Measuring ICT Development with an Integrated Information and Communication Technology Development (IICTD) Framework

Mindila A.N††., Rodrigues, A.J., McCormick D., Mwangi, R.W.

ABSTRACT

This paper presents an Integrated Information and Communication Technology Development (IICTD) framework that developing countries can use to measure the ICT initiatives undertaken both sectorally and nationally. The paper draws concepts from a large repertoire of digital development models developed by various researchers in the information society. The paper uses the Digital Opportunity Initiative (DOI) framework by Accenture et al (2001] as a base model and systematically carries out content analyses of twenty six models and composite indices for ICT development measurement drawing similarities and differences in the variables. The original variables of DOI framework are retained while the variables from other models that do not appear in the DOI framework are incorporated to form the IICTD framework. The policy portion of the IICTD is tested on Kenya and results output indicates the commitment of the stakeholders in creating an enabling environment for ICT to thrive.

Keywords: ICT, ICT Development, ICT Development Measurement, DOI, ICT Human Capacity

IJCIR Reference Format:

Mindila A.N., Rodrigues, A.J., McCormick D., Mwangi, R.W. Measuring ICT Development with an Integrated Information and Communication Technology Development (IICTD) Framework**.** International Journal of Computing and ICT Research, Vol. 7 Issue 2, pp 67-91. http://www.ijcir.org/volume7-issue 2/article 6.pdf

1.0 INTRODUCTION

The IICTD integrates variables, identified by various models in ICT development, under five categories namely Infrastructure (I), Human Capacity (HC), Enterprise (E), Content and Applications (CA), Policy (P) and Strategic Compact (SC). The categories used are similar to those used in the DOI framework by Accenture et al (2001) because it is used as a reference model upon which all the rest revolve.

ICTs are technologies that include a varied set of goods, applications and services that facilitate collection, storage, processing, transmission, communication and presentation of information by electronic means. The information can take the form of voice, data, text and images (Albright 2005; Gripenberg 2004). This broad definition encompasses the full range of ICTs from radio and television to telephones (fixed and mobile), computers, satellite and wireless technologies and internet.

†† Author's Address:Mindila A.N - Jomo Kenyatta University of Agriculture and Technology, Kenya. Department of Computing. amindila@yahoo.com, amindila@icsit.jkuat.ac.ke
Rodrigues, A.J - Jaramogi Oginga Odinga University of Science and Technology, Kenya. Department of Computing. tonyaniceto@gmail.com
Mcormick , D - University of Nairobi, Kenya. Institute for Development Studies. dmccormick@uonbi.ac.ke
Mwangi, D.W - Jomo Kenyatta University of Agriculture and Technology, Kenya. Department of Computing. waweru_mwangi@icsit.jkuat.ac.ke

International Journal of Computing and ICT Research, ISSN 1818-1139 (Print), ISSN 1996-1065 (Online), Vol.7, Issue 2, pp. 67-91. December 2013.

There is a belief that digital empowerment of society could become the cornerstone of development in the information age. Economic and social empowerment today rests on the ability to access, gather, analyze and utilize information and knowledge to widen individual choices for political, economic, social, cultural and behavioral decisions. ICTs are the conduits which transmit information and knowledge and they are central for building knowledge societies (I-Ways 2005; Bijker et al 1987; Orlikowski 1992).

The revolutionary potential of ICTs lies in their capacity, with appropriate content and applications, to instantaneously connect vast networks of individuals and organizations across great geographical distances (Gripenberg 2004; UNDP-APDIP ICT4D 2004) and potential to facilitate creation of more and better knowledge and enabling existing knowledge to be better accessed (Mokyr 2000).

Over the years ICT has experienced what is known in the technical domain as convergence where we have seen the old technologies merge with the newer technologies, the radio, television, internet, computing have converged (Asian Development Bank Institute 2001). This description of ICT together with the concept of convergence is what forms "ICTs" referred to in this paper.

In trying to analyze the impact of ICT on firms, organization and countries researchers have adopted diverse conceptual, theoretical and analytical approaches and employed various empirical methodologies at multiple levels of analysis. The literature includes contributions from several academic disciplines in addition to information systems, including economics, strategy, accounting and operational research. Although knowledge has been enriched by such diversity, an ancillary consequence has been separate research conversations, hampering cross-pollination of ideas and findings (Melville et al. 2004). The struggle by ICT development scholars with various multi-disciplinary approaches will undoubtedly continue but this paper makes a contribution by presenting the IICTD that represents a convergence of the many models that exist.

2.0 REVIEW OF ICT THEORIES AND MODELS

A large repertoire of models has been developed by various researchers in the information society. This models range from descriptive models (those that have not been tested by data), theoretical models (those tested at least once) and composite Indices (Pena-Lopez 2009]. Most of these models seek to define what ICT development is, or what is also referred to as the digital economy development and they mainly illustrate how ICT development or information society or digital economy has been modeled.

One specific model is used in this paper as a reference point as it has been suggested as a development dynamic model whose modelers had a focus on ICT for development. Accenture, Markle foundation and UNDP created in 2000 the Digital Opportunity Initiative (DOI), which is a descriptive model, to identify the role of ICTs in development. The DOI also referred to as the development dynamic was developed to help policy-makers to identify the main points to foster the development of ICTs and their impact of sustainable development (Accenture et al. 2001)

The Digital Opportunities Initiative (DOI) framework has been offered to provide key strategic interventions to countries. The components of this framework are, policy, infrastructure, enterprise, human capacity and content and applications. DOI is itself a descriptive model which has not been tested against real data. Its main strength lays in the fact that it focuses on the intense use of ICTs to spur development. The proponents of the framework argue that used in the right way and for the right purposes ICT can have a dramatic impact on achieving specific development goals as well as play a key role in broader national development strategies (Accenture et al. 2001). They further argue that strategies of the use of ICT are not universal because countries face different circumstances. The key characteristic of this approach is its recognition of the need for flexibility with importance placed on different components depending on the region and the type of project.

The models considered cover descriptive, theoretical and composite indices models of digital economy development (Pena-Lopez 2009). They include the Access Rainbow (Clement and Shade 1998), the Global Action Plan for Electronic Business (WITSA 2002), the e-Commerce Readiness Assessment Guide (APEC 2000), Readiness Guide for Living in a Networked World (CSPP 2000), the e-Readiness Guide (GeoSINC 2002), the Models of access (Warschauer 2002; Warschauer 2003a; Warschauer 2003b), the Horizontal layers, Vertical sectors and diagonal areas of the Information Society (Hilbert and Katz 2003), the Real Access Criteria-e-Readiness Assessment (Bridges.org 2002), the Comprehensive Metric (Barzilai-Nahon 2006), the Global e-readiness (McConnell 2000), the e-Commerce Readiness in East Asian APEC economies (Bui et al 2002), the InfoState Model (Sciadas 2002), the e-African ICT e-

Index, (Gillwald and Stork 2007), the Technology Achievement Index (TAI) (UNDP 2001), the ICT Diffusion Index (UNCTAD 2006), the Digital Access Index (DAI) (ITU 2003), the Digital Opportunity Index (DOI) (ITU 2007a), the ICT opportunity Index (ICT-OI) (ITU 2007b), the ICT Development Index (IDI) (ITU 2009), the Knowledge Economy Index (KEI)(The World Bank 2007), the E-Government Readiness Index (UNPAN 2002), the Information Society Index (ISI) (IDC and World times 1996), the e-Readiness Rankings (Economist Intelligence Unit 2000-2009), the Networked Readiness Index (NRI) (Kirkman et al 2002), and the Connectivity Scorecard (Waverman et al 2009)

Each of these models focus on different perspectives of ICT development. For instance the Global Action Plan for Electronic Business (WITSA 2002) developed by the Alliance for Global Business (AGB) in collaboration with World Information Technology and Service Alliance (WITSA), an organization that has played an instrumental role in development of the information society. Its major focus is on the Enterprise and policy components of the DD, however it also tackles some of the other areas. With a great experience as practitioners in the ICT field and having dealt with governments in various countries the authors present a model based on trends, patterns and actual practices and how they can positively affect the development of ICT. They specifically make a call on establishment of the impact of ICTs on the economic and social aspects of communities through conducting studies.

The e-Commerce Readiness Assessment Guide (APEC 2000) model developed by the Asia-Pacific Economic Cooperation (APEC) forum presents guidelines upon which specific countries could use to gauge their e-Commerce situations. The forum focused on national policies, level of technology integration and regulatory practices. The major contribution this model has towards the development dynamic is provision of possible measurements that countries can do on the components of the dynamic. The guideline acknowledges diversity in regulatory, social, economic and cultural frameworks therefore putting in cognizance the fact that different economies encounter different challenges in their quest for development of e-Commerce.

The Readiness Guide for Living in a Networked World (CSPP 2000) model was designed as a self assessment tool to help communities gauge themselves to indicate how prepared they are to participate in a networked world. It was designed by the Computer Systems Policy Project (CSPP).

Each of the models was developed with specific aims targeted for either communities or countries hence covering a diversity of aspects in ICT development. Section 3 presents an assessment procedure used on each of the models and presents the resultant IICTD.

3.0 AN INTEGRATED ICT DEVELOPMENT DYNAMIC

In this paper the reference model, the DOI, was compared against other models listed below and a variant model output as described in figure 1 output.

A comprehensive review of the models (M) was done and gauged against the DOI development dynamic (DD) and new desirables aspects (A) identified added to the DOI DD to create new variant model (VM). The development of the variant model involved merging similar components and addition of new components. The flow chart given in figure 1 represents the procedure taken in reviewing existing models and picking new desired aspects that finally formed the Integrated ICT Development (IICTD) framework.

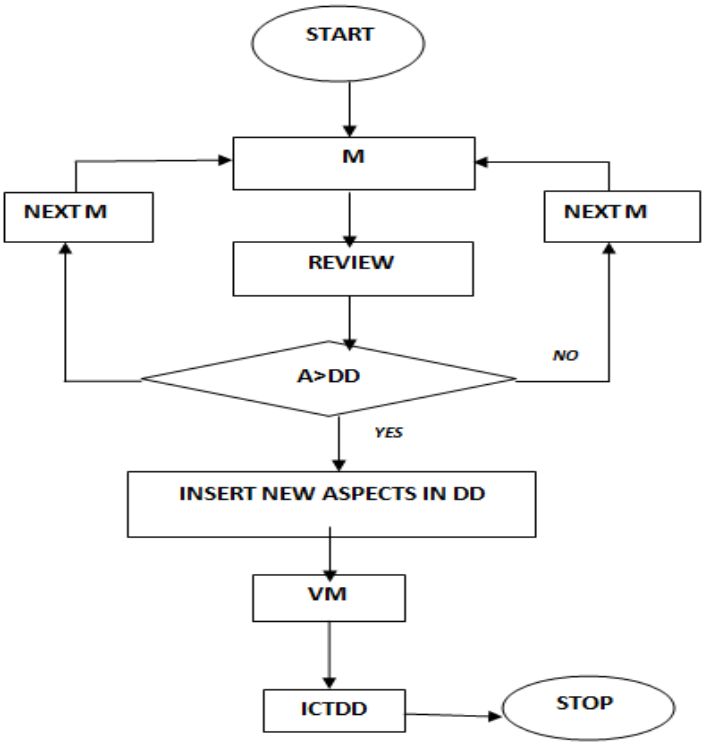


Figure 1: Flow Chart representing Models Review Procedure

An IICTD framework was developed that incorporated factors from the other models. Section 3.1 to 3.6 presents the components of the IICTD framework.

3.1 Content and Applications

The DOI framework when addressing content and applications it focuses on relevance and usability issues that seek to ensure responsiveness of ICT content and applications to local user needs and environment. It also addresses language compatibility, affordability and development of applications to ensure appropriate application of ICT for development (Accenture et al. 2001)

The Global diffusion of the internet model by Wolcott (2001) in addressing content and applications it focuses on sectoral adoption of ICTs. The Horizontal layers, vertical sectors and diagonal areas of information society model by Hilbert and Katz (2003) emphasizes applications in e-government, e-business, e-health, e-culture and e-media. Readiness guide for living in a networked world by CSPP (2000) in addressing issues of content and applications advocates for businesses to incorporate ICT into their operations for efficiency, schools should use ICTs to connect students, teachers and parents and they should also develop digital content and use ICTs for administrative purposes. It also advocates for government to be efficient internally and externally by employing ICTs. It posits that higher education sector should develop digital content and use ICTs for administration.

The e-commerce readiness assessment guide by APEC (2000) addressing content and applications it that the economy should support the development of adaptive technologies and applications, that there should be electronic payment, online authorization and deployment of e-commerce solutions. That there should be legal recognition of electronic documents and signatures and existence of liability policies.

On application of the flow chart in figure 1, the IICTDD Content and Application (CA) component derived is as shown in figure 2 which also shows the details therein.

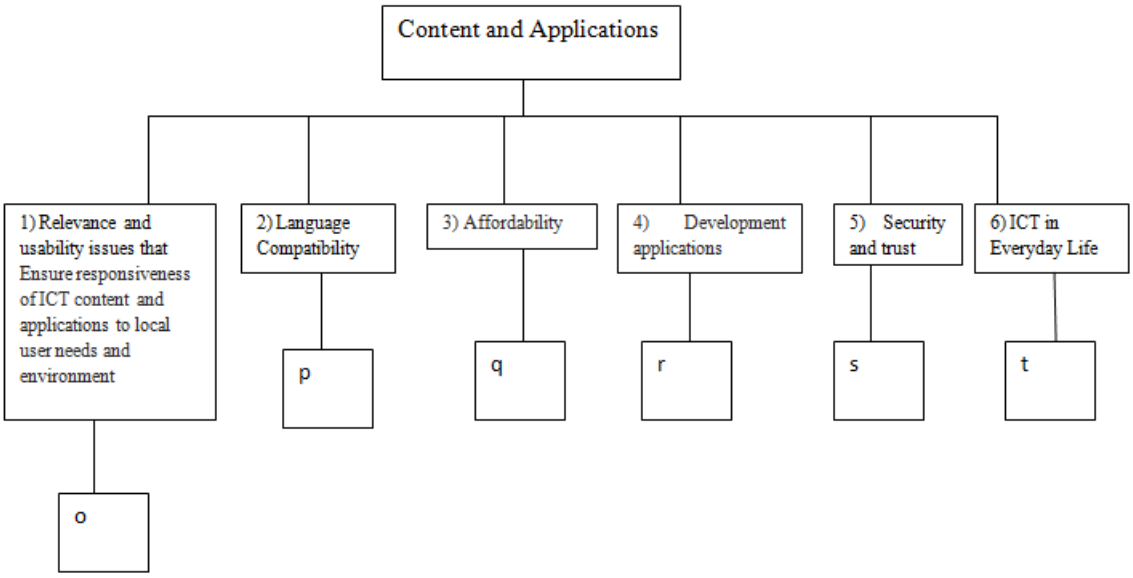


Figure 2: The Content and Applications (CA) Component of the IICTDD Framework

t		
(i) Penetration of ICT devices in the society (wireless phones, mobile phones) (ii) facilities like cybercafés, telecentres, community training centres and community information centres (iii) Strategies for drawing people to use the facilities. (iv) Demographics of internet users (Women, physically disabled, racial and ethnic minorities) (v) Organizations present online (vi) Government offices and businesses using ICT (vii) Incorporation of ICT into core processes	(viii) Fully networked computers in offices (ix) different office locations connected (x) Most employees with internet access (xi) Own email addresses. (xii) Businesses to incorporate ICT into aspects of their operations, for efficiency, for innovation. (xiii) Schools using ICTs to connect students, teachers and parents, develop digital content and for administrative purposes. (xiv) In health to contact patients online and perform consultation and procedures online.	(xv) For community based organizations to use the network to engage people and avail services. (xvi) For government to be efficient internally and serve citizens externally. (xvii) For higher education, digital content and administration. (xviii) The government to put in place Management Information Systems (MIS) and intranets for creating a collaborative work environment. (xix) e-Government and extranets for transparent public administration (xx) Encourage Sectoral absorption of ICTs

r

(i) Encourage web presence for domestic corporations, academic institutions and government agencies
(ii) Development applications: Interactive media and distance learning for both formal and informal learning
(iii) Support the development of adaptive technologies and applications (touch screens, special keyboards, speech technologies)
(iv) Existence of electronic payment
(v) Online authorization and settlement of e-commerce transactions

q

(i) Monitor telecommunication prices. Bridge differentials in urban and rural areas.
(ii) Waive taxes on personal computers.
(iii) Encourage flexible payment schemes for purchase of personal computers.
(iv) Encourage the establishment of cyber cafés/telecentres

s

(i) Existence of liability policies-balanced liability solutions ISPs should not be expected to carry burden of being held liable for all content nor should they be forced to control all
(ii) Content should comply for law enforcement
(iii) Self-regulation combined with user empowering technologies to provide a balanced and flexible solution to content control
(iv) There should be self- regulatory system for privacy protection based on self regulatory codes.
(v) Consumer confidence- enforcement by technical means through strong encryption, electronic authentication. Through user empowerment, quality labels, comparative reports, industry accreditation programs, track record of online transactions, codes of conduct.
(vi) Transparency in market enhanced by independent agencies dedicated to making and publishing market evaluation.
(vii) Existence of alternative dispute resolution and mediation for resolving consumer complaints

o

(i) Encourage content generators (for example, local media) to provide content on the web
(ii) Encourage the development of 'virtual malls' showcasing storefronts and products (for domestic and international benefit).
(iii) Dynamic content on local topics
(iv) Encourage web hosting and server hosting services (usually within academic centres).
(v) Implement national-level local content/ website awards
(vi) Local content generated by citizens at all levels of society
(vii) Interaction platforms such as chat rooms, online interest groups, special interest software, listservs and websites available

p

(i) Encourage the development of local language.
(ii) Encourage utilization of bilingual options on all government websites (for domestic and international use).

The factors *security and trust* and *ICT in everyday life* are new aspects that do not appear in the DOI framework but are contributed by other models considered. The detailed contents of the DOI framework are similarly enhanced by analyzing the content of the other models. For example the aspect of *relevance and usability* under the DOI framework in details shown in **o** focuses on the first five factors i.e. *encouraging content generators, virtual malls, dynamic content on all topics, encouraging web hosting and implementing national level local content* and *website awards*. The last two factors, *local content generated by citizens at all levels of society* and *interaction platforms* are contributions from other models. The models are adding new major aspects of CA and also enhancing the details of those factors.

3.2 Human Capacity

The DOI framework addresses development of human capacity as big contributor towards digital development. It focuses on developing a critical mass of core professionals with technical capabilities to provide and maintain ICT infrastructure and related services (Accenture et al 2001). It also focuses on encouraging development of a critical mass of entrepreneurs, technology users and interventions of the private sector in creating human capacity (Accenture et al 2001).

The Global Action for Electronic Business model by WITSA (2002) model complements the DOI by addressing human capacity that is focused on promoting technical training and lifelong learning. It advocates for promoting both formal and non-formal skills development programs and supporting studies that analyze impact of ICT on socio-economic factors.

The e-Commerce Readiness Assessment Guide by APEC (2000) model similarly addresses issues of human capacity development. On its part focus is on schools access to internet, schools and education institutions access to the most recent technology and technological applications. It proposes assessment of the percentage of schools with computer education as part of curricula.

Readiness Guide for Living in Networked World model by (CSPP 2000) focuses on three issues when addressing human capacity. One it advocates for assessment of schools access to ICT where it assesses number of computers in schools, physical access to technology and the types of computers. Two it advocates for enhancement of education with ICT where it focuses on training teachers to use computers and internet for the benefit of students, full integration of ICT in the learning process. Three, it advocates for training ICT workers in essential skills.

The e-Readiness Guide (GeoSINC 2002) model also addresses development of human capacity as necessary to achieve ICT development. It advocates for public awareness programs and organizing of short courses for computer specialization with the help of international network companies and equipment manufacturers.

The flowchart in figure 1 was applied to all the models and the Human Capacity (HC) component of the IICTDD designed as shown in figure 3 together with its details.

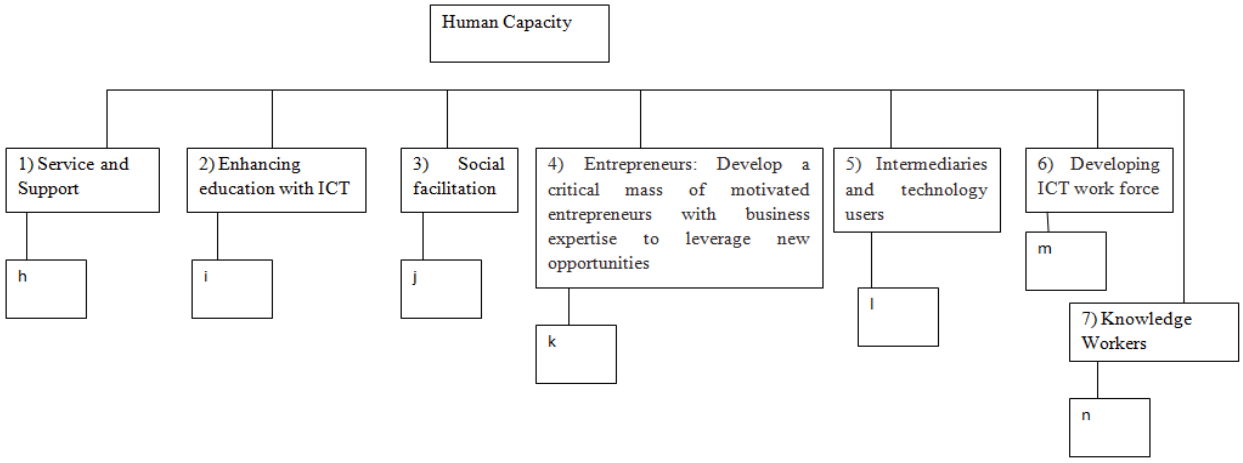


Figure 3: The Human Capacity Component of the IICTDD framework

n

(i) Promote ICT-related courses at university/college level and expand the base of supportive certificate and diploma level at college level. (ii) Create or promote the establishment of specialized ICT centres in institutes of higher learning. (iii) Begin basic ICT skills workshops for all students at tertiary level. **(iv)** Encourage national-level ICT awareness programmes, especially among primary and secondary school students. (v) Provide equitable remote access to resources in support of both distance education and the strengthening of local educational capacity. (vi) Connect schools, universities and research centres to national and international distance education facilities, national and international databases, libraries, research laboratories and computing facilities. **(vii)** Promote technical training and life-long learning (viii) Promote both formal and non-formal skills development programs (ix) Schools with access to internet and Initiatives to increase access of schools to internet	(x) Initiatives to integrate the internet and e-commerce in its education and training policy (xi) Schools and educational institutions accessibility to the most recent technology and technological applications (xii) Availability of end user organizations of skilled IT support service providers (xiii) Review of education system to take advantage of the most recent technological applications (xiv) Co-operation between educational institutions and businesses to develop up-to- date curricula. (xv) The percentage of schools with computer/ IT education as part of curricula

m

(i) Encourage corporations to appreciate ICT competent staff and conduct/sponsor ICT training for staff members/professionals. (ii) Emphasize re-skilling of present support staff in basic ICT skills. (iii) Encourage assessment and promotion of civil servants to include ICT competency. (iv) Begin basic ICT skills workshops for all civil servants to be conducted by the designated ICT officer in every ministry	(v) Share the e-government experiences of other developing countries at the senior civil servant level. (vi) Existence of regulatory barriers that restrict the free movement of workers by setting country specific requirements and avoiding mutual recognition. (vii) Existence of regulatory barriers to the free provision of services across border. (viii) Opportunities to offer future ICT workers both first time and continuing training in essential skills	(ix) Offering courses by vendor certification programs, educational institutions, private training centres, and distance learning programs **(x)** Online resources and courses available for development of technical skills (xi) Organization of short courses for computer specialization with the help of international network companies and equipment manufacturers

l

(i) Encourage ICT research and development and partnership with the private sector and international educational/research centres. (ii) Encourage student placements in international/domestic ICT corporations. (iii) Provide research and development grants to competing research centres on identified specialized areas.	(iv) Attract skilled ICT workers from abroad by offering benefits, ease of immigration, quick office set-up, and packages to facilitate participation. (v) Encourage conferences, workshops and seminars on the latest technological issues and trends to ensure dialogue and engagement (vi) Support studies and analyse impact of ICT on socio-economic factors

The models employed make a big contribution to the HC component. The DOI which acted as the reference model specifies three major aspects to be considered under HC. These are *knowledge workers, intermediaries and technology users* and *entrepreneurs.* The other four major aspects plus the detailed variables involved in the HC component are contributions from the other models. These aspects are *social facilitation*, *enhancing education with ICT*, *developing ICT workforce* and *service and support.*

3.3 Enterprise

The DOI framework presents the development of enterprises as an important aspect of ICT development. Under development of enterprises the framework focuses on providing access to funding and credit financing, observing property rights and commercial law, establishing fair tax regimes, increasing access to relevant global and local markets and demanding stimulus. The Access Rainbow model by Clement and Shade (1998) also focuses on enterprises and like the DOI framework focuses on finance and credit, property rights and commercial law and access to both local and global markets.

The Global Action Plan for Electronic Business model by WITSA (2002) encourages enterprise development by encouraging electronic business in production and distribution chains. The Readiness guide for living in a Networked World (CSPP 2000) model advocates for e-procurement, e-government, enabling innovation by enabling starting new business with minimal bureaucratic barriers and empowering consumers by enabling them to find information online.

The flowchart in figure 1 is applied to all the models under consideration and the enterprise component of the IICTDD framework is as shown in figure 4 together with its details.

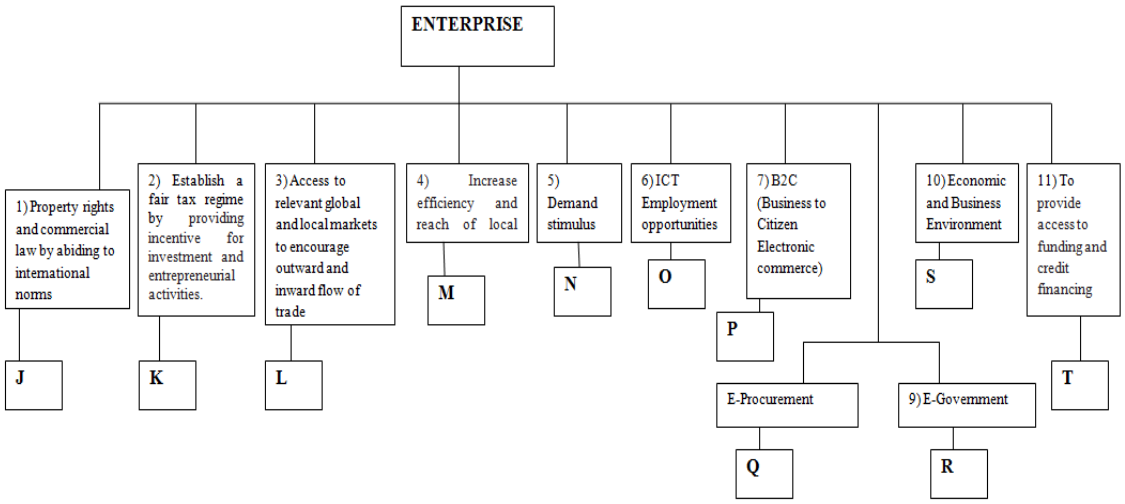
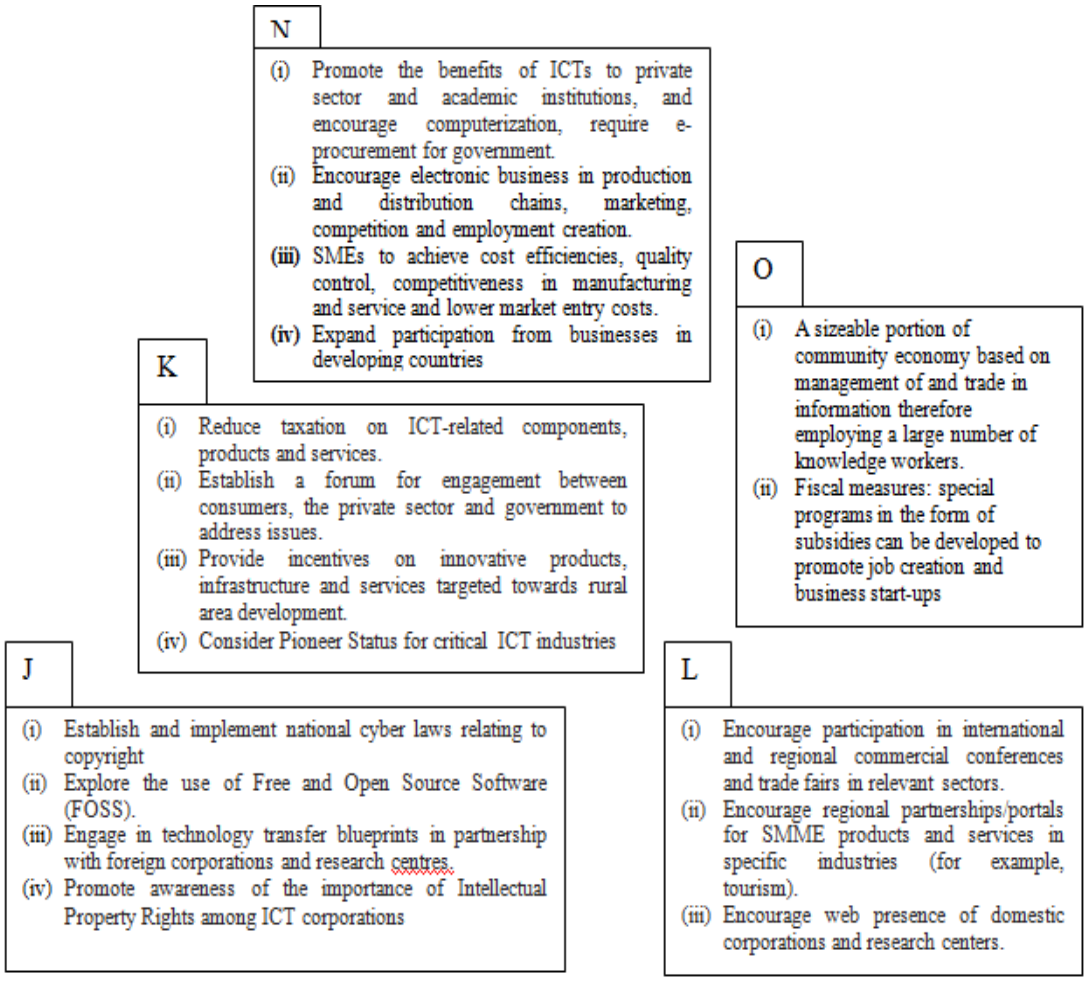
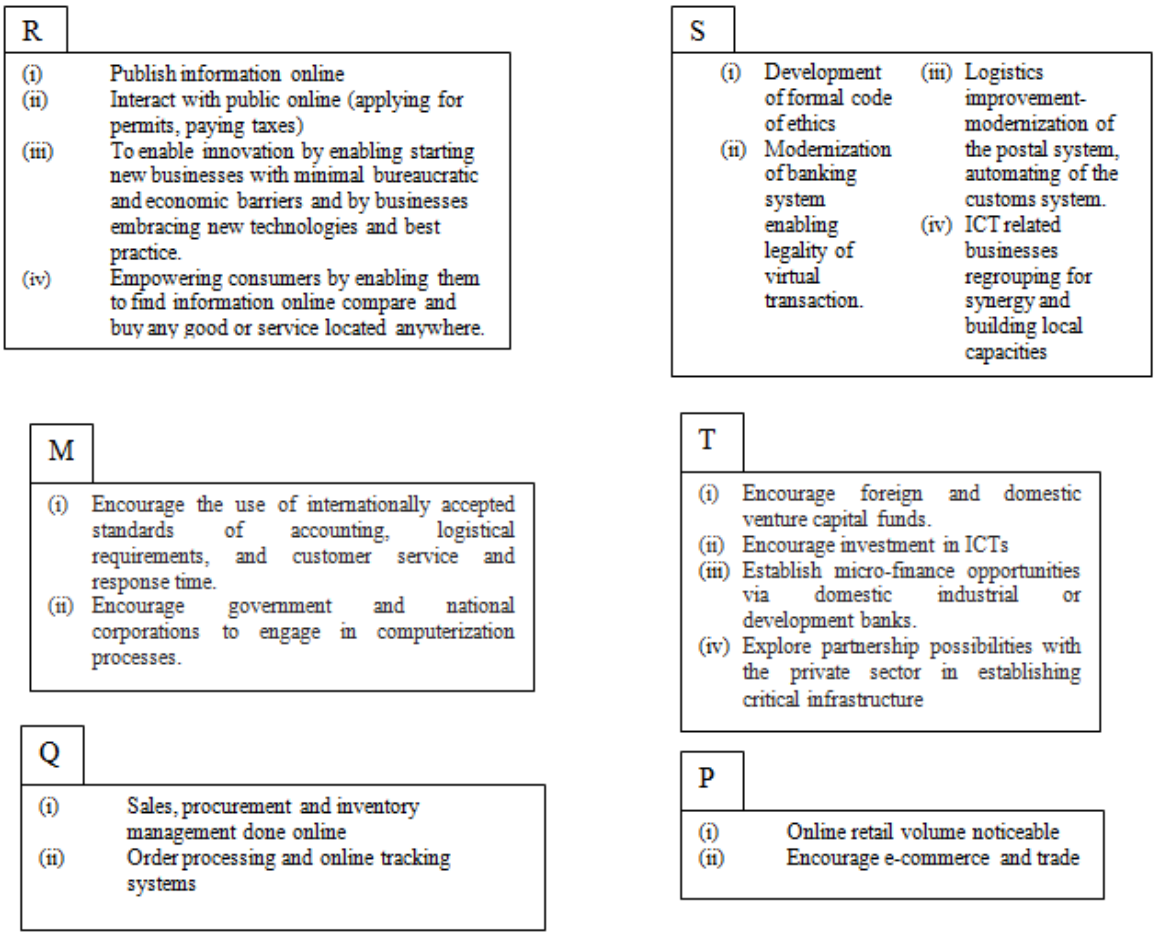


Figure 4: The Enterprise Component of the IICTDD framework


N
(i) Promote the benefits of ICTs to private sector and academic institutions, and encourage computerization, require e-procurement for government.
(ii) Encourage electronic business in production and distribution chains, marketing, competition and employment creation.
(iii) SMEs to achieve cost efficiencies, quality control, competitiveness in manufacturing and service and lower market entry costs.
(iv) Expand participation from businesses in developing countries
O
(i) A sizeable portion of community economy based on management of and trade in information therefore employing a large number of knowledge workers.
(ii) Fiscal measures: special programs in the form of subsidies can be developed to promote job creation and business start-ups
K
(i) Reduce taxation on ICT-related components, products and services.
(ii) Establish a forum for engagement between consumers, the private sector and government to address issues.
(iii) Provide incentives on innovative products, infrastructure and services targeted towards rural area development.
(iv) Consider Pioneer Status for critical ICT industries
J
(i) Establish and implement national cyber laws relating to copyright
(ii) Explore the use of Free and Open Source Software (FOSS).
(iii) Engage in technology transfer blueprints in partnership with foreign corporations and research centres.
(iv) Promote awareness of the importance of Intellectual Property Rights among ICT corporations
L
(i) Encourage participation in international and regional commercial conferences and trade fairs in relevant sectors.
(ii) Encourage regional partnerships/portals for SMME products and services in specific industries (for example, tourism).
(iii) Encourage web presence of domestic corporations and research centers.



Apart from the six aspects covered in the DOI framework under the Enterprise (E) component the E component of the IICTDD presents five more aspects contributed by other models. These aspects are *ICT employment opportunities*, *e-procurement*, *e-government*, *Business to Citizen* (B2C) and *economic and business environment*. These aspects detail the factors to be considered under each one of them as shown in figure 4.

3.4 Policy

Policy in the DOI (Accenture et al. 2001) framework focuses on transparency and inclusion, regulatory framework, de-regulation and liberalization, institutional capacity and an environment of trust and security.

The Global Action Plan for Electronic Business (WITSA 2002) complements DOI by detailing the specific policies. It tackles policies for most of the other components of the dynamic i.e. Infrastructure, Content and Applications, Enterprise, Human Capacity and strategic Compact. The contribution of this model is in the regulatory framework by focusing on protecting public interest, creating a good competition policy, creating open and competitive markets for provision of products and services at all levels of the information society, guarding intellectual property, enforcing technological neutrality, developing means of avoiding and settling commercial disputes between competitors by developing fair dispute resolution mechanisms, encouraging telecommunication liberalization, determining jurisdiction and applicable law in cyberspace, setting friendly taxation and tarriff regimes and using government as model users. The global action plan for electronic business also contributes to policies governing content and applications. Some of its contributions include: Protection of personal information, use of self-regulatory solutions and technological innovations that empower the user, protection of personal information in a way that does not prevent trans-border data flows, businesses should be encouraged to develop their own contracts and codes of conduct and seek endorsement from their governments, electronic validation mechanisms should be put in place, legal validity of electronic signatures, interoperability of certificates and electronic signatures, accreditation arrangements be enforced, certification practice statements based on internationally recognized best practices should be set up.

The e-Commerce Readiness Assessment Guide (APEC 2000) makes contribution for policies governing infrastructure and enterprise measures. These policies include how the telecommunication market is characterised (monopoly, duopoly, oligopoly, multiple licensed companies, open and effective competition), how the telecommunication market is regulated-(independent regulator, clear separation between telecom operators and regulator, regulator with authority to enforce pro-competitive principles), to what extent the government adopts international principles that facilitate the development of global services and ensure a level playing field for all providers (market commitment through World Trade Organization(WTO), complete adoption of regulatory principles), whether the economy has acceded to WTO Information Technology Agreement (ITA) in order to enable optimal market conditions and prices for technical equipment, whether foreign providers are allowed to participate in the market of wireless communication services, whether licensed spectrum is used for internet access, the number of spectrum bands used for internet access, whether the economy is open to foreign investment in wireless telecommunications, the number of licenses present(cellular, PCs network, packet data network), existence of a targeted public budget- universal access plans, position of the country on Intellectual Property(IP), country's' adoption of World intellectual Property Organization (WIPO) treaties on copyright and related rights, endeavors to avoid double taxation, introduction of taxes and tariffs on cross-border e-Commerce.

Applying the flow chart on all the models considered yielded figure 5 together with its details that represents the policy component of the IICTDD framework.

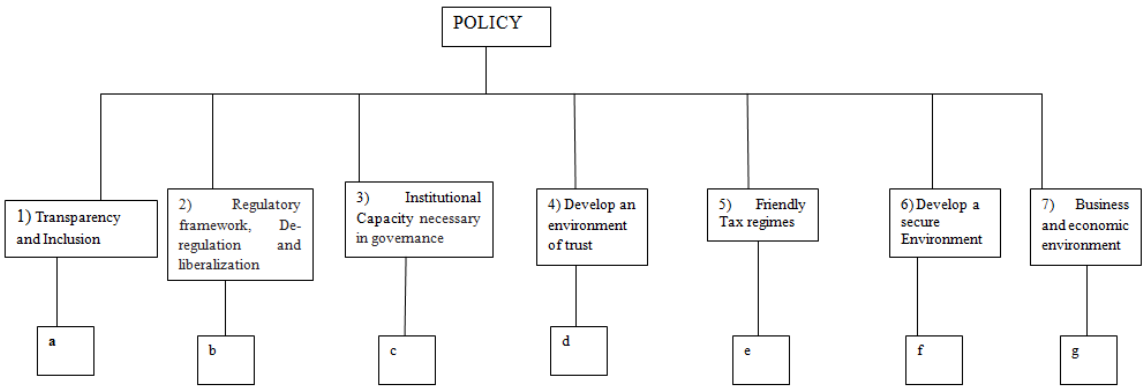


Figure 5: The Policy Component of the IICTDD Framework

d

(i) Establish national security policies and appropriate cyber laws. **(ii)** Review existing labor laws to remove existing barriers for workers to be able to learn and share in ICTs **(iii)** Appropriate policies to deal with convergence of technologies (iv) Governments to secure their own national and regional networks. (v) Protect public interest (vi) Create a good competition policy (vii) Create open and competitive markets for provision of products and services at all levels of the information society	(viii) Ensure Technological neutrality (ix) Develop means of avoiding and settling commercial disputes between competitors, develop fair dispute resolution mechanisms and determining jurisdiction and applicable law in cyberspace. (x) Transparency and availability of proprietary and best practice legal terms, model contracts e.t.c (xi) Businesses should be encouraged to develop their own contracts, codes of conduct and use of self-regulatory solutions and seek endorsement from their governments. (xii) Accreditation arrangements be enforced, availability of certification practice statements based on internationally recognized best practices. (xiii) Position of the country on Intellectual Property (IP), country's' adoption of World intellectual Property Organization (WIPO) treaties on copyright and related rights.

f

(i) Protection of personal information should not prevent trans-border data flows (ii) Electronic validation mechanisms, legal validity of electronic signatures, interoperability of certificates and electronic signatures (iii) Good management of Domain Name System and development of policy in collaboration with Internet Corporation for Assigned Names and Numbers (ICANN).	(iv) Ensure cyber-Security (v) Appropriate legislation and resources in place to investigate and prosecute cyber attacks (vi) Enterprises to put in place data storage requirements that support appropriate co-operation with law enforcement to enhance security (vii) Promotion of technology and services to ensure security

e

(i) Ensure friendly taxation and tariff regimes (ii) Avoid double taxation, introduction of taxes and tariffs on cross-border e-Commerce

b

(i) Careful planning on phases of liberalization and de-regulation has to be undertaken in order not to fall under the control of foreign corporations, as governments depend on domestic telecommunication revenues to fund national programmes. (ii) Initiate an objective study to determine at what level and in what areas deregulation and liberalization should be undertaken to ensure that the present and future needs of the populace are met (iii) How the telecommunication market is characterized (monopoly, duopoly, oligopoly, multiple licensed companies, open and effective competition)	(iv) How the telecommunication market is regulated-(independent regulator clear separation between telecom operators and regulator, regulator with authority to enforce pro-competitive principles) (v) Government adoption of international principles that facilitate the development of global services and ensure a level playing field for all providers (market commitment through World Trade Organization-WTO, complete adoption of regulatory principles)

a

(i) Recognize the importance of an enabling environment for the success of ICT for development. (ii) Engage and facilitate consultative processes with all stakeholders in the development of national strategies, agendas and policies. (iii) Publish and share national ICT policies and agendas in the public domain. (iv) Ensure access to decrees, policy papers and other information. (v) Encourage the process of interaction with the public via email and forums on the Internet.	(vi) Conduct assessments of public perception on levels of transparency and efficiency of civil servants. (vii) Address grievances at the ministerial level. (viii) Review the pros and cons of having a domestic monopoly of the telecommunication industry. (ix) Keep in mind that needs differ at different levels of national development. (x) Improve accessibility to national public administration information, especially to citizens who live in rural areas

g

(i) Perceived political risk (ii) Predictability of the legal environment (iii) Soundness of economic and monetary policies (iv) Openness to foreign direct investment (v) Convertibility of local currency (vi) Restrictions on capital flow	(vii) Credit card usage (viii) Credit card processing protocols (ix) Access to credit (x) Entrepreneurial culture (xi) Access to start up capital (xii) Regulations and restrictions on small businesses

c

(i) Establish a body or agency to monitor the telecommunications and ICT industry.
(ii) Establish a forum for engagement between consumers, the private sector and government to address issues.
(iii) Re-visit legal frameworks to ensure their continued applicability.

The DOI framework highlights four aspects that are *transparency and inclusion*, *regulatory framework* and *institutional capacity*. The other four that appear in figure 5 are highlighted by the other models. These are *developing an environment of trust*, *friendly tax regime*, *develop a secure environment* and *business and economic environment.*

3.5 Infrastructure

Infrastructure as posited by the DOI framework focuses on two items which are one, focused capacity that seeks to develop a strategically focused network infrastructure capacity for key sectors and two, it focuses on universal access to promote ubiquitous access (Accenture, 2001).

The Access Rainbow by Clement and Shade (1998) when considering infrastructure it focuses on the importance of carriage facilities, devices and software. The Global Action Plan for Electronic Business (GAPEB) (WITSA 2002) digital model when considering infrastructure focuses on interoperability and adherence to standards and convergence of technologies. The e-Commerce readiness assessment guide model (APEC 2000) on the other hand when considering infrastructure focuses on access where it talks of aspects like number of telephone lines per 100 people, percentage of population in economy with digital wireless Personal Computers (PCs) and percentage of population with access to internet. It also focuses on speed and functionality where it considers highest connection speeds supported by infrastructure. It focuses on price where the pricing structure of Internet Service Providers (ISPs) is considered. This model also focuses on reliability of infrastructure, availability of terminal equipment and interconnectivity and interoperability. Applying figure 1 on all the models yields the infrastructure component of the IICTDD as shown in figure 6 with its subsequent details.

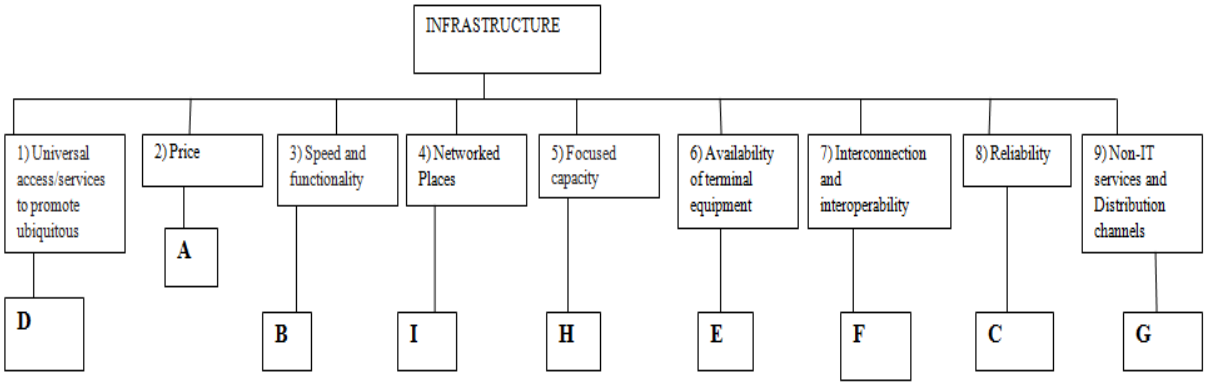


Figure 6: The Infrastructure Component of the IICTDD Framework

D

(i) Promote community telecentres/projects in rural areas to ensure last mile connectivity and simple community access solutions for people without means to equip themselves.
(ii) Encourage pilot projects with innovative technologies.
(iii) Explore partnerships with the private sector and encourage telecommunication firms to explore/expand into rural areas and boost ICT infrastructure for tax rebates.
(iv) Establish partnerships with NGOs engaged in awareness and innovative projects.
(v) Ensure that telecommunication costs are affordable to the masses.
(vi) Improve communication and information flow for better research and extension service linkages.
(vii) Increase coordination of donors and information flow among donors.
(viii) Tele density: number of telephone lines per 100 people
(ix) Percentage of area of economy with access to digital wireless or other system as direct PC.
(x) Percentage of population in economy with digital wireless or direct PC.
(xi) Percentage of economy accessible to cable
(xii) Percentage of population with access to internet via cable.
(xiii) Licences of radio spectrum for voice, data and video network access as alternative for wire line local loop or last mile
(xiv) Presence of restrictions to ISPs (individual license, class license, types of services, normal competition rules.
(xv) Number of ISPs
(xvi) Freedom of customers to choose ISPs, regulated service, pricing package
(xvii) Is access unbundled (without purchasing other services)
(xviii) Number of internet hosts as percentage of population
(xix) Estimated number of people who access internet per account
(xx) Percentage of businesses accessing internet.
(xxi) Internet sites with Secure Socket layer (SSL) with third party certification
(xxii) Presence of Secure Electronic Transaction (SET) and Secure Electronic Commerce Environment (SECE)
(xxiii) The purposes for which the internet is used by individuals (email, random surfing, catalogue and product search, low value transaction, high value transaction.)
(xxiv) The purposes for which internet is used by businesses (communication, marketing and customer support, work, e-commerce, total business transformation)
(xxv) How the government use ICT (internal use, online publishing, provision of services to public, transforming government)
(xxvi) Ensure Geographical dispersion and connectivity of Telecommunications Infrastructure
(xxvii) Organizational Infrastructure and geographical dispersion of the ISPs
(xxviii) Disabled and special needs population infrastructure

A

(i) The pricing structure charged to connect to the internet on dial-up(consumers/ business customers, levied by Internet Service Providers(ISPs)
(ii) Price level and structure charged to connecting to internet via leased line.
(iii) Pricing for leased business lines be set in a competitive environment featuring multiple vendors.
(iv) Prices for telephone/internet usage set competitively and affordable to nearly all citizens

C

(i) The number of dial-up attempts/connections that fail because of being busy
(ii) How often websites and addresses are inaccessible
(iii) packet loss
(iv) Faults reported per year for each 100 mainlines

B

(i) The highest connection speed supported by infrastructure to users
(ii) Average connection speed
(iii) Highest connection speed to business users
(iv) Average connection speed to business users
(v) Highest connection speed for wireless internet access
(vi) Users with dedicated high speed (>1.5Mbps) digital access to the internet.
(vii) How many ISDN or DSL subscribers are there per 1000 mainlines.
(viii) Are cable upgrades underway to permit interactive applications necessary for e-Commerce?
(ix) Access to high speed DSL, cable modems and wireless media
(x) Adequate opportunities for public access for those without access at home, school or work
(xi) High solution such as Digital Subscriber Line (DSL) and cable modem

H

(xi) Prioritize national sectoral policies
(xii) Establish industrial e-parks for selected sectors of the economy/industries.
(xiii) Establish regulatory frameworks to monitor telecommunication services and costs.
(xiv) Reduce taxation of ICT-related components, products and services.
(xv) Prioritize national-level initiatives to capitalize on the infrastructure envisioned.
(xvi) Plan and monitor the national telecommunication infrastructure grid.
(xvii) Establish regional and domestic telecommunication partnerships/peering/ hubs.
(xviii) Support national and regional as well as zonal, coordination, cooperation and standardization of regulations and legislation.
(xix) Tailor services, hardware and software to meet different demands for speed, service, security , quality and cost and needs and languages
(xx) Create a vibrant market place for software and hardware with a competitive retail and wholesale market for the products

I

(x) All businesses of all sizes and in all sectors connected
(xi) At government level network available to employees and at all public places for the public access.
(xii) Schools networked
(xiii) Higher education networked
(xiv) All heath providers have high speed access for communication and telemedicine.
(xv) All homes connected to the network.
(xvi) Provide network accessibility to the general public by means of a functional metropolitan and regional telecommunication network at an affordable price
(xvii) Provide infrastructure required by the development of ICT-based projects.
(xviii) Different technological solutions should be considered with a criteria based on cost, adaptation to context (geography and demography).

E

i)Availability of terminal equipment. Percentage of population with access to PC's through home, work, school

ii) Availability of terminal equipment. Mobile/ cell phones as a percentage of population

G

(i) Delivery services, airfreight, electricity, highways Transport infrastructure such as roads, railways, ports airports
(ii) Delivery channels such as postal services, private shipping services, warehousing, licensing and permits
(iii) Reliability and cost of electric power

F

(i) To what extent interoperability of networks enable user choice.
(ii) Standards – encourage industry to co-operate internationally for development and adoption of global, open standards and safe guarding against abuse of proprietary standards.
(iii) Existence of strict regulation of types of services allowed, quality levels, security levels.
(iv) Keep in mind convergence of technologies
(v) Ability to choose between varieties of fixed line and mobile infrastructure

The DOI framework focuses on two aspects of Infrastructure (I) namely relative ubiquity and strategically focused capacity. The rest of the aspects in the I component of the IICTDDD in figure 6 are highlighted by the other models. These factors are *price, speed and functionality, networked places, availability of terminal equipment, interconnection and interoperability, reliability* and *non-IT services and distribution channels*. They also specify the details of each of

the aspects as shown in figure 6. The models also enhance the details in relative ubiquity, whereas the DOI contributes i-vii of the factors, the other models contribute viii-xxviii of the factors.

3.6 Strategic Compact

The strategic compact component of the IICTDD remains similar to the one in the DOI (Accenture et al 2001) framework.

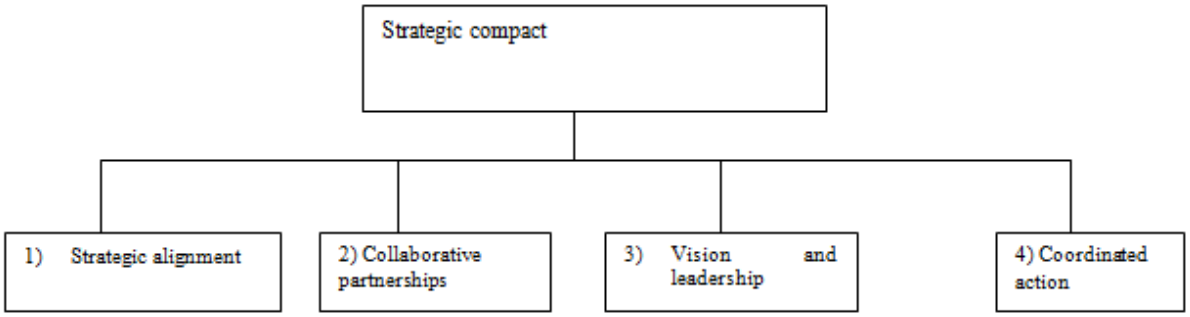


Figure 7: The Strategic Compact (SC) Component of the IICTDD Framework

The aspects under strategic compact are strategic alignment, collaborative partnership, vision and leadership and coordinated action. These factors would depend on the extra effort governments and communities would put in to ensure that ICT projects are successful.

4.0 VALIDATION OF THE IICTD FRAMEWORK

The Policy component of the IICTD was validated against Kenya. The data on the policy component in Kenya was obtained using secondary data from policy documents posted on the website of the Ministry of Information and communication and those printed by the government printer. The research was also informed on the current position of ICTs from the KICTANET mailing list archive. KICTANET is a mailing list which brings together many stakeholders in ICT in Kenya. It was founded by the Ministry of Information and Communication. Its mandate is to run debates on policy issues concerning ICT in the country and run structured discussions. The researcher was privileged to access the longitudinal archive data of the mailing list through one of the members. Sections 4.1-4.7 below give results for the policy component captured earlier in figure 5.

4.1 P.1: Policy: Transparency and Inclusion

P.1:Policy.Transparency and Inclusion		
1.i: Recognize the importance of an enabling environment for the success of ICT for development	**1.ii: Engage and facilitate consultative processes with all stakeholders in the development of national strategies, agendas and policies.**	**1.iii: Publish and share national ICT policies and agendas in the public domain.**
1. Existing policy frameworks for ICT4D emphasizing areas of focus 2. Civil society roles in ICT4D in extension of markets, finance and information services. Examples in this category Kimathi Information centre, SIDAREC, CFSK that emphasize community information access and resource centre, KICTANET for policy advocacy 3. Private sector roles of providers like Airtel, safaricom, Kenya Data Networks (KDN), Tespok, Jamii, Cisco academies 4. Public sector initiatives that include commissioning of e-government secretariat and ICT board, liberalization of ICT sector, gazettment of National ICT policy, initiation of TEAMS submarine project.	1. Participation in the WSIS process, Internet Governance Forum (IGF), AfTLD forums, ITU activities, African internet forum, Eassy meetings,AfNOG meetings, Rural connectivity forums 2.formation of working committees by MoIC and ICT stakeholder brainstorming sessions for discussion of bills and agendas- Kenya Information Communication Bill 2006, Kenya Communication Amendment bill, ICT parks, BPO standards development, KENIC open forums, e-waste policy discussion forums. ICT master plan debates 3. Regional Communication Infrastructure Program (RCIP) stakeholder consultation facilitated by World Bank and MoIC for private sector participation 4. Engagement in volunteer service to participate in governing bodies like ICANN 5. Formation of regional policy advisory groups- Internet society (ISOC) regional policy advisory groups	1. Study outcomes documentations circulated, participation of developing countries in WSIS, 2. Conferences, workshops and meetings on ICT issues- Digital commons, Konza city investment opportunities, ICT strategy paper, consultative meeting on financing of regional communication infrastructure program, models for EASSY and TEAMS discussed, AfTLD conference, ICT sessional paper, ICT bills discussion forums.

Table 1: Policy Results for Enabling Environment, Consultation and Sharing of ICT Policies

Table 1 shows the effort made in creating a consultative environment where key stakeholders in ICT are involved. For example part 1.ii indicates effort towards formation of working committees and stakeholder brainstorming sessions for discussion of bills and agendas in ICT.

Table 2 indicates a deliberate effort made in making policies accessible to the public by gazetting key policies and bills. Interaction with the public is achieved by creation of a web platform where policy discussions are done in a systematic way.

P.1:Policy.Transparency and Inclusion		
1.iv: Ensure access to decrees, policy papers and other information	**1.vi: Encourage the process of interaction with the public via email and forums on the Internet**	**1.x: Improve accessibility to national public administration information, especially to citizens who live in rural areas**
1. Gazettement of Kenya National ICT policy enacted in 2006 2. ICT bill 2009 enacted 3. BPO/ITES gazette notice 4. Kenya Communication (Radio communication and frequency spectrum) regulations, 2009 gazzeted. 5. National ICT sector master plan 2008-2012 6. Media Act 7. Digital Migration plan 8. ITU distributes standards free to telecommunication industry. 9. Report of IGF meetings distributed 10. Broadcasting regulation and the miscellaneous amendment act distributed 11. Kenya ICT board upcoming events posted 12.Distibution of reports- EAIGF summary reports, National business agenda report, press releases from MoIC, economic survey reports, accomplishments of Kenya ICT board, Freedom of information bill drafts, e-waste management policy draft, the copy right act drafts	1. Government Information portals and websites 2. KICTANET discussions	1. Enactment of Freedom of Information Bill. 2. Data Protection Bill 3. Government information portals and websites 4. Availing public data to the public through Kenyan portal

Table 2: Policy Results for Access to Policies, Interaction with Public and Access to Public Information

4.2 P.2: Policy: Regulatory Framework, De-Regulation and Liberalization

Table 3 exposes the good ideas implemented by the government but also raises the concerns. In part 2.i of table 3, the good ideas include the universal access fund set at 1% of telecommunications company gross revenue. This helps the places that are remote to be connected. One of the concerns raised is the level of independence of Communications Commission of Kenya (CCK) on issues of liberalization. Stakeholders felt that by the government appointing board members, then their independence of carrying out their mandate is questionable. On issues concerning adoption of international principles, section 2.v of table 3 reveals that Kenya is a member of International Telecommunications Union (ITU), WSIS and World Trade Organization (WTO), hence implementing international principles. The other details are as listed in table 3.

P.2: Policy. Regulatory framework, De-regulation and liberalization				
2.i: Careful planning on phases of liberalization and de-regulation has to be undertaken	**2.ii: study to determine at what level and in what areas deregulation and liberalization should be undertaken**	**2.iii: How the telecommunication market is characterized (monopoly, duopoly, oligopoly, multiple licensed companies, open and effective competition**	**2.iv: How the telecommunication market is regulated**	**2.v: Government adoption of international principles**
1. Selling shares in Telecom Kenya to Orange, complains of low pricing 2. Ownership and financing aspects of the fiber optic addressed 3. Questions arising over shareholding in safaricom, Mobitelea shares 4. Concerns expressed for need for ICT investment policy. 5. Implementation of universal access/service fund set at 1% of telecoms operators gross revenue. 6. Safaricom IPO suffered criticism-complains of setting prices in the international pool and allotting shares to all international applicants. 7. Independence of CCK questioned-appointment of board members by government. 8. Parliamentary debate on concerns over jeopardizing national security by selling shares in telecoms sector to foreigners.	1. Baseline review of media a study used to improve media policy 2. Kenya performance dubbed connectivity score card by nokia Siemens study 3. Internet market study commissioned by CCK. 4. Discussion forums on key issues in ICT as outlined in P.1.i	1. Oligopolistic tendencies present among ten major ISPs 2. Safaricom and Zain demonstrating duopolistic tendencies. 3. 4G spectrums open to all as stipulated by CCK 4. Presence of many operators enhanced competition and occasioned fair prices, UUNET, JTL, Wananchi, Safaricom, Airtel, Yu, Orange. 5. Mobile Number Portability failed.	1. CCK is the regulator on ICT issues e.g. Interconnection determination for termination rates of both voice and short message service (SMS), vetting promotional tariffs. 2. Sentiments from practitioners is independence of CCK is a theory and that government footprints are all over, may be aggravated by government having shares in Telkom/Orange and Safaricom, and KBC.	1. Kenya member state to ITU, WSIS, WTO

Table 3: Policy Results for Liberalization and De-regulation, ICT Surveys, Market Structure, Telecoms Market Regulation and adoption of International Principles

4.3 P.3: Policy: Institutional Capacity Necessary in Governance

Kenya has done well in building the institutional capacity necessary in governance.

P.3: Policy. Institutional Capacity necessary in governance.	
3.i: Establish a body or agency to monitor the telecommunications and ICT industry	**3.ii: Establish a forum for engagement between consumers, the private sector and government to address issues**
1. CCK, Kenya ICT board, KENIC PPP board, ICT advisory board, E-government secretariat, Computer Society of Kenya(CSK), Kenya ICT Federation (KIF), Kenya Business outsourcing and contact centre society, Business incubation association of Kenya, MoIC	1. ICT consumers association of Kenya 2. CSK forums, IGF forums, Civil Society congress forum on Kenya ICT.

Table 4: Policy Results for Agencies for Monitoring ICTs and Forum for Engagement with Consumers

Table 4 shows several bodies that monitor the telecommunications industry. These are as listed under part 3.i of table 4. There exist also a number of forums for engagement with consumers who include ICT consumers association of Kenya and Computer Society of Kenya (CSK). Others are as shown in part 3.ii of table 4.

4.4 P.4: Policy: Developing an Environment of Trust

Table 5 and table 6 summarize the measures the Kenyan government has put in place to ensure that an environment of trust is created. The results also indicate some crucial concerns raised by the public. For example in part 4.i on establishing national security policies and appropriate cyber laws, Kenya has Data Protection Bill, Child Online Protection Guidelines and Kenya Communication Amendment Bill. It has also enforced registration of mobile phones so that prevention of crime is achieved. Other interventions made are as summarized in table 5 and 6.

P.4: Policy. Develop an environment of trust.			
4.i: Establish national security policies and appropriate cyber laws	**4.iii: Appropriate policies to deal with convergence of technologies**	**4.iv: Governments to secure their own national and regional networks.**	**4.vi: Create a good competition policy**
1. Legislation that include: Data Protection Bill, child online protection publication by CCK, KCA bill, registration of mobile phones 2. Courts of Law 3. Concerns: Kenya website hacked, crime up due to cheap telephony by buying sim cards and throwing away 4. Interventions: police keeping track of suspected criminal activities by tracking of SMS and calls, development of a national cyber security strategy, surveillance on broadcasted content, SMS and e-mails.	1. Kenya Communication Amendment bill 2008 deals with convergence from a technological, context, regulatory and economic perspective. 2. Issues arising: Safaricom M-pesa and commercial banks raw	1. EASSY and TEAMs project 2. Efforts to secure GIXP/KIXP by CCK. 3. Efforts to harmonize regulatory requirement in the region.	1. Emerging issues: price wars between Safaricom and Zain 2. Profit margins posted by operators questioned. 3. Cost structures of operators questioned.

Table 5: Policy Results for National Security Policies, Policies for Convergence of Technologies, Government National and Regional Networks and Competition Policy

P.4: Policy. Develop an environment of trust.			
4.ix: Develop means of avoiding and settling commercial disputes between competitors, develop fair dispute resolution mechanisms and determining jurisdiction and applicable law in cyberspace	**4.xi: Businesses should be encouraged to develop their own contracts, codes of conduct and use of self-regulatory solutions and seek endorsement from their governments**	**4.xii: Accreditation arrangements be enforced, availability of certification practice statements based on internationally recognized best practices.**	**4.xiii: Position of the country on Intellectual Property (IP), country's' adoption of World intellectual Property Organization (WIPO) treaties on copyright and related rights.**
1. Communication tribunal that handles dispute between telecom operators, users and regulator 2. CCK 3. Law Courts	1. Media Council of Kenya and media advisory board which self regulates the industry 2. Information system/security advisors self regulate to protect consumers. 3. CSK aim to self regulate ICT industry	1. BPO society licensing any software applications to be used for any BPO business 2. Regional accreditation for ICT courses to meet regional standards by IUCEA	1. Kenya member state of WIPO 2. Copy right laws drafts 3. Kenya Intellectual Property Institute (KIPI) in place. 4. ISOC public policy working group on policy responses to copyright infringement via internet.

Table 6: Policy Results for Dispute Resolution, Codes of Conduct, Accreditation Programs and Intellectual Property

4.5 P.5: Policy: Friendly Tax Regimes

Table 7 shows the tax regimes the Kenyan government has adopted to ensure friendly taxation. These include waiving duty on telecommunication equipment and offsetting taxable incomes for ISPs and telecommunications companies.

P.5: Policy. Friendly Tax regimes
5.i: Ensure friendly taxation and tariff regimes
1. 25% exercise duty on imported refurbished computers and zero rated imported new computers, duty on computers and printers zero rated 2. Import duty on telecommunication equipment waived 3. Allow ISPs offsets on taxable income up to 20% 4. Exempted VAT to all telephones for cellular networks

Table 7: Policy Results for Friendly Tax Regimes

4.6 P.6: Policy: Developing a Secure Environment

P.6: Policy. Develop a secure Environment	
6.ii: Electronic validation mechanisms, legal validity of electronic signatures, interoperability of certificates and electronic signatures	**6.iii: Good management of Domain Name System and development of policy in collaboration with Internet Corporation for Assigned Names and Numbers (ICANN).**
1. KCA, 2008 provides for electronic transactions and signatures, supported M-pesa transactions and BPO where foreign investors can sign electronically.	1. Kenya member of Internet Corporation for Assigned Names and Numbers (ICANN) 2. All domain managers must be licensed by CCK 3. KENIC is current manager of .KE space.

Table 8: Policy Results for Electronic Validation Mechanisms and Management of Domain Name System

Table 8 part 6.ii shows that in the KCA 2008 it provides for laws on electronic transactions and signatures. Part 6.iii shows that Kenya is a member of ICANN for management of domain name system.

4.7 P.7: Policy: Business and Economic Environment

P.7: Policy. Business and economic environment	
7.i: Perceived political risk	**7.ii: Predictability of the legal environment**
1. Destruction of telecommunication masts 2. Mobile broadcast SMS reminding citizens of liability. 3. Sensor of SMS content 4. Sensor of radio station broadcast content. 5. Kenya Communication amendment Act deals with offences.	1. KCA Act stipulates the legal environment for businesses.

Table 9: Policy Results for Perceived Political Risk and Predictability of Legal Environment

Table 9 captures actions done to mitigate perceived political risk. Some telecommunication companies are concerned about censoring of content by the government and some are concerned with physical destruction of telecommunication installations.

5.0 DISCUSSION AND CONCLUSION

The IICTD provides researchers with a framework with which to measure ICT development in countries and communities. It integrates in one framework key aspects of infrastructure, content and application, human capacity, enterprise, policy and strategic compact variables that have been highlighted as important in order to achieve ICT development. The IICTD framework reconciles models for ICT development proposed by various researchers into one framework. It provides a means for an in-depth analysis of what is needed. IICTD is a framework that is measurable, as in the case of the policy component, and effective.

Further research would focus on testing of the remaining components of the IICTD framework on countries.

6.0 REFERENCES

ACCENTURE et al. 2001. "Creating a development dynamic: Final report of the Digital Opportunity Initiative (DOI)" Online Available: http://www.itu.int/wsis/docs/background/general/reports/26092001-doi.html. Accessed 30/5/2012

ALBRIGHT K.S. 2005. Global measures of development and the information society. *New Library world.* 106 (7/8), 320-331.

APEC .2000. E-Commerce Readiness Assessment Guide Auckland: APEC". (Online) Available: (http://www.schoolnetafrica.net/fileadmin/resources/APEC_E-Commerce-Readiness-Assessment.pdf. (Accessed: 12/7/2012).

ASIAN DEVELOPMENT BANK INSTITUTE. 2001. Information and communication Technology (ICT) strategies for developing countries. *Workshop for capacity building*. 21-27 February 2001. Singapore.

BARZILAI-NAHON .2006. Gaps and Bits: Conceptualizing measurements for digital divide/s. *Information Society* 22 (5), 269-278

BIJKER et al .1987. The social construction of technological systems In GRIPENBERG P. et al .2004. Entering the European Information society: four rural development projects. *The Information Society* 20, 3-14.

BRIDGES. 2002. Real Access/Real Impact criteria". (online). Available. http://www.bridges.org/Real_Access. (Accessed: 22/11/2012).

BUI et al .2002. E-Commerce Readiness in East Asian APEC economies- A Precursor to determine HRD Requirements and Capacity Building". (Online). Available: http://www.apec.org/apec/publications/free_downloads/2002.MediaLibDownload.v1 (Accessed: 4/9/2012)

CLEMENT A. AND SHADE L.R. 1998. The Access Rainbow: Conceptualizing Universal Access to the Information/Communication Infrastructure". *Information Policy Research program, Faculty of Information studies, University of Toronto Working paper* No.10. (Online). Available: http://www3.fis.utoronto.ca/research/iprp/publications/wp/wp10.html. (Accessed: 23/8/2012)

CSPP 2000. Readiness Guide for Living in the Networked World". (Washington DC:CSPP) (Online). Available: http://www.cspp.org/documents/NW_Readiness_Guide.pdf. (Accessed: 12/8/2010)

ECONOMIST INTELLIGENCE UNIT. 2000. The E-business Readiness rankings". (Online) Available: http://www. Ebusinessforum.com/index.up. London. EIU.

GEOSINC. 2002. E-Readiness Guide. How to develop and Implement a National e-Readiness Action Plan in developing Countries. Washington DC: InfoDev-The world Bank. (Online). Available: http://www.apdip.net/documents/evaluatio/e-Readiness/geoSinc01042002.pdf

GILLWALD A AND STORK C .2007. Towards an African ICT e-Index: Towards Evidence Based ICT Policy in Africa: Johannesburg. The Link Centre. (Online). Available: http://lirne.net/test/wp-content/uploads/2007/11/gillwald-and-stork-2007.pdf

GRIPENBERG P *et al*. 2004. Entering the European Information Society: Four Rural Development Projects". *The Information Society* 20, 3-14

HILBERT M.R AND KATZ. 2003. Building an Information Society; A Latin American and Caribbean Perspective. (Santiago de Chile). (Online). Available: http://www.cepal.org/cgi-bin/getProd.asp. (Accessed: 5/5/2010)

ITU .2003. World Telecommunication Development Report 2003: Access Indicators for the Information Society.

ITU .2007a. Definitions of World Telecommunication/ICT Indicators". (Final version April 2007. Geneva: ITU). (Online). Available: http://www.itu.int/ITU-D/ict/material/indDef-e-v 2007.pdf . (Accessed: 2/6/2007)

ITU .2007b. Measuring the Information Society. ICT Opportunity Index and World Telecommunication/ICT Indicators". Geneva ITU.

ITU. 2009. Measuring the Information Society. The ICT Development Index". (Geneva: ITU.) (Online). Available: http://www.itu.int/ITU-D/ict/Publications/idi/2009/material/IDI 2009-w5.pdf

I-Ways.2005. Global E-government Readiness Report 2004: Towards Access and Opportunity.*" Digest of Electronic Commerce Policy and Regulation.* 28, 9-23.

KIRKMAN et al. 2002. *Global Information Technology Report 2001-2002: Readiness for networked World*. New York. Oxford University Press

MCCONNELL.2000. Risk E-Business: Seizing the Opportunity of Global E-readness. Washington.D.C. (McConnel international). (Online). Available: http://www.McconellInternational.com/ereadiness/ereadiness.pdf

MELVILLE N et al. 2004. Review: Information Technology and Organizational Performance: an integrative model of It business value." *MIS Quarterly.* 28 (2), 283-322

MOKYR J. 2000. Knowledge Technology and Economic Growth During the Industrial Revolution. In Van Ark, B. Kuipers S.K and Kuper, G(Eds). *Productivity Technology and Economic Growth*. New York.

ORLIKOWSKI W.1992. The Duality of Technology: Rethinking the Concept of Technology" In Gripenberg P. et al (2004) "Entering the European Information Society: Four Rural Development Projects". *The Information Society* 20, 3-14

PENA-LOPEZ I. 2009. Measuring digital development for policy making: models, stages, characteristics and causes." (PhD Thesis (mimeo)). (Online) Available: http://ictlogy.net/articles/20090908_ismael_pena-lopez_measuring_digital_development.pdf

SCIADAS G. 2002. Monitoring the Digital Divide. Montreal: orbicom.(Online). Available: http://www.orbicom.uqam.ca/projects/ddi2002/ddi2002.pdf

THE WORLD BANK. 2007. Knowledge Economy Index (KEI) 2007 Rankings. Washington DC. The World Bank. (Online). Available: http://siteresources.worldbank.org/KFDLP/Resources/461197-1170257103854/KEI.pdf

UNCTAD 2006. Promoting TNC-SME linkages to enhance the productive capacity of developing countries firms." (Online) Available: http://www.gtz.de/en/document/en-FDI-SME-linkages.pdf. (Accessed 6/6/2010).

UNDP 2001. Human Development Report-Making New Technologies work for human development." (New York).

UNDP-APDIP ICT4D 2004. *Information and Communication Technology for development. A source book for Parliamentarians*. GALROLA B.K, CHANDRA M., MALL P. CHACKO J.G AND SAYO P (eds). Elsevier. India. New Delhi

UNPAN 2002. *E-government Readiness Index. Benchmarking E-government: A global perspective*. New York

WARSCHAUER M .2002. Reconceptualizing the Digital Divide." (Online) Available: http://justmonday.org/issues/issue7-7/warschauer/index-html

WARSCHAUER M. 2003a. Demystify the Digital Divide." (In Scientific American Inc. ScientificAmerican.com). (Online) Available: http://www.sciam.com/article.cfm.

WARSCHAUER M. 2003b. *Technology and Social Inclusion- Rethinking the Digital Divide*. Cambridge, MIT Press.

WAVERMAN L et al. 2009. *The Connectivity Scorecard*. London. Legg and Nokia Siemens Network

WITSA 2002. A Global Action Plan for Electronic Business." (3rd Edition Prepared by Business with Recommendations for Governments). (Online) Available: http://www.witsa.org