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On Education and Training Appropriate Information Technology for Developing Societies

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Abstract

While information technology (IT) potentially holds promise in the technological advancement of developing countries, it is a revolution whose diffusion needs to be assessed. With the advent of IT in developing societies, education and training should play a significant role in IT policy dissemination and initiatives. Education and training towards appropriate IT remains crucial for the viability of a developing nation or region. Such viability is based on the effective use of material resources for public and private infrastructure.

This paper focuses on the applicability of IT in developing countries. It presents some issues of ***appropriateness*** *that need to be considered in formulating IT policies. It identifies education and training as crucial means of harnessing the potential of the emerging IT in developing societies.*

Introduction

Despite the fact that governments of developing societies would be concerned about the advent of IT and its impetus for scientific and technological, IT is emerging at a time when most are experiencing a period of economic recession and are obliged to meet basic social needs (Mhlanga, 1995). The IT industry in developing societies, on the other hand, represents a minute fraction of the economic activity.

The IT industry has a potential which holds promise in the technological advancement of developing countries. While developed industrialized countries could be viewed on almost an equal footing form an IT perspective, the same is not true for developing countries (IT penetration and perception in all the developing countries in not uniform.) Despite the lack of resources, large developing countries like India, Brazil and China have a high growth of IT industry because of the size of their domestic markets (Bhatnagar, 1992). Such countries have

experienced a rapid industrial growth in the last decade. Porter et al. (1996) report on the standing, emphasis and rate of change of high tech competitiveness for 28 nations. Their results show strong standing for the '4 Asian tigers' (Singapore, South Korea, Taiwan, Hong Kong), comparable to many Western European countries. Five of the 6 Asian 'cubs' (Malaysia, China, Thailand, Philippines, India and Indonesia), show dramatic rate in high tech production and export capabilities.

Most African countries, on the other hand, are disadvantage by the lack of resources, insufficient funding for training and limited domestic markets. The lack of vibrant indigenous IT industry forces such countries to import IT which may not be appropriate to their needs (the imported IT is quite often panel beaten to meet local needs.) The lack of software development houses leads to poor computerization efforts in developing countries. As a result the impact of IT on socio-economic development becomes very low.

In the absence of a government initiative on IT, the onus is on educators and computer professionals to educate professional bodies, government and other stakeholders on those elements of IT which are appropriate and conductive to developing societies.

This paper realizes the importance of education and training as a crucial means of harnessing the potential of the emerging IT in developing societies. It focuses on the applicability of IT in developing countries and presents some issues of appropriateness that need to be considered in formulating IT policies.

Importance of IT to Africa

Indeed, developing countries are capable of coping with and benefiting from IT (Ernst, 1986; Gupta, 1981), and should realize its importance as a tool for development, defence preparedness, and a catalyst in social transformation.

Open information

One significant socio-economic impact of IT stems from its ability to provide wider and free access to information which has been buried and archived in heaps of physical paper. For example, data collected from

examination results can be analyzed with results leading to public pressure on poorly performing schools. School admission processes can be automated, making them less corruptible. A lot of valuable data collected by governments is not analyzed simply because it is not accessible to individuals or institutions.

The advent of computers and telecommunication continue to enhance the increasingly interdependent world today. It is crucial for developing countries to realize the need of participating in the IT revolution so that they are not left isolated. The telecommunications revolution, for example, is clearly and fundamentally international in nature. The emerging 'networked economy', if allowed to develop in a competitive environment unfettered by artificial restrains and unnecessary regulation, will literally connect all the nations of the world. With schools and libraries connected to networks, educational resources available to children are multiplied. A global information highway will enrich their learning experience and better equip them for success in a complex world.

Decision making

Most developing countries are experiencing a period of harsh economic realities and are implementing economic structural adjustment programmes. One of the reasons for the poor economic performance of many African countries has had to do with the failure of both their private and public sector in terms of good administration, affective management and efficiency (Woherem, 1992). The advent of IT brings with it executive support systems, management information systems, decision support systems, etc. which can be used as catalysts to improve the management and administration of private and public sector organizations. Decision making, administration and management of organizations are enhanced.

Shortcomings of IT penetration in Africa

IT systems continue to penetrate Africa in different forms. Developing countries lack adequate expertise in software development. Many companies end up buying software packages that would still need to be tailored to their operations. This is mainly because most of these systems are developed by consultants from abroad. It is important to

note that the development models of such systems would be foreign to the local setting. Besides, when these systems go down, staff of the user company is unable to repair them. Their maintenance will, therefore, call for very large foreign currency expenditures.

Most African countries are characterized by poor telecommunication infrastructure, unpredictable electricity, and lack of financial and material resources. It becomes a challenge to realize the potential benefits that can accrue from the technology.

With the lack of skilled manpower, inadequate resources and lack of funding, there is a danger that Africa may become a physical dumping ground of technological goods made elsewhere. Real technology transfer occurs when a particular technology is capable of being developed, maintained, managed and operated domestically. This means that the receiving end user would have acquired not only the operational knowledge but also the deep technical know-how and tacit knowledge of the technology.

Strategy towards appropriate IT

It is very clear that the preceding section suggest that African countries should endeavour to initiate and control the process of IT skills and know-how acquisition through an internally generated development and policy/ strategy.

Policy for appropriate IT

It is important for a developing country to determine a policy for appropriate IT that will serve it best. Governments, on the one hand, always have a central role to play in the industrial process of their respective countries. They have to provide the infrastructure and stability necessary for the private sector to operate properly. IT professionals and educators, on the other hand, have an important role to play in providing a total prescription on how to determine an appropriate policy.

Avgegrou and Land (1992) and Land (1992) give a lengthy discussion on policy making for appropriate IT. Of interest, the authors present IT infrastructure that is needed to support national development plans. The

infrastructure comprises:

- Communication channels ranging from conventional telephone lines and postal services, to electronic networks, communication satellites, mobile telephones and faxes;
- Facilities such as telephone exchanges, repeater stations, value-added networks which enable other components of the infrastructure to function;
- Education and training facilities to provide the level of competence, understanding and skill of the populations at large, to ensure the successful use of new technology;
- Software tools including spreadsheets, e-mail systems, CASE tools, database management systems and systems software;
- Hardware systems including mainframes and personal computers.

The following are also cited to complement five areas:

- Whether (and how) to support the development of an indigenous IT industry, or to import technology and concentrate on effective utilization practices;
- What effective use of IT in the government sector can be made;
- How effective IT use for the benefit of the country's economy and society can be promoted.

The policy maker should have a clear vision of the desirable national activities and objectives that the IT should provide or support. It is imperative for IT specialists to develop a conceptual model of the processes by which developing societies gain access to external technology and technical information, absorb that technology/ information effectively, and institutionalize a science-based development and manufacturing capability leading to export-led growth in high technology products.

Curriculum oriented to development needs

Educational programmes geared specifically towards IT areas of need have not been designed. Such programmes would have to be interdisciplinary as there could be many different IT needs. University programmes cater for different categories to students and therefore

would not easily respond to the needs of the market place. Besides, education designed as it was, for the academic elite, cannot be applied in the same form when educational opportunities are opened up to the whole population (Nganumu, 1996). Academies in developing countries should spearhead the tailoring of curricular according to their societal needs. Textbooks with technology that is appropriate to development needs should be developed. With increasing paucity of funds for the university education system, private training will need to carry a large burden of the growing demand of IT professionals.

It remains a very difficult task, however for formal education centres such as universities and technical institutions to design curricula and define a syllabus for a dynamic and fast-changing technology. This is primarily because of the thorough and critical vetting procedures in constructing a syllabus. The rate at which technology is changing should not at all reflect a notion that formal education institutions are teaching obsolete technology and that non-formal training is the answer to coping with trends in technology. Formal education is really intended to integrate a solid foundation that enables the student to cope with the continuing requirements that are prompted by changes in technology. Non-formal training organizations, commonly considered as start-up entities on integrating information in IT such as types of software applications, are suitable for the development and growth of IT education and training. For example, designing a syllabus for high school computer education requires a foresight of how it is going to benefit the student (or loosely, client) at the end of the day.

Not all high school leavers go to university. Some go for vocational training while some look for industrial employment. A few of those that go to university remain in academia. Those that go into industrial employment will most likely end up pursuing continued education and training relative to their professional requirement. It is important to note that such high school computer educated leavers will be employed largely as trained technicians. The syllabus should, therefore, incorporate computer organization and architecture component. Such a component would also be included in due consideration for the student who opts for the continued formal education. Continued formal education emphasizes the three broad areas of computer science:

software development, hardware (or computer) architectures, and theoretical computer sciences.

On a more general note, it is important to underscore that the use of computers is, in its appropriate ways, just as relevant to any profession as it is to the computer profession. The rapid use of IT in different areas makes it imperative that computer literacy is spread far and wide. This includes the use of word processing and spreadsheet facilities. Such use of computers is viable more significantly to that student who pursues formal education (or employment) in a field (or profession) other than computer science.

Need for trainers

The major issue of IT manpower in developing countries relate both to the shortage in quantity as well as the gap in quality. Whether the gap is bridged through government initiative or private institutions, it would require a large number of trainers. Therefore, the immediate area which would need to be tackled is the training of trainers. In an environment where teaching is not the most attractive profession, special efforts would be needed to recruit and to train sufficient number of teachers. Rust and Darling (1990) state that "a significant portion of the limited funds in the developing world is being channelled into the educational sector, and yet, the governments responsible for allocating these funds and the donor agencies that are providing funds ... have a very unclear grasp of the factors that contribute to the improvement of teaching." This means improving the quality of teaching is rather difficult in the developing world. On the one hand, a reduction in educational services might be planned so that quality is improved for a smaller number of students. However, education is the focus of much attention of the meagre budget allocations. Thus, the political, moral and economic ramifications of such a course of action are overwhelming. On the other hand, the material and human resources available for education might be increased. However, the prospect of a much larger national investment in education is remote in many countries.

IT education and training quality is of central importance and concern to developing countries. To motivate excellence, the educators should be singled out and seen as making a special contribution to the

foundations of economic reconstruction. Whether the context is escaping economic recession or increasing competition for newly emerging markets, or one of striving for rapid national development, the role of science and technology education is of paramount importance (Eshiwani, 1986).

The development of the teachers' personal pedagogical knowledge and judgement should be the central concern of the training process. This is facilitated by collaboration with others, sharing the analysis and experiences in networks of colleagues. Recent research into the kinds of knowledge which teachers need in order to act effectively in classrooms and laboratories supports this view of what constitutes professional development. The practical knowledge which relates directly to action is qualitatively different from both academic subject matter and theoretical knowledge of educational disciplines (Calderhead, 1988; Carr, 1989; Shulman, 1987).

School-industry links

One emerging area that has high promise for the future is the development of industry/ education partnerships. These links are particularly promising for three reasons (Gardner, Sloane-Weisbaum & Rosman, 1992):

- industry's growing awareness of the vital role that education plays in the quality of their future workforce
- the only major new source of funding and other resource is industry; local and national government funding sources are stretched to the limit
- industry is a rich source of 'real world' examples for the classroom

Industry/ education programmes must be mutually beneficial. Industry gains the following from such partnerships:

- a more skilled and knowledgeable workforce
- a more supportive public

Education, on the other hand, receives:

- funding and other resources such as in-kind services
- places for students and teachers in industry laboratories

- equipment, materials, visiting scientists and engineers for the schools
- valuable interaction between industry personnel, teachers and students that promote knowledge and understanding
- classroom teachers with real world experience, increased credibility, and status

Interaction between industry and education will compel the educator and trainer to integrate instruction that is appropriate and conducive to society.

Conclusion

IT has a potential which holds promise in the technological advancement of the developing world. However, most developing countries are disadvantaged by the lack of resources, insufficient funding for training and limited domestic markets. Education and training are key elements of developing IT appropriate to developing societies.

With the world becoming increasingly interdependent today, IT is just as important to Africa as it is to the developed world. Besides, the advent of IT brings with it enhanced decision making, administration and management of organizations. However, with the lack of skilled manpower, inadequate resources, lack of funding, poor telecommunication infrastructure, and unpredictable electricity, there is a danger that Africa may become a physical dumping ground of technological goods made elsewhere. Most of the technology would be deems inappropriate.

African countries should, therefore, endeavour to initiate and control the process of IT skills and know-how acquisition through an internally generated development and policy/ strategy. The strategy should address among other elements, policy for appropriate IT, curriculum oriented to development needs, need for trainers and school-industry links.

References

Avgerou, C., & Land, F. (1992). Examining the appropriateness of Information Technology. In S. C. Bhatnagar and M. Odedra, (Eds.). *Social implications of computers in Developing Countries* (pp. [illegible] McGraw-Hill: New Delhi.

Bhatnagar, S. C. (1992). Information technology and socio-economic development: Some strategies for developing countries. In S. C. Bhatnagar and M. Odedra, (Eds.). *Social implications of computers in developing countries* (pp. 1-9). MacGraw-hill, New Delhi.

Calderhead, J. (1988). The development of knowledge structures in learning to teach. In J. Calderhead (Ed.). *Teachers' professional learning* (pp. [illegible]). London: Falmer Press.

Carr, W. (1989). Introduction: Understanding quality in teaching. In W. Carr, (Ed.). *Quality in teaching: Arguments for a reflective profession* (pp. [illegible]). London: Falmer Press.

Ernst, D. (1986). Implications for human resources development. *Economic and Political Weekly*, 30 August 1986.

Eshiwani, G. (1986). Use of science and technology to mankind. *The Kenya Times*, p. 10, 10, July.

Gardner, M., Sloane-Weisbaum, K., & Rosman, K. M. (1992). Training science teachers to establish and make use of school-industry links: Three exemplary models. In D. Layton (Ed.), *Innovations in Science and Technology Education, IV*, (pp. 75-86). UNESCO.

Gupta, P. P. (1981). Policy framework for development of computer technology and applications. In J. Bennet & R. Kalman, (Eds.), *Computers in Developing Nations*. North Holland, Amsterdam.

Land, F. (1992). The Management of change: Guidelines for the successful implementation of information systems. In A.

Brown, (Ed.), *Creating a business-based IT strategy*. Chapman & Hall.

Mhlanga, F. S. (1995). Towards a systems integration model framework for developing countries. *Ife Journal of Technology, 5*(2), 45-48.

Nganunu, M. (1996). A compromise curriculum for science and technology education *Towards scientific and technological literacy for all in Africa* (pp. 51-58). UNESCO.

Roessner, J. D., Porter, A. L., Newman, N. C., & Cauffiel, D. (1996). Indicators of high technology competitiveness of 28 countries. *International Journal of Technology Management, 12*(1), 1-32.

Rust, V. D., & Darling, P. (1990). *Teachers and teaching in the developing world*. New York/ London: Garland Publishing Inc.

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*, 1-22.

Woherem, E. E. (1992). Strategy for indigenization of information technology in Africa. In C Bhatnagar and M. Odedra, (Eds.). *Social implications of computers in developing countries* (pp. 70-80). New Delhi: McGraw-Hill.