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ABSTRACT

Information technology has changed the way that individuals and organizations interact with each other. New technological innovations have resulted in greater demands on IT departments to meet the needs of their internal and external customers and stakeholders. As a result of this, the management of information technology has become a very important issue within organizations. Previous research has indicated that the diffusion of information technology throughout a region can significantly impact the social and economic development of that territory; this is particularly true for developing countries. However, indications are that developing countries tend to have a common set of challenges that prevent them from fully capitalizing on these opportunities. Some of these challenges include deficiencies in technological, economic, as well as skilled human resources. The goal of this paper is to develop a theoretical framework to examine and analyze the factors that affect effective management of information technology within organizations. This framework is then examined empirically utilizing results from an exploratory survey questionnaire that was distributed to IT executives in three industries within developing regions. Organizational and managerial implications as well as future research directions are also presented.

Keywords

Management of Information Technology, IT executives, IT strategy, developing regions.

INTRODUCTION

Research has shown that the diffusion of computing and communications technology can have a significant impact on the economic development and growth of nations' worldwide (Goodman 1991, Nidumolu, Goodman, Vogel and Danowitz 1996, Rao 2001, Seally 2003). As a result of this, the development and subsequent use of information technology to improve the social and economic well-being of developing countries has gained increasing interest in recent times (Nidumolu et al., 1996; Goodman, 1991). However, indications are that developing countries tend to have a common set of challenges that prevent them from fully capitalizing on these opportunities. Some of these challenges include deficiencies in technological, economic, as well as skilled human resources. The magnitude of these problems varies from country to country. Some developing countries are able to adopt and make use of new technologies a lot faster than others. Most developing countries also have inadequate financial resources given that they possess very limited income and assets (Sadowsky, 1993). The Gross Domestic Product (GDP) of most of these regions is way below that of countries in developed regions. This results in very volatile economic conditions in these countries. The availability of skilled human resources will also be affected by the government and economic policies and the amount of investment that is made in the public education systems. Developing countries tend to have a huge supply of inexpensive, unskilled labor (Sadowsky, 1993). The drive to implement technologies that would improve efficiency and reduce labor costs is therefore not as urgent in these territories as it is in developed regions such as North America.

As a result of this, the management of information technology has become a very important issue within organizations, in spite of the fact that little research exist that attempts to identify and explain the factors that may affect this process in developing regions. In order to address these issues the paper develops a theoretical framework to identify, examine and analyze the factors that affect effective management of technology within developing countries. This framework is then examined empirically utilizing results from an exploratory pilot study involving three firms in three different industries within the Caribbean region. The paper addresses the general research question: What are the unique factors that affect effective management of information technology within developing regions? The primary purpose of the paper is to contribute to a broader understanding of the challenges that developing regions face as they attempt to become a part of the global network environment. This is accomplished by conducting an exploratory study. The general methodology utilized is to establish some broad dimensions from the research literature, an exploratory study over a small number of firms is then used to refine and extend those dimensions. The remainder of the paper is structured as follows: The theoretical background

of this research is explored and the research framework is developed based on the extant literature on developing countries and management of technology. A description of the research methodology used in the paper follows, and the findings of the study are then presented and discussed. The paper concludes with a discussion of the managerial implications and the limitations of the study, as well as future research directions.

THEORETICAL FOUNDATION

Fiscal and Regulatory Policies

Foreign Direct Investments in industries within developing countries has been going on for years. In a publication by the Bureau of Census (2002) on mergers and acquisitions in over 41 industries for the year 1998, it was reported that there were 483 cases of foreign companies' acquisitions of U.S. companies estimated at a value of US $233 billion, and 746 cases of U.S. companies acquiring foreign companies estimated at a value of US $128 billion. This kind of cross-border acquisition of companies results in international business across global networked organizations which often include operations in developing regions. One of the distinctive factors of international business is the number of different governments that makes the rules and regulations that can affect the network business environment   Each national government has the right to define the regulatory policies that govern doing business within their regions. In general, these governments are trying to protect the rights and interests of the citizens and local businesses; this sometimes conflicts with the growth strategy of international organizations (Sanyal, 2001). Government policies may dictate labor laws which can affect the length of time and the number of expatriates that can be sent from headquarters to work in some of these foreign countries. Other factors include customs and tariffs laws that affect organizations ability to import and export products. Research has highlighted the fact that regulatory policies at both the country and industry levels could have a significant impact on the competitiveness of the markets in which multinational corporations operate and this in turn could affect the IT structures and strategies of these firms (King and Sethi, 1992; Sanyal, 2001). Managers in these organizations have to therefore familiarize themselves with and play by the rules of the specific countries. Differences in languages and time zones further add to the complexities of this new environment.

In the case of foreign investments in developing countries, changes in the foreign exchange rates of developing regions in relation to the currency in developed regions can also affect the stability of the environment leading to volatile economic conditions (Reuer and Zollo, 2000). The economic policies of developing countries can also affect these countries ability to invest in quality telecommunications infrastructure to establish international links and to effectively participate in the global environment. The amount of investment in technology education and training can also be affected by the economic policies of the local government. In developing countries where the majority of the population are living below the poverty line, as exists in various parts of Africa, India and the Caribbean, Governments are more concerned with providing health care and jobs for the survival of its citizens, than in establishing an adequate and reliable telecommunications network. The costs of establishing and maintaining such a network would also be prohibitive in that environment. The procurement and taxation policies of government, the exchange rate of the local currency, inflation as well as tax incentives and special discounts to public and private sectors can all have an impact on the implementation and management of technology in developing countries (Madu 1989, Seally 2003).

Global Business / IT Strategy

The global business environment has undergone massive changes over the last two decades. The proliferation of the internet and the resulting global network has resulted in changes in the way individuals and businesses communicate and the way they interact with each other. In addition to this, information technology has begun to play increasingly important roles in assisting organizations to achieve short and long-term goals (Rockart, Earl and Ross, 1996). The mid 1990's have seen the emergence of strategic business networks or virtual organizations, either through mergers and acquisitions across various countries or through mutual cooperation. Traditional geographical boundaries are becoming non-existent. The information systems planning process during the 1990's has evolved into one that places great emphasis on the strategic alignment of the information systems plan with the business strategy (McKay, J. and Marshall, P., 2001). The focus is on the ability of the organization to use information systems planning to obtain some kind of competitive advantage.   The concept of IT as a value adding component to the business has therefore become extremely important in recent times. Commercial software production has been big business for many years. Historically however the cost to produce these commercial technology products has been extremely high (Banker, Datar, Kemerer and Zweig, 1993). This is demonstrated by the amount of spending that has been taking place within large corporations on these products. In a study conducted by Strassmann in 1997 it was estimated that this spending was US$1.076 trillion globally per year, of which approximately US $500 billion was spent in the United States (1997, p. 2). One of the reasons given for this high level of expenditure is the cost of software

development projects.   In order to achieve a reduction in these costs attention has been focused on the software development process. This process is one that has been studied and researched for many years (Deutsch and Willis, 1988; Kemerer, 1998). Various models and metrics have been used in an attempt to make the software development life cycle (i.e., the process from requirements definition, through to analysis, design, development and implementation) an efficient and cost effective one (Boehm, 1981; Kemerer, 1987, 1998; Hu, Plant and Hertz, 1998). Organizations within North America have attempted to reduce this labor cost by moving much of the software development process to developing countries where the cost of labor is a lot less than in their own territories. We have seen significant evidence of this with the movement of the software development processes from large companies within North America to developing countries such as India (Rao, 2001; Baker and Kripalani, 2004). The availability and quality of the skilled labor to be found in these territories is however not prevalent in all developing regions. The majority of these developing countries still face significant challenges in finding and retaining their own skilled local labor to assist in the effective management of technology in these regions. The technological environment is also changing, many of the tasks that were previously performed solely by the IT department is now being done through internal line managers, outsourcing to vendors, application service providers and other third party companies (Rockart, Earl and Ross, 1996). Demands for returns on IT investments by knowledgeable internal and external stakeholders of an organization are also increasing. The senior IT executive is therefore required to be able to develop and present financial statements identifying the risks and benefits to be derived from the various IT investments (Earl and Feeny, 1994; Chatterjee, Richardson and Zmud, 2001).

Telecommunications Structure

There is a huge variation in the technology infrastructure within developing countries. One of the main reasons for this variation is the availability and adequacy of the network that exists within individual countries, and that connects each country to the external world. The availability and quality of the network will also be impacted by the fiscal and regulatory policies that exist in each country. The telecommunications infrastructure is usually controlled by the state in most developing countries, although deregulation and liberalization of the telecommunications industry within these regions is transforming that entire environment (Gutierrez and Berg, 2000). The availability of bandwidth that is reliable and adequate to serve the needs of the country and establish international connectivity is extremely important. However in order for the data and telecommunications equipment to function effectively, there also has to be reliable electrical power supply (Sadowsky, 1993). Quite a few developing countries are notorious for power failures and there are still remote regions that do not have regular electricity supplies. Most developing countries at a minimum may have adequate telecommunications and power supply in the capital city but not anywhere else in the country. There continues to be a huge "digital divide" between countries in developed and developing regions. One example of this is the proliferation of computers and computing equipment within countries such as the United States in comparison to countries within developing regions. Countries such as Nigeria and Jamaica had an average of 4 and 199 mainline telephones and 7 and 39.4 personal computers per 1000 people respectively in 2000. While Finland and the US had 550 and 700 mainline telephones and 396 and 585 personal computers per 1000 people respectively in 2000 (World Bank 2002). The involvement of developing countries in the global network economy will be heavily dependent on those countries being able to have access to a technology and telecommunication infrastructure that is both reliable and economical.

Technology and Management Expertise

Maintenance and utilization of the technology to its fullest capacity is one of the major components of effective technology development and management that will lead to economic growth (Madu 1989). The traditional job path to the top IT executive position in most organizations has been through internal promotions within the organization usually from among employees within the IT department (Applegate and Elam, 1992).   In 1991 a study conducted by Stephens et al. indicated that 80% of the five Chief Information Officers (CIOs) they interviewed were internal hires. The research literature indicates that there is a growing move towards obtaining IT executives with a broader span of knowledge within the business area. In some instances this has resulted in organizations hiring outside of the organization, as they are unable to find the required skill sets internally. This however has the added problem of the new hire not having as in-depth knowledge of the organization and its business processes as desired.   The "brain drain" of professionals from developing to developed countries makes it extremely difficult and expensive for developing countries to advance in technological development and effective management. The availability of a local pool of skilled IT executives will therefore be affected by the quality and level of investment in IT and other technical and managerial training as well as the migration rate of competent individuals from the country (Hawkins 2002). In a study conducted by Mathiassen, Borum and Pedersen (1999) the merits of action learning in an in-house management-training program within a Danish financial institution was examined. The CIO of the company was the sponsor of the program which was designed to equip the 1000 IT employees with the required technological and managerial skills. The program included the following topics: information, technology and management;

organization, strategy and management; economics and finance, and managerial techniques. The program was designed using the principles of action learning, which is essentially training conducted within an organizational environment rather than in a classroom setting. This program utilized a combination of practical and real-world situations as well as theories and trainers from the academic world. The general consensus obtained from the study indicates that the program was successful in achieving its objectives.

RESEARCH FRAMEWORK

Based on the discussions above, the following research framework for examining the factors that affect effective management of technology in Organizations in developing regions is presented in Figure 1. The main objective of this paper is to examine the unique challenges that developing countries face in the management of technology functions within their territories.
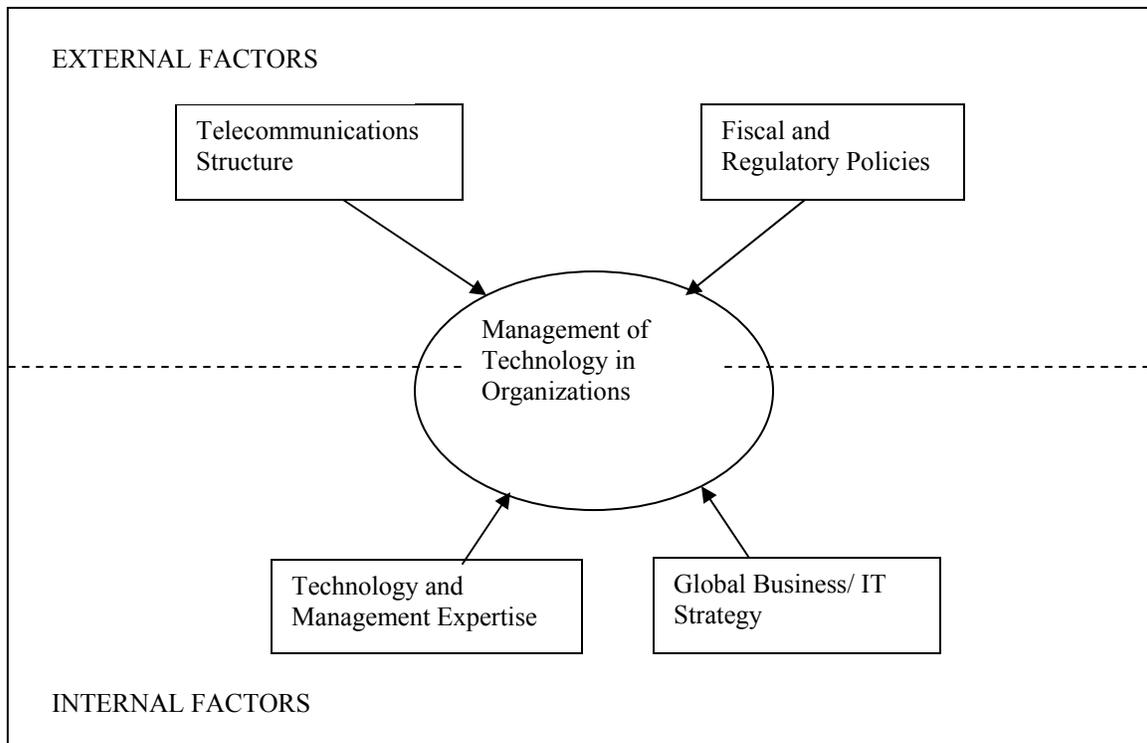

Figure 1. Factors affecting management of technology in Organizations

Research Methodology

In order to evaluate the broad dimensions presented in the research framework, an exploratory pilot study was conducted utilizing three firms. Four broad categories were identified based on the extant literature. A survey questionnaire which the participants completed online was then developed in order to examine the specific components within each of the categories. Some of the questions used in the survey were adapted from the CIO survey conducted between September and October 2001 and published in the CIO Magazine (2002). In order to provide flexibility, the option of "other" was included in all of the questions; this provided the opportunity for the respondents to identify items that were not included in the list under each of the categories. All of the data obtained was analyzed and will form the basis of a benchmarking exercise for the refinement of the survey tool for the future expanded study. The profiles of the three firms involved are as follows: Firm A is in the Education sector and operates as a non-profit entity. Firm B is in the Marketing sector and is a distribution subsidiary of a US based Multinational Corporation involved in hardware manufacturing. Firm C is a software development company with operations in Canada and the Caribbean focusing on the development of financial packages for the local financial sector within the region. The same selection criteria utilized by Stephens, Mitra and Ford (1992) was used in this study. The individual chosen from each firm was the highest ranking IT executive, responsible for strategic planning of information resources, and was also responsible for all areas of IT inclusive of systems development and maintenance, IT infrastructure and end-user computing. All of the participants were a part of the organization's executive management team. Summaries of the results of the survey are shown in Tables 1 and 2.

ANALYSIS AND RESULTS OF THE PILOT STUDY

Fiscal and Regulatory Policies

The territories in which these organizations operate vary according to size and economic stability. The Caribbean region consists of Islands located in the Caribbean Sea. These Islands vary in population size and terrain, from the smallest, approximately 8,000 people in Montserrat to the largest, over 2.5 million in Jamaica. The majority of the economies in these regions depend heavily on Tourism, which in some territories accounts for more than half of GDP. The countries range in approximate GDP per capita from US$2,900 in St. Vincent and the Grenadines to US$35,200 in Bermuda, with the vast majority being under US$10,000. The native language of the majority of these territories is English with some islands having a native dialect. In answer to the question "What are the biggest problems you face in being effective in your positions right now?" with regards to fiscal and regulatory policies components, Firm B indicated one of the problems for effective performance is the risk and uncertainty due to volatile economic conditions. Firm A indicated inadequate budgets as well as difficulty proving the value of IT. Firm C did not indicate any of these measures. This would therefore suggest that the economic and budgetary constraints of an organization play a significant role in the IT executives in that organization being able to effectively perform their function and manage the technology.

Global Business / IT Strategy

With regards to the problems faced by the IT department in the organization to effectively perform, Firm A indicated ineffective communication with users. Firm C indicated shortage of time for strategic thinking/planning. Firm A and B indicated that the IT needs of the organization are handled by Local centralized IT department. Firm C utilizes the corporate IT department. Firms A and B indicate that the majority of software projects are acquired by purchasing from vendors. Firm C indicates that these are obtained by Internal IT Staff Development. The results of this component suggests that there is a need for an expansion of the management function of IT executives as they are not only managing the internal IT staff but they are also now being required to manage the process on a more global scale which involves the inclusion of business partners such as the vendors and suppliers of software products.

Technology and Management Expertise

With regards to the Technology and Management Expertise measure that affects effective performance, all three firms indicated communication skills as being most lacking in current and potential employees. Firm A also indicated Interpersonal skills and Firms B and C indicated a lack of Project Management Skills. In the area of skills most important for the success of IT executives, all three Firms indicated Effective communication and Understanding the business process as being very important with a score of 1 each. Firm C gave Strategic planning a score of 1, while Firm A gave that component a score of 3 and Firm B a score of 2. Financial Planning/budgeting/risk assessment was given the following scores: Firm A – 3 and Firms B and C – 2. Thorough knowledge of technology options was given the following scores: Firm A – 3, Firm B – 1, Firm C – 2. Negotiation skills were given a score of: Firms A and C – 3, Firm B – 2. Managerial Skills: Firm A – 1, Firms B and C – 2. Technical proficiency received a score of 2 from all three Firms and Ability to influence salesmanship: Firm B – 1, Firms A and C – 3.

Telecommunications Structure

With regards to the technology infrastructure components, Firm A indicated that one of the factors of poor performance was the overwhelming pace of technology change. None of the other firms indicated any of the measures in this area affecting performance.

The results obtained show some amount of variance between the firms with regards to the specific items in each category. Despite this however, there are some items which are common to two or more firms. This includes an IT strategy which involves both the use of a local centralized IT department as well as purchasing from vendors, thereby demonstrating the need for an expansion of the management of information technology function to encompass business partners. In the area of technology and management expertise there is consensus on the lack of communications and project management skills in current and potential employees. Communication and understanding the business process are highlighted as very important factors for IT executives' success by all three firms. Factors dealing with the economic and financial components are also highlighted as being important factors by the firms. The lack of local technical and managerial skills within a developing country environment can cause the cost of the technology functions in organizations within these territories to be far greater than it would be in developed regions. Therefore being able to identify and deal with factors affecting the overall management of information technology on a local level would be extremely beneficial to organizations.

Categories	Firm A	Firm B	Firm C
Fiscal and Regulatory Policies			
Risk and Uncertainty due to volatile economic conditions		X	
Inadequate Budgets	X		
Difficulty proving the value of IT	X		
Global Business/ IT Strategy			
Ineffective communication with users	X		
Inadequate time for strategic planning			X
IT needs of organization handled by:			
Local centralized IT Department	X	X	
Corporate IT Department			X
Acquisition of software products:			
Purchasing from Vendors	X	X	
Internal IT Staff Development			X
Technology and Management Expertise			
Lack of key staff and skill sets		X	
Lack of business knowledge within IT Dept.	X		
Skills lacking in current/ potential employees:			
Communication Skills	X	X	X
Interpersonal Skills	X		
Project Management Skills		X	X
Telecommunications Structure			
Overwhelming pace of technology change	X		

Table 1. Summary of Findings

Technology and Management Expertise	Scale 1- Very Important, 5- Not Important		
Important Skills for success of IT Executives	**Firm A**	**Firm B**	**Firm C**
Communication	1	1	1
Understanding the Business	1	1	1
Strategic Planning	3	2	1
Financial planning/budgeting/risk assessment	3	2	2
Knowledge of Technology Options	3	1	2
Negotiation Skills	3	2	3
Managerial Skills	1	2	2
Technical Proficiency	2	2	2
Salesmanship Ability	1	3	3

Table 2. Summary of Findings (Only items that scored 3 or higher are reported)

CONCLUSION

The major contribution of this paper is to present a research framework for the identification and examination of factors that affect the management of information technology in organizations within developing countries and to present the preliminary results of a test of the usefulness of the framework. Although this exploratory study only examined three organizations and more data would have to be collected in order to do a full analysis of this area, the results obtained provide us with some useful insights. In the area of fiscal and regulatory policies, the factors highlighted are the volatile economic conditions, the inadequate budgets and difficulty proving the value of IT to the organization. In the area of Global Business/ IT Strategy, ineffective communication with users and shortage of time for strategic thinking/ planning were highlighted. Although Firms A and B indicated that the IT needs of the organization are handled by the local centralized IT departments, they also indicate that the majority of the software projects are obtained by purchasing from vendors. In the area of Technology and Management Expertise, all three firms indicated communication skills as being most lacking in current and potential employees. All three Firms also indicated Effective communication and Understanding the business process as being very important skills for IT executives. It should also be noted that these two factors were rated above Technical proficiency by all three firms. In the area of Telecommunications Structure, Firm A indicated that the fast pace of technology change was one of the factors affecting poor performance in that organization.

The identification of these factors can help managers in these areas to identify deficiencies and to improve the management of technology in these regions. The results indicate that effective management of information technology will be impacted by the ability of these organizations to obtain the required financial resources to invest in new information technology. The ability to provide in-house managerial and technology training of employees to make up for the deficiencies that exist in the public education systems is also an important factor. Effective management of information technology in developing regions can result in an improvement in the productivity levels of organizations and an improvement in their ability to take advantage of various economic opportunities globally. In continuing this research, the survey instrument will be refined to facilitate broader input from respondents and the number of organizations involved will be increased.

REFERENCES

1. Applegate, L. M. and Elam, J. J. (1992) New Information Systems Leaders: A Changing Role in a Changing World, *MIS Quarterly*, 16,4, 469-490.

2. Baker, S. and Kripalani, M. (2004) Software: Will Outsourcing Hurt America's Supremacy? *Business Week,* March 1, 2004, 85-94.

3. Banker, R. D., Datar, S. M, Kemerer, C. F. and Zweig, D. (1993) Software Complexity and Maintenance Costs, Association for Computing Machinery. *Communications of the ACM*, New York; 36, 11, 81-95.

4. Boehm, B. W. (1981) Software Engineering Economics, Prentice-Hall.

5. Bureau of Census. (January, 2002) Mergers and Acquisitions by Industry: 1998. Statistical Abstract of the U.S.: 2001. 493. Retrieved March 9, 2003 from LexisNexis Statistical.

6. Chatterjee, D., Richardson, V. J. and Zmud, R. W. (2001) Examining the Shareholder Wealth Effects of Announcements of Newly Created CIO Positions, *MIS Quarterly*, 25, 1, 43-70.

7. Deutsch, M. S. and Willis, R. R. (1998) Software Quality Engineering – A Total Technical and Management Approach, Prentice Hall Inc., Englewood Cliffs, New Jersey.

8. Earl, M. J. and Feeny, D. F. (1994) Is Your CIO Adding Value? *Sloan Management Review*, 35, 11-20.

9. Goodman, S.E. (1991) Computing in a Less-Developed Country. *Communications of the ACM*, 34, 12, 25-28.

10. Gutierrez, L. H. and Berg, S. (2000) Telecommunications Liberalization and Regulatory Governance: Lessons from Latin America. *Telecommunications Policy*. 24, 865-884.

11. Hawkins, R. J. (2002) Ten Lessons for ICT and Education in the Developing World. In: The Global Information Technology Report 2001-2002 (G. S. Kirkman, K. Schwab, J. Sachs and P. Cornelius eds.), Ch. 4, pp. 38-44. World Economic Forum. Oxford, University Press, New York.

12. Hu, Q., Plant, R.T. and Hertz, D. B. (1998) Software Cost Estimation using Economic Production Models, *Journal of Management Information Systems*, 15, 1, 143 - 163.

13. Kemerer, C. F. (1987) An Empirical Validation of Software Cost Estimation Models, *Communications of the ACM*, 30, 9, 416 - 429.

14. Kemerer, C. F. (1998) Progress, Obstacles, and Opportunities in Software Engineering Economics, *Communications of the ACM*, 41, 8, 63-73.

15. King, W. R. and Sethi, V. (1992) A Framework for Transnational Systems, in The Global Issues of Information Technology Management (Palvia P., Palvia, S., and Zigli, R. editors.), Idea Group Publishing, Harrisburg, PA. 214-248.

16. Madu, C.N. (1989) Transferring Technology to Developing Countries – Critical Factors for Success, *Long Range Planning,* 22, 4, 115-124.

17. Mathiassen, L., Borum, F. and Pedersen, J. S. (1999) Developing Managerial Skills in IT Organizations - A Case Study Based on Action Learning, *The Journal of Strategic Information Systems*, 8,2, 209-225.

18. McKay, J. and Marshall, P. (2001) Conceptualising Information Systems Planning Across Strategic Business Networks. *Journal of Global Information Management*, 9, 2, 23-33.

19. Nidumolu, S. R., Goodman, S. E., Vogel, D. R. and Danowitz, A.K. (1996) Information Technology for Local Administration Support: The Governates Project in Egypt. *MIS Quarterly*, 20, 2, 197-224.

20. Rao, P.M. (2001) The ICT revolution, internationalization of technological activity and the emerging economies: implications for global marketing, *International Business Review*, 10, 5, 571-596.

21. Reuer, J. and Zollo, M. (2000) Managing Governance Adaptations in Strategic Alliances, *European Management Journal*, 18, 2, 164-172.

22. Rockart, J. F., Earl, M. J. and Ross, J. W. (1996) Eight Imperatives for the New IT Organization, *Sloan Management Review*, 38, 43-55.

23. Sadowsky, G. (1993) Network Connectivity for Developing Countries, *Communications of the ACM*, 36, 8, 42-47.

24. Sanyal, R. N. (2001) International Management - A Strategic Perspective, Prentice Hall.

25. Seally, W.U. (2003) Empowering Development through E-Governance, *International   Information and Library Review*, 35, 335-338.

26. Stephens, C. S., Mitra, A. and Ford, N. (1995) The CIO's Dilemma: Participating in Strategic Planning, *Information Strategy*, 11, 13-17.

27. Strassmann, P. A. Will Big Spending on Computers Guarantee Profitability? *Datamation*, February 1997, http://www.strassmann.com/pubs/datamation0297/ (07/2/2001).

28. World Bank (2002) World Development Indicators 2001. Issued By: International Bank for Reconstruction and Development. Publication Date: 2002.