside developing countries will have to pay attention to hybrid delivery methods and developing alliances in developing nations.

Technology and programme content

The use of IT at UWI and at other tertiary institutions in the region is not restricted to the computer literacy function. It enhances graphical preparation and presentation of course materials, and is being incorporated into the curriculum of several disciplines, especially in languages, social sciences and human resource development training. In

Engineering, IT is used as a training tool: some experiments are difficult and dangerous and computers are used to simulate an experiment before the students carry it out .

Professor Charles Cadogan of the Department of Computer Science, Mathematics and Physics at UWI's Cave Hill Campus foresees changes in the Department's present course content. He noted that the first group of students in this area will graduate in July 2000. The B.Sc. IS/IT will be reviewed and the Certificate in IT will be upgraded in anticipation of more advanced students. In addition, an M.Sc. IT is to be introduced.

Use of Infrastructure

Professor Cadogan cites insufficient support staff and difficulty in the procurement of site licences as the main problems encountered by the Department in the use of computer-aided learning (CAL) packages. Similar problems are encountered on the other UWI campuses. At Mona, Jamaica, Professor Han Reichgelt also identified the shortage of staff as a major obstacle. Similar views were expressed by Sharon Kinch, Executive Assistant at the Centre for Management Development (Eastern Caribbean) Inc., UWI. She stated that in general it is difficult to find a good IT lecturer.

Other Initiatives in IT Education

It has been suggested that while there is significant evidence of the use of IT in the education sector, its use varies at the different levels. At primary and secondary levels, the emphasis is on introducing and exposing students to various uses of IT. Training at secondary level allows for the immediate transfer of skills from school to the workplace, and creates an awareness of the extent of the impact of IT on our everyday lives.

Use also differs between the public and private sectors. The private education system recognises a need to be innovative and to remain on the 'cutting edge'. It has a strong research base and can determine demand. The public sector generally cannot keep up with the market in the same way, and has difficulty staying up to date. The private sector's success may be due to facility availability, or it may be more enterprising. Whatever the reason, the private sector is able to adapt more readily to changes.

At the University of Technology (UTECH) in Jamaica, IT usage is extensive. All the business education courses have an IT component. There are also several computer and IT educational initiatives, including the Institute of Management Sciences (IMS), the Institute of Management and Production (IMP), and the Jamaica Computer Society (its objectives include getting computers into schools).

The Royal Bank's Institute of Technology (ROYTEC)

Some educational organisations in the region are totally IT dependent. For example, at the Royal Bank's Institute of Technology (ROYTEC) students are taught Secretarial Services and are exposed to word processing and spreadsheet preparation. Emphasis is placed on use of the internet. In particular, ROYTEC offers a Bachelor's Degree in affiliation with the University of New Brunswick. This degree is heavily dependent on the internet as the primary means of transmitting data for the course. IT is also being incorporated into the institution's marketing department which uses the technology for advertising and consultancy. The school also has an associate degree programme in Management Information Systems which involves substantial IT knowledge.

Other Distance Learning initiatives

Distance education is generally taken to mean independent study, or open learning based on self-instruction materials. The key element is the separation in space and time of the the teaching and learning activities. Distance learners are supported at-a-distance by trainers, tutors or subject specialists and, informally, by other learners taking the same course. Traditionally, distance education referred to correspondence study; the delivery tool was the mail. IT has broadened distance learning to include audio, video and computer technologies.

Tele-education refers to a variety of applications of telecommunication technologies and services for educational purposes, including anything from televised educational programming to individual researchers using remote databases, and covering all levels from elementary to adult education. There is often a video component, which generally starts with one-way video and two-way audio.

Online education is a step forward in the realm of tele-education systems. With the emergence of computer-based communication systems such as the internet, online education has enhanced the distance education experience. Tutor support can be almost instantaneous; interaction with one and/or all other students is readily obtainable; distance and cost for the transmission of messages has become irrelevant, and the educational material can be interactive, multimedia, and available online. The rapid migration of distance learning courses to the internet is manifest evidence of this transformation.

Internet-based courses have a number of advantages over those delivered via satellite. First, the cost of setting up the system is dramatically different. Satellite transmissions require earth stations relatively close to the point of delivery to reduce the cost of ground telecommunications connection. They are generally one way. Internet transmission can be achieved for a fraction of the cost of satellite, and is always interactive.

Second, the reach of the broadcast of each system – and therefore the economies of scale that can be achieved – is also quite different. A satellite transmission reaches only the geographical area covered by the footprint, whereas an internet broadcast has no geographical limitations once basic communication infrastructure is in place.

The benefits that apply for tertiary education are applicable to postgraduate training and continuing education. Internet distance education programmes in developing countries are not only conceptually viable, but practically feasible. Building the required communication infrastructure is generally the easiest, and in the long run the cheapest part of the process. What seems to be much more difficult to achieve, in terms of time and cost, is the sustained production and supply of content. In other words, the successful introduction of new technologies such as the internet into education depends largely on the quality of course materials and their relevance in the local context. In developing countries most of the educational content available is not suited to distance/online education. Most of the distance/online educational content available is from developed nations, which often makes it unsuitable and inappropriate to developing countries' needs.

The current thin educational content available over the internet does not mean that demand is also thin. With the rise of new electronic media the patterns of information consumption in some developing nations are changing, and the appeal for internet news and general information is growing at a fast pace *vis-à-vis* that delivered by traditional media. But if the demand for news over the internet is experiencing a rapid surge, then the rise in the demand for educational information and content is unprecedented.

Awareness of Distance Learning in the Caribbean

Throughout the region there is little awareness of the distance learning programme, except at the tertiary level. Perhaps this is because most courses offered through distance learning are for first and higher degrees. In countries where interviews were conducted, there was no mention of the principle being used as a means of post-primary training.

The programme is fast becoming an option in many countries because demand exceeds supply of further education facilities. The distance learning programme is being used to bridge the gap between those who are able to obtain a tertiary education and those who are not.

The Benefits and Costs of the Distance Learning Programme

A distance learning system has many benefits for our region. Yet this form of instruction is expensive because there it is difficult to develop the appropriate infrastructure, capacity and institutional responses to change. Another perceived problem is the lack of intimacy and absence of physical interaction.

Use of Distance Learning

Instances of use of distance learning are:

- *St Lucia:* The Sir Arthur Lewis College is planning for the use of distance education via video conferencing.
- *Jamaica:* UTECH has been taking steps to implement this programme. The pilot project is expected to be in the area of business administration, and it is anticipated that this will eventually branch off into the other academic disciplines. UWI offers assistance in designing products.
  Few other institutions offer distance education using IT. Bob Sempel of UWI notes that at present Jamaica is more of a recipient than a provider of the distance learning initiative. He affirms that there is a need for more of this kind of education, since all the major educational institutions are located in the capital. Distance education would help to bridge the gap between urban and rural education.
- *Trinidad and Tobago:* ROYTEC's programme in Management Information Systems and Business Administration is offered in collaboration with the University of New Brunswick. The Ministry of Information, Communication, Training and Distance Learning recently began its distance learning programme which will promote the use of this non-traditional form of educational instruction.
- *Belize:* Distance learning is not widely known in Belize. It is used sporadically by the Teacher's College. Harry Noble, of Belize Information Technology Systems Ltd., affirms that Belize has a real need for distance learning programmes, especially in tertiary education.

Multi-Purpose Community Centres: Suriname – A Case in Point

The Telecommunication Corporation Suriname (TELESUR) in collaboration with the ITU started the implementation of an Integrated Rural Telecommunications Project, in order to extend the telecommunication network to the interior of the country through modern technology. The pilot project was completed in May 1996.

The telecentres are installed in an area where approximately 20,000 people (about 40 per cent of the population of the interior) live in scattered villages near the Upper Suriname river. Each telecentre is equipped with two telephones, one fax machine, one computer with internet facility and printer. The most used service is telephony. The telecentres are operated by local people – two for each telecentre, who were trained by TELESUR. To guarantee a good service and to cover the costs of exploitation, including maintenance of equipment, there are plans to put the telecentres on lease.

Suriname intends to install 15 telecentres at strategic places in the interior; their locations will be determined in consultation with the Ministry of Regional Development and the medical institutions working in the interior. Video and audio broadcasting possibilities will be available in these centres for tele-education and tele-medicine purposes.

The Integrated Rural Telecommunications Project (IRTP) of Suriname is based on Programme No. 9 of the ITU Buenos Aires Action Plan (BAAP) 'Integrated Rural Development'. This programme includes the collaboration of ITU and developing countries in the long-term planning of integrated rural development at regional and national levels, rural networks and the promotion of the community telecentre concept and services. These concepts are to be implemented through the partnership arrangements involving developing countries, ITU, donor agencies, other UN agencies, regional and national organisations and other parties in the telecommunications industry.

Suriname's approach could be adopted by other Caribbean countries.

Collaboration, Co-operation and Financial Assistance

Some corporate entities are providing assistance, but more needs to be done. This section highlights some of the firms assisting in the funding of IT projects, and so promoting the use and development of IT. In some countries the Government has had to be the sole provider.

- *Belize*: There has been an initiative by the Organisation of American States (OAS) and the local telephone company to provide internet access to all the high schools. Provision has been sporadic and there is a need for a more specific plan from the IT bodies in Belize. Belize Telecommunications Ltd. has donated, and continues to donate, computers to schools on a periodic basis. It provides free internet access to primary and secondary schools and has made a commitment to provide equipment to the secondary schools.
- *St Kitts and Grenada*: The Ministry of Education is responsible for providing the schools with computers. In St Kitts all the secondary schools have computers, and in Grenada the Ministry has recently embarked on a computerisation project.
- *St Lucia*: The OAS and the local telephone company are working on a project to assist with LAN (Local Area Network) provision.
- *Trinidad and Tobago*: In Trinidad the Telecommunications Services of Trinidad and Tobago (TSTT) provides some internet service. Companies such as AMOCO and the Royal Bank have been donating computers to secondary schools. TSTT has provided a free line for internet access, and in Tobago is providing 33 schools with access (some at a 50 per cent rebate).
- *Montserrat*: Cable and Wireless donated computers to the only secondary school on the island.

- *Jamaica:* UTECH is Government-funded, and solicits grants from other sources, among them private-sector companies to which UTECH provides trained staff.
- *Suriname:* The IRTP launched by TELESUR in collaboration with ITU was financed by the Government of the Netherlands (20 per cent) and TELESUR (80 per cent).

The Role of the Private Sector

Views differ on the role of the private sector in telecommunications development. But of all the countries where interviews were conducted[9] only one felt that there was not a role for the private sector in telecommunications and IT.

The main view is that the private sector should exist for the purpose of providing services to the public. Another major role identified for the private sector is to aid in research and modification techniques. The telecommunications industry in the Caribbean is at a lower level than in developed countries. Much of the technology is standardised when it is imported and no provision is made for adjusting it to suit the needs of receiving countries. Frequently Caribbean countries pay for more than is really needed. Because the private sector is an enterprising and investing sector, it is believed it is best suited to this research activity.

The private sector is extremely forward thinking, and its involvement is, in most cases, with the end user. The private sector is therefore the best entity to advise on developmental and educational development issues. It is knowledgeable about problems being experienced, aware of the impact of new technologies, and aware of suggestions regarding the changes in the technologies in use.

Financing Electronic Education

The virtues of accessing the internet to support education are undeniable. The question is, how does a country finance it? In the USDA, for example, a programme to connect every American school to the internet by the year 2000 has been estimated at more than US$ 30 billion, plus at least US$ 5 billion annual operating expenses. The task, which is expensive for even the richest countries, can turn into a staggering burden for developing countries.[10]

For developing countries the need to migrate to electronic-based education has come at a difficult time. In most nations the state – traditionally the main financer of the educational system – is facing financial constraints and retreating from its former direct participation in the national economy. Although it is now well accepted among economists and government officials that health and education are two areas in which the state should remain deeply involved, most developing nations are finding it hard to sustain their presence in the sector and are cutting their education budgets across the board.

As nation states scale back their financing, two other kinds of institutions – multilateral lending agencies and private-sector companies – are increasing their role in the sector. In Latin America, for example, the Interamerican Development Bank (IDB) and the World Bank (WB) have committed US$ 8.32 billion in soft loans to support improvements in education in the period 1998-2000, to upgrade information and communication infrastructures and services.

The participation of private-sector capital in education is shaping up in a number of different ways. One is the increasing presence of private entrepreneurs directly involved

in the provision of education at all levels, which has expanded the volume of capital available for IT in the educational system. Some of these private institutions not only have the necessary finance, but are extremely successful in raising funds. Their experience may be useful for Caribbean development plans.[11]

Other kinds of private sector involvement in education are less direct, yet no less effective or significant. A number of communication and information technology companies are looking with interest at the potential offered by the education market, and are supporting rapid growth in the use of communication and information services, such as those provided over the internet.

Education

Providers of education and training in Trinidad and Tobago[12] see the need to follow closely the requirements of industry when planning future programmes. Trends suggest that the focus will be on internet training and project management and programming courses. These courses are not necessarily driven be local market needs, but by the international affiliations of many of the institutions.

Research

Research and development are important. The needs of the market must be examined extensively to ascertain the requirements of the country and the region. Research should also seek to identify the demand for IT services. In the region the demand for IT professionals is higher than the supply. Most IT educational facilities are in urban areas; private-sector research must highlight rural demand for IT and offer positive solutions.

IT Education at Ministerial Level

Dr Kwame Charles, and nearly every other participant in the CTU study,[13] identified the need for a national enabling mechanism in each country to promote IT as a national priority. Its responsibilities should include:

- the development of national and regional IT strategy;
- the development of an IT culture;
- a national human resource development plan based on an information and knowledge-driven education system.

Encouraging investment in the IT education sector would play an important part in IT promotion. Funds could be acquired and used to access the much needed infrastructure as well as for research and development.

The study also pointed to the need for the IT industry to work closely with the various teaching institutions, especially universities and tertiary institutions to help them to supply the quality and quantity of graduates needed to sustain the industry.

Institutions should be encouraged to become more flexible in their teaching. Their rigid structures must be broken down so that they can more readily adapt to changes as they occur in the sector. Areas such as operating systems, software development and internet must be examined carefully, and the associated tools must be developed. There must be an IT human resource development programme to deal with the quality and quantity objectives pertaining to the supply of IT professionals.

Researchers note that in Trinidad and Tobago, the Ministry of Education is yet to adopt an IT education policy, although a proposal to introduce computers into public education has been in existence since 1995.[14] Though computers have been installed in many primary and secondary schools in the country, there is no systematic strategy for computer education in the national education system.

In St Lucia some government and private secondary schools do teach computer studies, but there is no body or group co-ordinating or planning the IT programmes for schools.[15] Belize benefits from the Curriculum Development Unit of the Ministry of Education. This body develops the school curriculum and buys suitable computer programmes to assist in its delivery. However, there is a problem in Belize regarding the lack of capable teachers who, as soon as they become competent, are absorbed by the private sector. The Association of School Principals seems to be the only organisation attempting to remedy this problem.

The Barbados Government has recently embarked on its 'EDUTECH 2000' plan which, as described above,is intended to make all primary school students computer literate by the year 2000.

Governments, and more particularly Ministries of Education, are faced with the difficult decision of which technologies to chose for different levels of education, distance learning included. Some pertinent questions to bear in mind are:

- *Access:* How accessible is a particular technology for learners? How flexible is it for a particular target group?
- *Costs:* What is the cost structure of each technology? What is the unit cost per learner?
- *Teaching and learning:* What kinds of learning are needed? What instructional approaches will best meet these needs? What are the best technologies for supporting this teaching and learning?
- *Interaction and user-friendliness:* What kind of interaction does this technology enable? How easy is it to use?
- *Organisational issues:* What are the organisational requirements, and the barriers to be removed, before this technology can be used successfully? What changes in organisation need to be made?
- *Novelty:* How new is this technology?
- *Speed:* How quickly can courses be mounted with this technology? How quickly can materials be changed?

The new and emerging IT trends should also be borne in mind when planning future education strategies. As noted earlier these trends include:

- internet technologies;
- network computing;
- electronic commerce;
- enterprise applications;
- digital libraries;
- knowledge management;
- component-based software development;
- multimedia;

- network security; and
- 'disintermediation'.

IT Education and Training: Social Equity

It seems obvious that there is a deep gulf between the traditional educational system, whose basis was designed in the nineteenth century, and the demands of the 21st century society, with its paradigm of production, whose development is increasingly based on knowledge, technical progress, innovation and creativity.

Governments agree that in order to increase their competitiveness, one of the biggest challenges ahead is that of transforming the quality of education: they will need more and more people with good training, and must outgrow the mechanical accumulation of knowledge.

Governments also see the need to create closer links between the educational system, the world of communications, and the sphere of work, if they are to be successful in developing internationally competitive persons. Further, the educational function of the future cannot be carried out through a routine, hierarchical structure. Autonomy, administrative responsibility, experimentation and close links with the community are needed. While decentralisation is to be fostered, the risk of inequalities which could lead to a growing differentiation between minorities trained to manage the future and majorities linked with the past, or excluded from the dynamic progress of modernity, should be avoided. Thus, together with decentralisation, emphasis should be placed on the importance of integration, social compensation for the underprivileged, and policies aimed at checking the segmentary tendencies of the market and education.

IT and Education: Trinidad and Tobago

IT education and training in Trinidad and Tobago is still in its early stages, yet many see this as a growing business. Institutions are cropping up literally overnight to try to capitalise on the increased demand for 'computer courses'. However, most of the offerings are at the lower end of the IT skills spectrum. Analysts argue that if Trinidad and Tobago is to compete in the software development market, it will have to increase its competencies in education and training in this area. The introduction into the economy of international and local software development houses can enhance the country's ability to educate and train itself.

Barbados is pursuing such a strategy by insisting that its offshore software development companies contribute in tangible ways to the development of local IT human resources, through working with UWI and professional IT bodies. Its experiences may be useful to Trinidad and Tobago's strategic planning.

Dr Kwame Charles's analysis of the IT human resource development issue makes it clear that training is inadequate. It was difficult to obtain data on enrolment and graduation for the region. Table 5.1 (page 162) shows figures from Trinidad and Tobago, and gives an idea of throughput by award and by area. The data reveals that approximately 1,122 people enrolled in the degree, diploma and certificate programmes offered by the 21 institutions studied by Charles et al. At the same time, 558 graduates emerged from these institutions with undergraduate diplomas and higher awards. 7,599 students were enrolled in a wide range of IT-related areas. Of this figure, 5,389 successfully completed

programmes in these areas. These figures should not be taken as absolutes because students may have pursued other courses during the academic year.

Consider also Table 5.2. This table indicates that by far the greatest IT/computer usage is for computer literacy which records an enrolment figure of 2,225. This sounds quite good and indicates that the country has recognised the importance of IT, yet there is no mention of enrolment or graduates being produced in the field of software maintenance and development.

Input from Trinidad and Tobago also reveals that the highest academic qualification for IT professionals is at the Bachelor degree level, accounting for 41 per cent of IT staff in the country. An equally large number of people (41 per cent) have only a secondary school education, and only 11 per cent hold a postgraduate degree. Undergraduate diplomas and doctorates are qualifications possessed by IT professionals in Trinidad and Tobago, but these figures are both under 5 per cent.

An important area in IT education is on-the-job training. Faced with a shortage of IT professionals, there is a greater need to focus on human resource training. Again,

Table 5.1 Throughput of Computer Programmes by Award in Trinidad and Tobago, 1998

	Award	*Enrolment*					*Graduates*				
		1997	1996	1995	1994	1993	1997	1996	1995	1994	1993
	Associate Degree	233	105	78	91	29	61	49	7	1	0
	B.Sc	291	211	151	20	16	110	18	17	5	5
CAN	Certified Novell Administrator	25	50	75	75	50	15	38	45	49	28
	Certificate of Completion	140	132	83	83	108	119	115	83	83	108
CLP	Certified Lotus Notes Professional	–	4	4	–	–	–	2	2	–	–
CLS	Certified Lotus Notes Specialist	20	12	12	–	–	10	6	2	–	–
CNE	Certified Novell Engineer	2	5	10	10	2	2	5	10	10	2
	Diploma	15	40	40	–	–	15	40	40	–	–
	Graduate Diploma	57	25	–	–	–	25	25	–	–	–
MCNE	Master Certified Novell Engineer	–	–	3	–	–	–	–	3	–	–
MCP	Microsoft Certified Professional	200	75	36	–	–	120	45	36	–	–
MCSD	Microsoft Certified Solution Developer	15	2	–	–	–	11	2	–	–	–
MSE	Microsoft Certified Systems Engineer	30	15	12	–	–	15	5	12	–	–
	Masters	67	25	–	–	–	55	15	–	–	–

Note: Blank fields are due to unavailability of data.

Table 5.2 Computer Courses Offered in Trinidad and Tobago, 1998

Course name	*Enrolment*					*Graduates*				
	1997	*1996*	*1995*	*1994*	*1993*	*1997*	*1996*	*1995*	*1994*	*1993*
Computer Literacy	2225	1703	1527	1350	1191	1310	1108	942	765	616
Office Productivity	1865	1123	241	93	86	1667	1118	231	93	86
Internet User and Authority Tools	37	22	–	–	–	37	22	–	–	–
Network Operating Systems	200	50	–	–	–	65	50	20	–	–
Computer Applications	180	0	–	–	–	178	–	–	–	–
Programming Languages	40	40	40	–	–	40	40	40	–	–
PC Repair and Maintenance	45	0	–	–	–	23	–	–	–	–
Data Communications	95	80	80	–	–	83	60	70	–	–
Information Systems	315	262	133	163	108	242	235	128	153	108
Project Management	170	130	45	–	–	125	85	–	–	–
Database Management	919	402	86	–	–	927	405	86	–	–
Computer Aided Design	319	107	104	–	–	134	107	104	–	–
Geographic Information Systems (Certificate)	15	15	–	–	–	–	–	–	–	–
Desktop Publishing	79	–	–	–	–	–	–	–	–	–

Note: Blank fields are due to unavailability of data.

training to be computer literate does not suffice; emphasis should be placed on software maintenance and development. The latter is the main area of deficiency in the IT industry, as Table 5.3 shows.

Table 5.3 IT Skill Deficiencies in Trinidad and Tobago, 1998[16]

Deficiency	*%*
Software development skills	18
Working experience	17
Project management	17
Lack of a mix of skills	15
People/communication skills	14
Database management	11
Networking	9
Business skills	6
Web and internet	6
Other	28

Conclusion

Caribbean economies will be greatly affected by the level and quality of IT use in each country. Aptitude and skills in the application of IT tools are becoming a matter of basic literacy. As IT is set to become an integral part of life, it is important that social, technical, political, moral, organisational and economic issues and principles associated with its use are discussed adequately and practised in context from a young age. Thus IT necessitates its growing presence at all levels of education and human resource development.

Most Caribbean countries are taking steps to make IT an integral part of the education system. Difficulties should be faced and resolved with the help of a clear national education plan. Private and government sectors must strive to foster IT awareness and literacy form a young age; view IT as a cross-curricular theme throughout formal education, convey the use of IT as a vehicle for life-long learning; and create an IT-proficient work-force, and use IT to encourage an ethos of life-long education and training.

Notes

1 Charles, Kwame, et al., *An Analysis of Information Technology Human Resources in Trinidad and Tobago*, April 1998.
2 Yearwood, C., Director of School Supervision, Ministry of Education, April 1999.
3 Information provided by David Eck, Director, Curriculum Development Unit, Ministry of Education, Belize, January 1999.
4 Information provided by Mrs Esther Joseph, Statistician, CAMDU, St Lucia, March 1999.
5 Examinations in IT include CXC 'O' level Information Technology (General and Technical); Cambridge GCE 'O' level Computer Studies; Cambridge GCE 'A' level in Computing.
6 Charles, Kwame, et al., *An Analysis of Information Technology Human Resources in Trinidad and Tobago*, April 1998.
7 April 1999.
8 'Technology Transforming Education', *Trinidad Express*, 12 April, 1999, page 12.
9 CTU Working Papers: *The Role of the Caribbean Private Sector in Telecommunications Development*, September 1998.
10 In India, for example, even assuming that financing were available (which it is not), if more than 1,000 villages a year were to be connected and provided with the required hardware, it would still take 640 years to achieve nationwide coverage. See the proposal for the creation of a public communication utility at village level: Woods, Bernard, *Communications Technology and the Development of People*, London 1993.
11 *Tapping the financial market: The case of the Education Investment Corporation (Educor) of South Africa*
Educor is the largest private education institution in Southern Africa. The group, which has investments in education and personnel placement, has seen a boom in growth in recent years. The education arm employs more than 4,000 faculties to teach 300,000 students registered in its 160 branches.

Aside from traditional sources of funding (such as student fees) the company has explored new areas with considerable success. In June 1996 company shares were floated on the Johannesburg stock exchange. The promising prospects of distance education, paired with good management and excellent systems, has lead to an impressive 51 per cent rise in earnings per share in little more than 18 months.

The rise in share values reflects the impressive financial performance of the company. Educor's turnover more than tripled from December 1996 to the end of 1997, while operating profits rose by 78 per cent in the same period. Management attributes the impressive performance of the group largely to the sustained growth in the education businesses. The market capitalisation of Educor already exceeds US$ 433 million.

Reflecting the expanding business and cash availability, Educor has recently acquired the Charter Group spearheaded by the Academy of Learning franchises and the International Colleges Group (ICG). The ICG, integrated by Inter and the Rapid Results College, is a leading distance learning group with operations in South Africa, Zimbabwe and other countries in the region. The Charter Group is one of the top training institutions in South Africa and with new businesses opening up in places like Eke, New Zealand.

These acquisitions have not only doubled Educor's operations, but have boosted the group's presence in distance education over the internet. Intec in particular brings to the group state of the art internet technology and solid experience in delivery of education over the internet. Furthermore, based on the current size of the operation, Educor managers are seeking to achieve significant economies of scale in areas such as course development and advertising. The next step for the group is to go global in their operations and provide distance learning services around the world.

Source: <http://www.btimes.co.za/98/0308/comp/comp11.htm> and <http://www.woza.co.za/intec.htm>

12 Charles, Kwame, et al., *An Analysis of Information Technology Human Resources in Trinidad and Tobago*, April 1998.

13 Ibid.

14 Ibid.

15 Information provided by Mrs Esther Joseph, Statistician, CAMDU, St Lucia, March 1999.

16 Charles, Kwame, et al., *An Analysis of Information Technology Human Resources in Trinidad and Tobago*, April 1998.