

Development of a Technology Planning Framework for School Districts in Developing
Countries

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Abstract

This developmental research used components of Rogers' diffusion of innovations (1962) theory to develop a technology planning framework for school districts in developing countries. The Framework may be used by officials from developing countries in different levels of government to develop a technology plan for their districts and states. The study utilized two types of expert reviewers to evaluate the proposed Framework. The first type was the Diffusion of Innovations theory expert reviewers who were selected to determine if the Framework conforms to the principles of the theory. The second expert reviewers were individuals in different parts of Africa who were selected to establish if the Framework is feasible and practical to the conditions of developing countries. The overall feedback from expert reviewers was positive and suggestions and comments were used to modify the Framework in order to improve it to be an effective technology planning tool. The final product of this study is a step-by-step procedural guide consisting of activities and suggestions that can be used to develop a school district technology plan in a developing country.

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Chapter 1: Introduction and Need for the Study

Introduction and Statement of the Problem

In the past three decades there have been increasing developments with regard to the acquisition and utilization of Information and Communication Technology (ICT) in education in both the developed and developing countries (DCs) (Boitshwarelo, 2009; Habib, 2003). Some researchers argue that ICT is a prerequisite for DCs to achieve economic growth and socio-economic transformation (Ayeh, 2008; Hosman & Fife, 2008). A number of studies indicate that there are common features that emerge about technology planning of ICT in DCs. These features include lack of information on ICT policies, planning approaches that are not systematic and coordinated within government, and undefined partnerships in funding initiatives (Kendall, Kendall & Kah, 2006; Plummer, 2002; Trucano, 2005).

Literature indicates that external organizations are involved in ICT developments in education more than government structures in DCs (Farrel & Isaacs, 2007). These external organizations are from international, national or local arenas. The UN bodies, development agencies, private sector, multinational corporations, foundations, regional bodies, community and civil society organizations are some external entities that play different roles of planning, funding and implementing of ICT programs in DCs (Kirkman, Cornelius, Sachs & Schwab, 2002; The World Bank, 2006). In the past few years, some developmental agencies and other entities assisted different DCs to formulate policies that promote ICT access and utilization in order to support socio-economic developments (Splettstoesser & Towry-Coker, 1996; Trucano, 2009). Included in some of those ICT policies were the strategies that make provisions for the education sector to craft programs that would equip students with necessary technology skills

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that would enable them to participate in the technology-rich job markets (Levy & Banerjee, 2008; World Summit on Information Society declaration, 2003). Overall, ICT developments in DCs are characterized by a myriad of programs that are not coordinated and are incompatible with one another (South African White Paper on Education, 2004).

DCs face ICT challenges that relate to both the education system in general and ICT in education in particular. The challenges that relate to education systems include the brain drain of experts, poverty, high illiteracy rates, inadequate access to education and training opportunities and many more (Global Digital Solidarity Fund, 2005; Millennium Development Goals, 2000; World Summit on Information Society, 2003). The challenges that relate to ICT in education include lack of clear policies and systemic planning at the three levels of government, poor sustainability approaches, inequity access of technology to the minority groups, and lack of comprehensive long-term strategies (Ihmeideh, 2009; Irwin, 2000; Wright, Dhanarajan & Reju, 2009). Within the structure of educational systems, ICT developments in DCs are characterized by irrelevant policies that are incoherent and unaligned plans with other broader government programs and poorly address the instructional strategies (Farrel & Isaacs, 2007).

Another major challenge with ICT strategies in DCs is that technology programs are usually planned at the national levels ignoring the roles and responsibilities of other government structures such as school districts (Chere-Masopha & Bennett, 2007; Warschauer, 2003). As a result, the national planning approach does not sufficiently address key important factors such as the sustainability of projects, staff development, community involvement, online content, disposal of technology after it becomes obsolete and many other important aspects. The role of

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the national, state, school districts and schools in the planning and implementation of technology plans are usually not identified because there is a lack of systemic planning approach in DCs.

With external organizations continuing to play the leading and funding roles in ICT, the three tiers of government of DCs seem to play lesser roles with regard to technology planning and implementation (Ayeh, 2007). The state and school district structures within education ministries should facilitate technology planning and implementation because they work with schools closely and can best determine the challenges and possible solutions. However, the greatest challenge for the ICT developments is that the states and school districts are not usually included in the technology planning and implementation for schools.

School districts are the government entities within ministries of education that are closer to schools and provide both administrative and professional support (Picciano, 2006). As a result, it would be beneficial to develop school district technology plans in order to identify the roles technology can play to effectively support schools' two important functions, administrative and instructional. Developing a school district technology plan is important because it would ensure that schools within a geographical area have a common direction and framework to accomplish clear goals and objectives (Baule, 1997). Furthermore, technology planning will assist school districts to determine the goals and objectives for relating technology to instructional processes of their schools (Baule, 1997).

The technology planning process will assist teachers and other professionals within a district to discuss the role of technology and possibly take ownership of the overall goals and objectives of the plan. The technology planning process will afford stakeholders in a district an opportunity to engage each other and reach consensus on issues that relate to the use of

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technology in their schools. Careful consideration should be given to ensure that school district technology plans fit into their national priorities and broader districts visions.

It is important for school district technology plans to have effective monitoring and evaluation mechanisms. A number of ICT programs in education are being implemented at varying degrees in DCs at the national, state and local levels (Picciano, 2006). Owing to lack of technology planning, few evaluations of ICT programs are based on goals and objectives. Proper evaluation will indicate the conditions and contexts in which ICT programs in education succeed or fail. With a lot of implementation taking place at the state and district levels within the education structure, local stakeholders will have more opportunity to participate in the technology planning processes. It is therefore important that a technology planning framework be developed to guide school districts to develop their own comprehensive technology plans. Such a framework, which districts can adapt to suit local conditions, will enable school district to meet their ICT needs more effectively.

In conclusion, research indicates that DCs that progress economically have sound ICT policies and well-defined implementation plans (Farrel & Isaacs, 2007; Hosman & Fife, 2008). With the lack of well-defined policies to guide plans, governments of DCs have mainly depended on partnerships with external organizations that are either international or local. As a result, different sectors including education, have not formulated comprehensive plans that would ensure maximizing the potential of ICT. The development of a technology framework should be based on a sound theoretical framework (Picciano, 2006).

Diffusion of Innovations (DoI) theory is the appropriate theory for guiding the development of a technology plan in DCs because it explains how innovations are adopted by

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population (Rogers, 1995). This DoI theory is also relevant to building a basis for the development of a technology planning framework because it addresses how social change occurs in the life of an individual or an organization (Rogers, 1995). In addition, the theory offers information about three important issues: the qualities' that make an innovation to be adopted, how social networks influences each towards a new innovation and an understanding of the needs of different users (Rogers, 1995).

Theoretical Framework: Rogers' Diffusion of Innovations Theory

Everett Rogers (1962) proposed the Diffusion of Innovations theory in his first publication in 1962. Although his original research was mainly focused on the field of agriculture, it, however, built the foundational work. He followed up the first edition with other research work that expanded the theoretical foundation and applications of the DOI theory in many other areas.

Rogers (1995) defines diffusion as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (p. 5). Expounding the theory, Rogers (1995) indicates that diffusion is determined by how individuals in a social system perceive characteristics of an innovation or attributes it may have. He further indicates that diffusion is based on how the attributes help to predict the rate of adoption of new innovations (Rogers, 2003). Rogers proposed the four elements of DoI that may be identifiable in most research study on the adoption of innovations. These elements are: (a) innovation, (b) communication channels, (c) time, and (d) a social system. It is important that one determines how the four elements of the DoI relate to technology planning. Rogers (2003) contends that “an innovation is an idea, practice, or object that is perceived as new by an individual or other unit of

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adoption” (p. 12). An innovation may not necessarily be new knowledge, but can be expressed in terms of knowledge, persuasion, or a decision to adopt.

Rogers defines communication as “the process by which participants create and share information with one another in order to reach a mutual understanding” (p. 18). Rogers (2003) further argues that the communication processes involves four factors, namely: innovation, an individual who has experience using the innovation, another individual that does not know the innovation, and communication channels connecting these units.

Rogers (2003) identifies time as the third element of DoI. He states that the time dimension is involved in diffusion in three factors. Factor one is “the innovation-decision process by an individual passes from the first knowledge of innovation through its adoption or rejection” (p. 20). Factor two is the “innovativeness of the individual” to adopt an innovation (p. 20). This factor deals with the earliness or lateness with which an innovation is adopted by an individual or a group of people. And the third time factor indicates the rate at which an innovation is adopted in a system within a given time.

The last element of DoI is a social system. Rogers (2003) defines “a social system as a set of interrelated units engaged in joint problem solving to accomplish a common goal” (p. 23). According to Rogers (2003) the “members of a social system may be individuals, informal groups, organizations and/or subsystems” (p. 23). Furthermore, Rogers explains that the social system has a structure, which affects the diffusion of an innovation. Within a social system, there is a boundary where diffusion takes place. Rogers further explains that the social structure of the system has an effect on the social structure that are “norms of diffusion, the roles of opinion leaders, and change agents, types of innovation decisions, and the consequences of innovation”

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(p. 24). The next section outlines how the four elements of the DOI may fit within the technology planning framework processes in DCs.

Application of DoI to the technology planning in DCs. In this study the technology planning framework served as the new innovation. While the idea of developing a framework may be new in the education systems of DCs, the concept of technology implementation is not necessarily a new idea because it is highlighted by many reports on pilot projects (Crow, 2009; Trucano 2009). However, efforts should not be spared to ensure that there are innovative ways that will lead to the adoption of the framework. In most cases, governments in DCs need to be persuaded to value the technology planning and how they may employ it to their planning processes in ICT. Paterson (2007) asserts that the success of some pilot projects, where there are visible results, may serve as a motivation for some governments to consider technology planning for large scale planning and implementation.

The DoI theory holds that the communication element allows participants to create a shared vision in order to reach a mutual understanding on the usage of technology in schools. In the context of the framework, communication should take place among key entities within ministries of education and with key stakeholders about technology planning processes. There is a body of literature that identifies building of partnerships between government and external organizations as important ingredients in making ICT successful in DCs (Hosman & Fife, 2008; Unwin, 2009b). The various partners may be from the private sector, NGOs, community and civil society organizations who could serve as another avenue to access technology skills and resources to support ICT initiatives in DCs. In some cases, some partners may get involved in the planning of projects beyond the initial pilot projects (Markauskaite, 2004; Unwin, 2009b).

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However, the successes of partnerships between key stakeholders may depend on the communication among partners. Ongoing communication about the framework will ensure that stakeholders work collaboratively and share the same vision and commitment.

In the context and processes of developing the framework, proper channels should be followed to seek the participation of key entities within government. According to Baule (1997), all three tiers of government from national, state and to local should be notified about the plan and how it could be aligned with other national programs. If governmental protocols are ignored or violated, the process of developing the Framework may be delayed or rejected by other entities. Entities outside of government such as the private sector, NGO's, regional bodies, and community organizations are to be invited to participate in the development of the Framework (Farrel & Isaacs, 2007). Furthermore, some studies indicate that there is growing iniquitousness of technology outside of government's planning systems, especially mobile technology, whose diffusion increases at the fast rate (Trucano, 2009). As a result, school districts should consider the potential use of other technologies such as mobile within the Framework.

Some researchers contend that it takes approximately three to five years to develop and implement technology planning for schools, which may also apply to a district context (Baule, 1997; Lumley & Bailey, 1993; Picciano, 2007). Developing a comprehensive technology plan will take time because it requires processes that involve a number of activities. Some of those activities may be the setting up of planning structures, assessing the current state of technology in a district, developing documents and implementing the plan as well consulting with stakeholders (Lumley & Bailey, 1993). In addition to developing a plan, it will take considerable time to eventually implement, revise, and evaluate a district technology plan.

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Assumption of the Study

This study assumes that there were a number of national e-strategies in DCs that focus on the ICT sector as well as those that specifically address the education sector. Therefore, this study assumed that school districts provide administration and professional support to a cluster of schools located in a close geographical area. This study further assumes that school districts have their professional staff, budgets and some autonomy and powers to decide some matters such as technology planning within their government.

Delimitation

This study proposed a technology planning framework for school districts in DCs. In particular, the proposed Framework focused on technology planning processes and other specific issues that apply to the contexts and conditions of DCs. The study was not about the ICT e-strategies, policies, technology integration, and educational planning; rather, it was about the development of the technology planning framework that could be used by school districts in the contexts and conditions of DCs.

Organization of the Proposed Study

Chapter 1 provided context information to the study, study assumptions, statement of the problem, theoretical framework, and delimitation. Chapter 2 discussed the historical development of ICT in literature related to this study. The chapter also discussed the main tenets of Rogers' DOI theory, and other relevant technology planning models. Chapter 3 outlined the methodology to guide the development of a technology planning Framework. Chapter 3 also discussed the selection process of experts, and the process of reviewing, evaluating and revising the proposed Framework.

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Chapter 4 presented the first draft of the proposed technology planning Framework. This chapter highlighted specific issues that affect the planning and implementation of technology in DCs. More importantly, this chapter presented the revised draft of the proposed technology planning Framework. Chapter 5 described the feedback. Comments and suggestions received from expert reviewers. Chapter 6 presented a reflection and conclusion on the whole study and offers the opinions that the researcher deemed significant and valuable. Chapter 6 also presented conclusions, challenges and issues that emerge in conducting a developmental research for a technology planning framework. Furthermore, the researcher made conclusions based on the literature reviewed in chapters 2 and 3; and the analysis of the comments and suggestions from the panel of experts in Chapter 5. In addition, the chapter indicated the comments and suggestions made and the questions raised by the panel of experts. Finally, the chapter will make recommendations based on these conclusions.

Definitions of Terms and Abbreviations

Information and Communication Technology (ICT): According to Unwin (2009a) information technology (IT) is a term that generally includes the use and application of electronic technology for the information needs of a business and individuals. Researchers agree that IT planning implies the process of identifying organizational activities, opportunities available, developing strategies and actions that meet the needs of a country (Boynton, Robert & Zmud, 1997; Warschauer, 2003). Evoh (2011) and Labelle (2005) concur that information and communication technology (ICT) is distinguished by three converged areas: telecommunications, broadcasting, and the Internet. ICT utilizes computer-based systems as well as

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telecommunication technologies for the information and data storage, processing, and communication (Evoh, 2011; Unwin, 2009a).

Technology plan: According to the Virginia State Technology Planning document (Virginia State Education Department, 2007) schools that are successful in integrating technology into the curriculum are often guided by a comprehensive technology plan. According to Baule (1997) technology planning is an “analytical process which involves an assessment of the future, the determination of desired objectives, the development of alternative courses of action, and the selection of a course of action from among alternatives” (p. 1). The plan is a document that aligns an institutional technology use with its strategic goals. The plan also defines what technology will implemented, and determines how technology will supported over time.

Developing Countries (DCs): Raman (2011) suggests that DCs or Least Developed Countries refer to the countries whose “citizens are subjected to conditions of poverty and are unable to meet their basic human needs and exercise their human rights” (p.66). Mbabuike (2001) asserts that owing to the fact that DCs are heterogeneous; each country should be considered separately in terms of its history, socio-economic environment and political conditions.

School District: A school district is an entity within the structures of the ministry of education. A School district is a government entity that supports schools administratively and professionally. Such a structure normally has powers and autonomy to decide matters regarding the administration procedures and professional practice of students.

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Developmental Research: Developmental studies deals with the creation of knowledge that is based on theory and grounded in data systematically derived from practice. This type of research studies involve the production of knowledge with should ultimately improve the process of instructional design, development, and evaluation. (Richey & Klein, 2007; Richey, Klein & Nelson, 2004; Seels & Richey, 1994).

Framework: A conceptual structure that aims to implement a set of specific design elements in order to effective use of something (Clifton, 2003).

The Potential benefits of the Study

The literature indicates that most developed countries are successful in the implementation of technology owing to the viable information technology infrastructure, planning systems, sufficient funding from governments, strong political leadership and investment from the private sector (Hosman & Fife, 2008). Most DCs face technology-related challenges such as unreliable energy supply, teachers with inadequate skills, poor national ICT infrastructure, environmental issues, poor connectivity solutions, scarce experts with technical skills, sustainability issues, less investment in evaluation and research and a lack of guidance to manage external organizations such as the private sector, NGO's and multinational corporations (Ayeh, 2008; UNESCO, 2009).

Some ministries of education in DCs lack planning skills to develop long-term comprehensive plans that are sustainable and can address the needs of their citizens. Lack of comprehensive plans may result in the situation where ICT initiatives are implemented in uncoordinated manner, in unsystematic approaches and where projects are incompatible with one another. Furthermore, lack of a comprehensive technology plans allow external organizations to

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implement whatever technology products and solutions they deem important, and this may in the long run cause other challenges to ministries of education (UNESCO, 2009).

In school districts that do not have comprehensive technology plans that are updated continuously, there is a risk for DCs to be stuck with a software or technology solution that could be irrelevant in the near future (Birinci & Kabakç, 2007).

The Framework may equip district officials with planning skills in order to facilitate technology planning process within their own school districts. More importantly, equipped district officials will be able to support teachers' efforts to integrate technology into the curriculum. The Framework will be developed to allow district officials as professionals to be familiar with the planning and implementation processes of technology. Properly designed technology plans will overall improve the functions of ministries of education as a social system. The main benefit of this study is that it will propose a technology planning Framework that can be utilized by school districts in the DCs contexts and conditions. In summary, DCs will benefit from this study by having a tool that they can use when developing plans for technology use in school districts.

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Chapter 2: Literature Review

Introduction

This literature review focused on the major issues that address information and communication technology (ICT) in education and technology planning. Issues such as the definitions of terms, technology planning in schools in developing countries (DCs), ICT in education, technology planning trends, and the technology planning models were dealt with. The diffusion of innovation theory, which is also discussed, was used as the theoretical framework for this study.

ICT in education

The potential of ICT in education offers hope to governments of DCs to address their educational challenges (Mentz & Mentz, 2003). Therefore, policy makers from DCs identify ICT as an important component that can effectively address the multiple socio-economic challenges that their countries face (UNESCO, 2011; Unwin, 2009a). Other policy makers view ICT as a prospect that may improve access to schooling, reduce the overall cost to resources and prepare youth for a globally competitive workforce (NEPAD e-Schools Initiative, 2007).

In many countries, various partnerships are formed between the government entities and external organizations that implement the ICT sector (Moon, 2007; World Bank, 2006). As a result, many policies in education related to ICT suggest the formation of public-private partnerships as a solution to access resources. However, some external organizations are keen to form partnerships that focus on the initial pilot projects and not on the long-term planning of ICT programs (Unwin, 2009b; Markauskaite, 2004).

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Teacher training is identified as one important component that would support the technology integration in schools (Farrel & Isaacs, 2007). Ministries of education craft programs in order to build the capacity of teachers to effectively use technology to enhance their instructional practices. Teacher training programs also seek to build the pedagogical capacity, and their technical competences (Kozma, 2005). Unfortunately such programs usually focus on the basic use of technology and do not address technology integration. Other researchers reveal that teachers from DCs are generally inadequately trained in subject skills and methodological teaching skills (Cronje, 2008; Farrel & Isaacs, 2007). Technology integration is a challenge because it requires the availability of equipment, quality resources, and effective professional developments (UNESCO, 2011).

Researchers conclude that there is a prevalence of technology that results from the ICT-related pilot programs (Farrel & Isaacs, 2007; Trucano, 2009). ICTs are also regarded as the avenue that may enhance the interaction between teachers and learners and also offer access to online materials that support curriculum (Kozma, 2003). Research also indicates that most policies put more emphasis on the education sector to promote ICT access and its use (Unwin, 2009d). A ministry of education is the key sector that benefits directly from the potential of ICTs, while other sectors are expected to benefit indirectly. In DCs, ICT seems to increase the educational opportunities to the urban areas, but exclude the remote and rural (Pelgrum & Law, 2003). Some researchers argue that ICT widens the divide between the urban and rural areas in DCs (Habib, 2003).

Hawkrige (1990) proposes four rationales that influence ICT policies with regard to ICT integration. These are: (a) an economic rationale, (b) a social rationale, (c) an educational

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rationale, and (d) a catalytic rationale. The economic rationale focuses on the development of ICT skills that are necessary to meet the need for a skilled work force, and are related to future jobs and careers. The social rationale focuses on the belief that all students should be familiar with computers in order to become responsible and well-informed citizens. The educational rationale deals with how ICT is viewed by policy makers as a supportive tool to improve teaching and learning. And the catalytic rationale deals with how ICT is expected to accelerate educational innovations. In support of these rationales, other studies conclude that the application of ICT will lead to the improvement of educational systems and increase student attainment (Hawkridge, 1990).

Fennema-Jansen, Edyburn, Smith, Wilson and Binion (1998) developed an instrument that provides a rubric for self-assessment of conditions for integrating technology in education. The rubric examines the following areas: “(a) technology administration and support, (b) technology capacity, (c) educator competencies and professional development, (d) learners and learning, and (e) accountability” (p. 11). And each area is assessed by four to seven items that are rated using explicitly described criteria. The rubric is available to schools through the website and schools may annually assess their own needs and school districts could evaluate where their schools are with regard to technology integration.

Factors influencing ICT planning in DCs

Unwin (2009a) observes that there are external and internal factors that influence the planning and implementation of educational technology planning in DCs. The external factors

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are those factors that influence the technology policy and planning developments that come from outside of a country's borders. On the other hand, internal factors refer to those developments that take place within a country.

External Factors. The developments regarding ICT strategies are informed by the increased participation of external organizations that include the United Nations' Bodies and Agencies such as United Nations Educational, Scientific and Cultural Organizations (UNESCO), the World Bank, World Economic Forums and the Global Digital Divide Initiative (Warschauer, 2003; World Bank, 2006). A number of international meetings took place between 1980 and 2005 such as UN Summits and conferences where ICT was identified as one of the potential drivers of socio- economic developments in DCs (The World Bank, 2006; Unwin, 2009d; World Summit on Information Society declaration, 2003). In such meetings recommendations and decisions regarding the potential impact of ICT were adopted and frameworks were proposed for the international organizations to assist DCs to develop their own ICT strategies (Kirkman, Cornelius, Sachs, & Schwab, 2002; Splettstoesser & Towry-Coker, 1996; The World Bank, 2006).

Several studies show how ICTs support global programs and efforts such as Education for All and the UN Millennium Development Goals (Moon, 2007). These international forums are characterized by positive rhetoric and strong advocacy for the formation of partnerships with different entities that include NGOs, private sector, development agencies, international donors, foundations, and civil society in order to support ICT developments in DCs (Levy & Banerjee, 2008; Olatokun, 2006). At these international meetings, the formation of partnerships was identified as an option for resource mobilizations and exchange of ideas to support ICT

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developments in DCs (Levy & Banerjee, 2008; World Summit on Information Society Declaration, 2003).

Warschauer (2003) maintains that the emergence of ICT phenomenon brought to the fore several terms and concepts such as information society, Digital Divide, Globalizations, information age, and information society. The ICT developments also gave rise to other ICT-related aspects such as e-health, telemedicine, e-education, and e-government (Brewer, Demmer, Du, Ho, Kam, Nedevschi, Pal, Patra, Surana, & Fall, 2007). As a result, different levels of government organs and agencies are involved in projects that focus on one or more of these concepts. In addition, there is a lot of duplication of ICT planning and implementation because organizations have no information on how their projects are linked with initiatives of other agencies (Unwin, 2009a).

Furthermore, the international development agencies and multinational corporations also play a critical role of supporting the developments and implementation of technology in DCs (Brewer et al., 2007). The United National Development Program (UNDP) worked collaboratively to assist countries in Africa, Asia and Latin America to develop their own ICT strategic plans and continues to provide support for their implementation (Unwin, 2009d).

Internal Factors. The World Bank (2007) and Unwin (2009d) discuss the liberalization of the telecommunications providers in DCs, which were initially owned by governments and operated as monopolies. Several researchers argue that the ICT developments in DCs improved as a result of the privatization of the telecommunication providers, because they became productive and profitable (Auriol, 2005; Kenny, 2001; Unwin, 2009d). The liberalization of the

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telecommunications was influenced by the ideals to increase competition and improve the quality of services. The liberalization of the telecommunications providers was also motivated by the desire to attract the foreign direct investment to invest more in the ICT infrastructural programs (World Bank, 2006).

Several studies report that the Open Source Software (OSS) offers the option to reduce overall costs of proprietary operating software (Thakrar, Wilson, 2008; Zinn & Wolfenden, 2009). In addition, the OSS is viewed as providing the opportunities for skills development, and support the creation of online content in the indigenous languages of DCs (Cogburn, 2008; De costa, 2006).

In conclusion, the external and internal factors that influence the planning and implementation of educational technology planning in DCs is mainly focused on national and international levels. There is a dearth of literature about how these factors influence the planning and implementation of ICT at the state and district levels (Kumar & Best, 2006). Overall there is lack of academic research on periodical basis that deal with ICT development in DCs (Munyua, 2000; Paterson, 2007).

ICT Planning developments in DCs

Status and Trends of ICT Developments in DCs. In most DCs, ICT programs are often initiated and funded by external organizations such as development agencies, donors, and private sectors (Cisles, 2005; Tinio, 2003). External entities outside government do not seem to value the involvement of local leadership and other stakeholders in the planning processes.

Mashinini (2008) and Jhurree (2005) warn that external organizations that do not seek the involvement of the local leaderships from indigenous entities such as community, churches

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and tribal authorities, may end up with unsuccessful planning and implementation of projects, particularly in the rural areas. Warschauer (2004) reveals that institutions at both the state and local levels tend to show less commitment and take no ownership if they are not allowed to take responsibility and are not given decision-making powers about the planning of programs. Kumar and Best (2006) and Evoh (2007) conclude that if the three tiers of government do not work in a coordinated approach, the involvement of other stakeholders in ICT projects may not be successful.

Planning processes in DCs. Chavula and Chekol (2011) maintain that the strategic planning process in government of most DCs is built upon the three pillars: setting up of a structure, developing the documents and designing implementation plans. Chavula and Chekol (2011) also suggest that the strategic planning processes include the review and assessment of the current status of a country's socio-economic policy frameworks and long-term developmental goals.

Several researchers reveal that there are common approaches that are followed by the governments of DCs to develop the strategic planning process (Bell & Juma, 2008; Chavula & Chekol, 2011; Farrel & Isaacs, 2007). Such a strategic planning process begins with the setting up of a dedicated structure to tackle planning. In most cases, a planning structure may be at the national, state or district levels. Representatives of such a planning structure may be from different sectors in government and may include policy makers, scholars, business leaders and innovators (Warschauer & Ames, 2010). Other researchers identify key stakeholders as the relevant national government departments, appropriate parliamentary portfolio committees, the academia and international organizations (Bray, 2007; Chavula & Chekol, 2011). A number of

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researchers point out that governments of DCs recognize the importance of representation in the crafting of strategic plans (Jhurree, 2005; Kendall, Kendall & Kah, 2006; Mackeogh, 2002; Unwin, 2009d).

However, there is insufficient literature on how the three tiers of government can facilitate systemic technology planning in education (Beaudoin, 2009). Some researchers argue that the tiers of government in DCs are not successful in planning because donors and other external organizations set the agenda of the ICT programs and exercise great influence on technology developments (Moens, Broerse, Gast & Bunders, 2010).

According to Roy (2005) some DCs invite their citizens who are ICT experts and live in the developed countries to participate in the policy formulation and planning processes. Another interesting feature is that some DCs governments appoint a high profile individual, such as a former head of state, to facilitate the ICT developments (Bell & Juma, 2008; Guida & Crow, 2009). The appointment of a person with a high profile elevates the technology planning status within the government and private sectors.

Trends with regard to the technology planning in DCs. A World Bank Report (2010) indicates that there are public and commercial initiatives in both the developed and DCs that aim to produce the low-cost computers and other computing devices. The prevalence of such initiatives raise the hopes of DCs that eventually a technology equipment may be produced in the future that could be affordable, consume less energy and are suited for their conditions (World Bank 2010; Wright, Dhanarajan & Reju, 2009). Noteworthy among the examples are the One Laptop per Child and the Simputer initiatives.

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Farrel and Isaacs (2007) observe that some DCs use old technology such as radio and television to support both formal and informal education developments. In some cases, the radio and television programs receive funding through bilateral agreements to support ICT developments that include teacher training developments and provide training and information to the out-of-school youth.

Challenges with regard to technology challenges in DCs. Numerous studies point out that there are socio-economic challenges such as the diffusion of technology, low income levels, unavailability of relevant content, inequality of ICT access by the minority groups, and lack of financial sustainability plans (D' costa, 2006; Kenny, 2001; Misra, 2006; Olatokun, 2008). Chudnovsky and Lopez (2006) identify the dominance of the English language as a hindrance to the growth and development of IT companies based in some DCs.

A sufficient amount of literature is published that addresses the common challenges on the planning and implementation of ICT in DCs (Archibugi & Pietrobelli, 2003; Hawkins, 2002; Unwin, 2009b). These challenges include lack of information on the ICT policies, uncoordinated planning approaches within governments, and the management of partnerships with external organizations as an avenue to access resources (Kendall, Kendall & Kah, 2006; Trucano, 2005).

According to Mentz and Mentz (2003) school principals identified obstacles that hinder technology integration in schools. These obstacles included “untrained teachers, lack of electricity, socio-economic status of the community, insufficient security resulting in vandalism and theft, curriculum constraints, unfavorable teacher-learner ratio, and lack of classroom suitable for computers” (p. 12). DCs face other challenges that relate to the lack of systemic planning within the ministries of education (Cronje, 2008). These ICT challenges are related to the

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infrastructural conditions, poor education systems, and socio-political conditions (Osin, 1998).

What emerges from literature is that short-term ICT solutions turn out to be unsuccessful (Cronje, 2008). On the other hand, ICT plans that are carefully planned on the long-term seem to succeed (Kleiman, 2000).

Literature indicates that there is insufficient scientific research and publications regarding the technology planning and implementation of ICT in DCs (Edmundson, 2007; Graham, 2002; Olatokun, 2006). While some studies pay attention to the monitoring and evaluation of the ICT programs they omit the technology planning processes in school districts (Bakia, 2005; Paterson, 2007). More importantly, there is little research conducted that address the school districts in DCs.

DCs receive a large amount of donated technology equipment such as refurbished computers from the developed countries (Kumar & Best, 2006; Swart, 2006). The challenge with refurbished computers is that some DCs do not have comprehensive e-waste plans that guide the disposal of old machines, thereby rendering technology equipment as another additional challenge of contributing to environmental pollution (Farrel & Isaacs, 2007). However, some researchers warn against using such refurbished computers owing to the issues of cost and financial sustainability over a long term as well as the environmental hazards when the technology later becomes obsolete (Cronje, 2008).

Technology programs in DCs have a low density of equipment, and there is a dearth of technical expertise to address schools technological needs timeously (Pelgrum & Law, 2003). Schools in DCs often lack electricity infrastructure or other alternatives (Osin 1998). Mentz and Mentz (2003) argue that lack of the exploration for an alternative energy is a hindrance to areas that are not in the electricity grid in their countries (NEPAD e-Schools Initiative, 2007). Where

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infrastructure is being developed it is usually not aligned with the other national plans such as technology planning in the districts.

Kleiman (2000) points out that there is a myth that school district plans will result in the effective use of technology in schools. He argues that schools face major challenges that include the integration of technology in the curriculum, and evaluating the impact of technology on teaching and learning. The challenge for school districts is that technology plans should aim to improve the instructional practices. According to Fishman and Pinkard (2001) school districts technology plans should be systemic and provide a balance between the technical aspects of technology planning, and learning.

The overall challenge with regard to technology planning is that there are many aspects that need to be incorporated and addressed when undertaking planning. Areas such as professional development, addressing the equity and access issues, curriculum integration, implementation, indigenous relevancy, policies, and online content are to be accommodated systemically in the technology planning (Pelgrum & Law, 2003). Kendall & Kendall (2006) draw the conclusion that most government officials in DCs lack the technology planning knowledge and skills in educational technology in order for them to be able to craft comprehensive technology plans.

Kleiman (2000) warns that technology access will not address the equity issues by ensuring that students in poor communities have the same quality of education as the ones in the wealthier communities. The reason is because such a conclusion ignores other challenges related to technology planning such as the technical support systems, inadequate teacher training, and lack of fund raising opportunities that schools located in poor areas tend to encounter (Kleiman, 2000).

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Emerging solutions and developments. The availability of Open Source Software (OSS) offers alternative resources and solutions that enable institutions to benefit from the ICT. Cronje (2008) asserts that the Moodle learning management systems and Open Office, are the OSS products that benefit organizations located DCs because they are able to run their systems without paying expensive licensing fees.

Thomas and Cronje (2006) propose four factors that influence ICT projects, which are: personal, programmatic, physical, and systemic that determines the sustainability of programs. Personal factors refer to the enthusiasm of the participants, coupled with the continued support that they receive from their superiors. In some research, these enthusiastic individuals may be labeled “champions”. Cronje (2008) suggests that more research is needed to determine the characteristics of champions in technology planning in DCs. Programmatic factors focus on the complex nature of the implementation of an ICT program. Thomas and Cronje (2006) suggest that each project should have an implementation plan developed for its own peculiarities. Physical factors refer to the infrastructure, which includes other elements of such as energy (electricity or solar), the telecommunications network, and the satellite. Systemic factors suggest that the implementation of programs should be placed within educational systems and consider socio-political issues (Thomas & Cronje, 2007).

Technology planning processes in DCs. Drafting a policy document is the first common step employed by most DCs to develop ICT strategy to meet their needs (Chavula & Chekol, 2011; Kenny, 2001). Several researchers concur that national priorities are given prominence when DCs develop policy documents (Archugbue, & Akporido 2011; Giovannetti, 2004;

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Mashinini, 2003). Such priorities may be privatization, competition, expansion, global economy, inter-governmental cooperation, and human resource developments.

Several studies propose the introduction of the universal service concept. The universal service concept is a discounted charge and subsidy for the goods and services of ICT (Bollou & Ngwenyama, 2008; Unwin 2006). Other researchers contend that another way to implement the universal service fund is to implement the educational rate (e-rate), which is a discount rate to educational institutions such as schools and libraries (Evoh, 2007; Kleiman, 2000).

Several researchers argue that the function of policy and planning is to craft a vision, develop a strategy and mobilize resources to achieve its implementation (Guida and Grow, 2009; United Nations Institute for Training and Research, 1980). D' Costa (2006) infers that ICT policy and planning should enable DCs to create an environment that encourages, “business growth, competition policy, intellectual property rights and regulatory-frameworks that consider the minority groups” (p.11).

Other researchers suggest that policy development should consist of three phases. The first phase should focus on designing implementation plans based on the broad national governmental vision, needs, challenges, and other development programs (Chavula & Chekol, 2011; Unwin, 2009d). The second phase should include the implementation of the plan based on a clear outcomes and indicators (Unwin, 2009d). And the third phase should deal with the monitoring and evaluation. The monitoring and evaluation should form part of the implementation plan to ensure that specific objectives are achieved based on the indicators (Chavula & Chekol, 2011; Unwin, 2009d).

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Researchers concur that the prevalence of pilot projects implemented by different organizations lead to challenges of incompatibility, sustainability, and incoherence of initiatives. In response to addressing challenges resulting from pilot projects, DCs should formulate policies and design comprehensive technology plans (Guida & Crow, 2009; Trucano, 2009). According to Trucano (2009) the implementation of ICT in education is disjointed and not planned within ministries of education of DCs and as a result there is wasteful and duplication of efforts. Habib (2003) and Kenny (2006) draw the conclusion that the prevalence of uncoordinated pilot projects motivates DCs to plan in order to manage their potential impact.

Paterson (2007) asserts that the success of some pilot projects, where there are visible results, serve as another motivation for some governments to consider planning for their replication on a large scale. As a result DCs governments came under pressure to plan for the replication of successful pilot projects. Other researchers infer that the worse failure of some pilot projects necessitates some DCs to respond by formulating policies and plans that aim to guide future implementation and avoid similar mistakes (Jhurree, 2005; Tedre, Bangu & Nyagava, 2009).

Several studies point out that there is an increase of new technologies in ICT infrastructure, satellite and wireless that aim to increase access to services and reduction of connectivity costs between the developed countries and DCs (Habib, 2003; NEPAD ICT Broadband Infrastructure Network, 2006; Wright, Dhanarajan & Reju, 2009). Satellites owned by some DCs such as India and Egypt encourage other DCs to explore effective ways of taking advantage of such telecommunications resources (Indian Space Research Organization, 2008; African Development Bank, 2009). Nour (2006) and Wright, Dhanarajan and Reju (2009) assert

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that the increase in the availability of telecommunications infrastructure, satellite networks, and wireless infrastructure encourage DCs to consider planning options for taking advantage of such developments.

Technology planning processes in school districts and schools in DCs. Technology planning in school districts and schools is advanced in developed countries (Picciano, 2006). The schools-based ICT policy planning gained attention as a condition that may ascertain successful implementation of technology in schools. Some researchers argue that school-based ICT policy planning is a crucial step towards effective implementation of technology (Farrel & Isaacs, 2007). Gülbahar (2007) points out that school-based ICT policy planning processes eliminate many challenges that emerge during the technology integration. According to Vanderlinde and van Braak (2010), successful schools in technology integration tend to be guided by clear ICT plans. Technology plans located at the state or district levels are generally broad and do not have clear specifications. School-based ICT policy plans tend to focus on the classroom activities and generally aim to improve student learning (Vanderlinde & van Braak, 2010).

Literature indicates that technology planning exists on the following different levels: (a) national, (b) states, (c) districts and (d) schools (Fishman & Zhang, 2003; Jones, 2003). In most cases these government entities craft their own technology policy plan, with specificity that varies based on their roles and responsibilities. Therefore, in order to have an education technology vision, one should consider the policy and plans from these four government entities.

Olatokun (2006) points out that once ICT plans and policies are developed they may not be revised until after many years. One major challenge within the DCs planning practices is that

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plans and policies are not viewed as dynamic processes that are to be revised periodically, and as a result they tend to be irrelevant after few years (Farrel & Isaacs, 2007).

Technology Planning Models Employed by DCs

DCs employ different models to facilitate the planning, management, and implementation of ICT education (Farrel & Isaacs, 2007). Literature shows that most DCs have a government entity that oversees the implementation of ICT programs. In addition, the entity may also negotiate access for sources with potential partners (Unwin, 2009a). The agreements with partners may involve access to resources, sustainability issues, and negotiation on priorities.

Farrel and Isaacs (2007) summarize the approaches of DCs in three categories: decentralized, centralized and quasi-centralized. The decentralized approach is employed mostly in countries where the national government and states share the responsibility for education. In such context, national government craft policies and states take the roles and responsibility of management and implementation. There are few cases where states may design their own specific ICT policies that suit their own contexts and conditions. The centralized approach is a situation where the national agency manages and implements technology in many sectors. Quasi-decentralized approach is the situation where ministries develop their own sector policies and plans. In this approach, a central agency manages and monitors implementation of the national plan at the sector level.

The role of ministries of education is to formulate ICT policies and oversee implementation (Farrel & Isaacs, 2007). In most cases, the ministries of education work in collaboration with other ministries such as telecommunications and science and technology. The prevailing tradition is that ministries of education establish an ICT unit that has staff members

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who have the necessary expertise, to act as the locus of responsibility for managing the implementation of policy.

Some studies report that organizations in the developed countries donate or sell ICT equipment to DCs at a low price, with refurbished computers being the popular practice (Bakia, 2005; Jhurree, 2005; Paterson, 2007). The advocates of refurbished computers argue that refurbished computer support local skills developments and stimulates computer industry (Cogburn, 2006; Paterson; 2007). As a result of accepting of the donated refurbished computers, DCs are then required to craft a long-term plan on how to take advantage and benefit from such option. In addition, DCs are required to design e-waste strategies for the disposal of computers when they become obsolete (Jhurree, 2005; NEPAD e-Schools Demo Project, 2007).

Status of Technology Planning in DCs

The planning and implementation of ICT in education in DCs is characterized by a number of factors. The factors include lack of national governmental vision and leaderships regarding the crafting of comprehensive planning that are compatible, systematic and coordinated within the different sectors of public and private sectors (Warschauer, 2004). Poor planning by DCs results in unsustainable and incompatible projects that tend not to make a considerable impact. Technology planning for schools in DCs is necessary in order to achieve the number of factors.

With regard to technology-related challenges, there are issues of inadequate skills and lack of knowledge about technology planning by school district officials. There are also other challenges that relate to copyrights, licensing, and intellectual property issues that DCs need to address when conducting technology planning (Roy, 2005).

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Research indicates that technology planning is mainly focused on school planning, but there is insufficient information about state and district level planning (Kumar & Best, 2006; Munyua, 2000). However, technology planning that is focused on school planning does not encourage collaborations amongst schools and coordination with regard to the staff development, sustainability, and the evaluation of programs (Unwin, 2009a). The technology planning that is focused on national, state and districts levels will address issues of coordination, compatibility, and impact over the education and training system.

Barry and Nichole (2001) argue that where technology plans exists, they tend to be divorced from “both content and pedagogy, and often result in technology infrastructures that are not supportive of either current practice or reform” (p. 2). Over the past few decades, DCs have been involved in the planning processes and implementation of pilot projects. These pilot projects may even be referred to as “boxes and wires” because they are not based on theories and models that support the pedagogical or curricular goals (Barry & Nichole 2001). Barry and Nichole (2001) argue that the introduction of ICT in education has to confront a number of challenges that can be addressed better in planning. A physical building needs to be built with proper facilities such as ceilings and air conditioners to accommodate the school technology infrastructure. In addition, issues of security and safe use of technology require systemic approach in planning. Proper planning will enable state and districts to properly control their management information systems, and deal with issues of records and statistics in secure and efficient way.

Barry and Nichole (2001) point out that the technology planning literature tends to focus on what kind of computers schools should buy and what network infrastructure they should schools have. Such focus results in the technology planning processes that pays little attention to

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the curriculum, and pedagogy. In addition, such focus ignores the professional training of teachers.

Theoretical Frameworks for Technology Planning

There is a sufficient body of literature that addresses the overall planning with regard to theories and its implementation (Bozeman, 2000; Furuholt & Ørvik, 2006; Rogers, 2003). There is some other literature that considers the models with regard to the adoption and use of technology. Models such as the Technology Acceptance Model, Technology Transfer, and Technology Readiness Level inform discussions about the value of the technology planning (Bozeman, 2000; Furuholt & Ørvik, 2006).

According to Huff (1987), the adoption and diffusion of innovations throughout organizations have been studied quite thoroughly in many different contexts and some conceptual frameworks have emerged to help better understand the diffusion and use of technology (Huff, 1987). Everett Rogers (1962), a researcher in agriculture, developed the Diffusion of Innovation (DOI) Theory. Although his research was mainly focused in the field of agriculture, it however built a foundation that was later applied to other areas. After his first publication, Rogers conducted further research work that expanded the application of the DOI theory.

With regard to the adoption of innovation theories and models, Rogers' foundational work on the DOI is much more extensive because it sufficiently covers the broad aspects (Rogers, 1995). Furthermore, Rogers (1995) produced subsequent editions of the publications to give the DOI theory substantial information and examples about the diffusion theory, innovations and adoption. Most subsequent published works on DOI theory are built on Rogers' foundational work.

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In his book, Rogers (1995) defines diffusion as “the process by which innovation is communicated through certain channels over time among members of a social system” (p.5). He defines innovation as “an idea perceived as new by the individual” (p. 13) Furthermore, Rogers (1995) concludes that an innovation takes many years’ time for an idea to be adopted. Rogers (1995) conceptualizes the model of innovation based on decision process into five stages: knowledge stage, persuasion stage, decision Stage, implementation stage, and confirmation stage.

At the knowledge stage, the individual or group gets exposed to an innovation existence, where he/ she understand how it functions (Rogers (1995). He further argues that an “individual will seldom expose themselves to messages about an innovation unless they feel a need for the innovation” (p. 165). With regard to the persuasion stage, the individual or group began to perceive the innovation as having relative advantage, compatibility, and complexity, which is vital. At this stage, individuals decide either favorable or unfavorable attitude towards innovation”, and lead to either adoption or rejection of the new innovation (Rogers, 1995, p.169).

At the decision stage, the individual or group either adopts or rejects the innovation. Individuals could actively reject a new innovation or passively reject an innovation (Rogers, 1995). The implementation stage is where the individual puts the innovation into practice. In some cases, the implementation stage logistical challenges may hinder this stage. The decision to adopt an innovation is put into practical steps and application at the implementation stage. The confirmation stage is where the individual or group seeks to reinforcement on the decision made to adopt a new innovation. However, even at this stage the adopter may still reject the new innovation (Rogers, 1995).

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In light of this theory and model proposed by Rogers, this research will extensively study how a technology planning framework may be developed, adopted and utilized in school districts of DCs. The DOI is relevant to the development of a framework in DCs because technology is generally produced in the developed countries where the conditions are advanced and the environments are suitable its implementation. The study will consider how the principles of the DOI theoretical can inform the development of a framework in school districts in DCs.

The Technology Acceptance Model is a model used to how users accept and use new technology (Davis, Bagozzi & Warshaw, 1989; Venkatesh & Davis, 2000). The model suggests that when users are offered new technology they base their decisions on perceived usefulness and perceived ease-of-use (Furuholt & Orvik, 2006). When DCs invest in technology, considerations should be taken to how the perceived usefulness and perceived use-of-ease would enhance or hamper the acceptance of a framework. In addition consideration will be given to how a framework may be used in school districts technology planning.

The technology transfer model is another model that implies process of moving skills, knowledge and technology from one organization to another (Bozeman, 2000; Meso, Musa & Mbarika, 2005). The model is used predominantly in the international aid and development field. In practice the technology transfer model implies the copying and transfer of successful projects in one context or institution to another. When applying this theory, an organization may copy the product or model from another institution while amending the product to suit their needs and conditions. This study will consider how the elements of technology planning models can be considered in the developments of the Framework for school districts located in DCs (Bozeman, 2000).

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Schools Technology Planning Models. A number of technology planning models are developed and implemented by different government programs and school districts. According to Picciano (2006) a technology planning framework may fall within two rationales: economic model and social process model. The economic rationale “posits that schools operate similarly to private businesses, with an emphasis on bottom-line profits (p.19). The social rationale model, on the other hand, focuses on producing social development of students, that may not be measured in terms of “human talents and abilities” (p.20).

Vanderlinde et al. (2008) describe what he termed the “missionary” approach (p. 3). According to Vanderlinde et al. (2008) the missionary approach is the tendency of “dumping computers in rural communities and hoping that the people will somehow become literate and internationally competitive” (p. 3). Such approach assumes that the availability of technology will result in the effective use by the project beneficiaries.

Picciano (2006) proposes a district technology planning framework that is built on the social rationale processes. The Framework outlines the different planning functions for a district and a school. This model suggests that the first step of planning for technology is a process that is informed by the environmental scan of the social values and culture in a district. The next step is for schools to determine their goals and objectives and the applications of their technology. Schools are to determine the type of facilities and technology equipment they need. The overall evaluation of the technology evaluation is conducted by a district (Picciano, 2006).

Lumley and Bailey propose a district planning tool that has six steps for developing plans (Lumley & Bailey, 1993). These steps are: (1) organizing and empowering a district technology planning team, (2) preparing the planning team for the study, (3) assessing current state of

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technology in district, (4) Developing guiding documents for technology, (5) developing the long-range technology plan, and (6) implementing and institutionalizing the technology plan (Lumley & Bailey, 1993).

Most technology planning frameworks suggest that a fair approach to address equity issues in order to promote access to as many users as possible (Barry & Nichole, 2001). The common model is to centralize the computers in a lab or classroom that is then made available to the whole school for pedagogical purposes. According to Barry and Nichole (2001) the approach of distributing computers to different classes is promoted as a fair approach to promote equity, but it does not seem to work well in schools.

Trucano (2009) asserts that there is a shift from the era of pilot project experimentation where technology is supported by donors, private sector and NGOs in DCs. In his view, there is a movement towards the systemic approach that is initiated by ministries of education and the evidence is that by policy formulated in cooperation of various stakeholders.

Elements and Conditions of the Technology Planning Framework

A sufficient amount of literature exists that discuss the issues, dilemmas and elements that technology coordinators in DCs need to consider when undertaking the technology planning for school districts (Pelgrum & Law, 2003). In many cases, the issues vary as to whether they are for schools, districts or national government structures. The components are proposed as steps to be followed and could enable the user to produce a planning document at the end of the process. In the planning process, terms are interpreted differently. Vanderlinde et al. (2008) argue that the implementation of technology integration requires some conditions and variables in order to

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flourish. It is important to discuss the elements that need to be considered in of technology planning when developing a framework.

Equity Issues. When conducting plans, technology coordinators should consider equity issues. Addressing equity issues means that consideration is given to accommodate these factors: race, ethnicity, language and disability minority groups, gender, and poor communities and rural areas (Picciano, 2006; Swart, 2006). A technology plan should provide opportunities and promote attitudes that would reduce bias towards the minority groups. Overall, a framework should advance access to technology and student performance. Schools located in rural and poor communities need a special consideration in order to ensure that technology do not perpetuate the inequalities within the education system.

Stakeholder Participation. A number of studies concur that DCs recognize the importance of representation of stakeholders to participate in the technology planning processes (Kendall, Kendall & Kah, 2006; Jhurree, 2005; Unwin, 2009d; Warschauer & Ames, 2010). Stakeholders may be from different levels of government, communities, beneficiaries, civil society, trade unions, private sector, international bodies, and NGOs. However, important stakeholders such as teachers, principals, and teachers' professional organizations should also have representation in a planning structure. Cronje (2008) suggests that the implementation technology in school districts needs to take cognizance of the power relationships within a community within which they operate.

Educational Administration. The Framework should provide guidance with regard to keeping records and files of schools (Picciano, 2006). More importantly, the Framework should offer criteria for data formation to ensure consistently over terms, and creation, updating and

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access of files. Common data management will enhance standardized issues with regard to security, software packages, and communication within a district (Lumley & Bailey, 2006). More importantly, a well recorded and accessible data will support informed decision making processes within school districts.

Internet and Data Communication in Schools. A technology plan should allow the use of data communication systems and networks (Picciano, 2006). The data communication systems and networks will enable districts and schools to create their own local area networks (LANs). The LANs will provide an opportunity for districts and schools to create common technology-based resources such as libraries, administrative data and laboratories (Picciano, 2006).

Monitoring and Evaluation. Investment in technology tends to raise hopes and pressure to bring immediate results by the education sector. The Framework should clearly stipulate the rationale and processes of conducting the monitoring and evaluation of the technology planning and implementation in school districts (Pelgrum & Law, 2003). Clear indicators that provide data on implementation targets should be developed. Ferrante, Hayman, Carlson, and Phillips (1988) suggest that the evaluation criteria of hardware consider factors these factors: “performance, compatibility, expandability, ergonomics, software availability, vendor and cost” (p. 36.). Implementing technology may take a long time of between three-seven years (Picciano, 2006).

Software Evaluation. Technology coordinators should include a process of evaluating and selecting the appropriate software to determine whether it meets the needs of the beneficiaries (Picciano, 2006). The important criteria for software evaluation may include efficiency, ease of use, documentation hardware requirements, vendor and cost (Picciano, 2006; Lumley and Bailey, 2006).

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Dissemination of Good Practice of Innovations. The Framework should have mechanisms to identify success cases and find effective ways to disseminate the adoption of a good practice within ministries of education (Pelgrum & Law, 2003). In order to promote successful innovations within different institutions, technology coordinators should be involved in the learning process and be careful to consider conditions that will allow success.

Summary

The literature review has indicated that there are many ICT developments taking place in DCs. While ICT offers the potential to address challenges in education in DCs, it however presents a number of challenges that these countries face. These socio-economic challenges are related to lack of systemic planning, low income levels, unavailability of relevant content, inequality of ICT access by the minority groups, the dominance of the English language, and the lack of budgets in DCs.

Furthermore, these ICT developments in DCs involve many external organizations other than the governments, and this result in technology programs that are not coordinated and are incompatible. In reaction to taking advantage of ICT developments, governments in DCs developed policies at national level, with no clear implementation plans. Such policies and plans do not identify the roles and responsibility of school districts in the implementation ICT. For ICT to be effectively utilized in DCs, there is a need to develop a framework that could be used by school districts, because they provide both professional and administrative support to schools.

Such plans will ensure that school districts and their stakeholders share a common vision on how ICT could be utilized to enhance their teaching and learning practices. A technology planning framework that is based on a sound theoretical framework will guide the development of

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a comprehensive school districts technology plan that meets their needs and their conditions.

Systemic planning and implementation of technology at the school districts level will equip government officials and other stakeholders to understand the technology issues that are relevant for their schools. More importantly, the Framework will enable school districts to have a clear purpose on technology integration. A proper framework that is comprehensive will enable school districts to address important areas such as staff development, hardware and software acquisition and upgrades, managing schools data for administrative purposes, and more importantly suggests approaches for technology integration.

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Chapter 3: Methodology

Statement of Purpose

The main purpose of this study was to develop a technology planning framework for school districts in developing countries (DCs). It was envisaged that the Framework could be used by technology coordinators of school districts (counties) to design a comprehensive technology plan. This developmental study employed the following phases: analysis, development, evaluation, and revision. Ultimately, this study resulted in the production of a written document (based on the DoI theory) that could serve as guidance to activities to develop the technology plan for school districts in DCs. The Framework document was a combination of statements and written narrative. The researcher provided the guidelines regarding the contexts and conditions in which the Framework may be used.

Design of the study

This study utilized the developmental research approach. The development research was part of the emerging research methods known as design and developmental research (Richey & Klein, 2007). The design and developmental research emerged from the psychological, communication, and instructional knowledge base. Richey and Klein (2007) define design and developmental research as “the systemic study of design, development and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and non-instructional products and tools and new or enhanced models that govern their development” (p. 1). According to Seels and Richey (1994), design and developmental research is defined as “systematic study of designing, developing and evaluating instructional programs, processes and products that must meet the criteria of internal consistence and effectiveness” (p. 127).

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This type of research was informed by the desire to address practical problems based theories, with the aim of establishing their application. Richey and Klein (2007) contended that the design and developmental research aims “to establish procedures, techniques, and tools based on a methodological analysis of specific cases” (p. 1).

Richey, Klein, and Nelson (2004) proposed two types of design and developmental research: Type 1 and Type 2 research studies. Type 1 research studies are context specific; and their conclusions typically take the form of lessons learned from the development of a specific product and conditions that improve its effectiveness. Richey et al. (2004) argued that design and developmental research focuses on the process where there was the product developed to be implemented in a specific situation. In most cases, the situation was described and analyzed and the final product is evaluated. In general, Type 1 research studies may have a structure that follows these phases: analysis, development, testing, and evaluation.

Type 2 research studies address generalization of the design procedures or principles learned in the processes designing a product and program. Richey et al. (2004) suggested that more methodological development work regarding design and developmental research was conducted to justify the importance of local contexts with regard to the implementation of this research. The focus of the research is always geared towards the design, development, and evaluation processes of tools or models. When applying Type 2, attention should also paid to the conditions that would facilitate its use (Richey et al., 2004). In Type 2 research studies, design and developmental research adopt this approach of first defining the problem, conducting literature review, and outlining research procedures (Richey, Klein, & Nelson, 2004). Design and developmental research studies also investigate how users apply the design principles in a

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particular context. The other element of design and developmental research values context in which learning or performance takes place. Within the design and developmental research, information about the topic is collected through a review of literature to establish the historical, trends and current status of design processes (Richey & Kein, 2007). In general, Type 2 research studies may be structured in this way: model construction, model validation, and model evaluation.

To address the issues of validity and reliability with regard to the Framework development, Richey and Klein (2007) proposed that the internal and external processes be conducted. The internal validation process addresses the following questions such as: (a) Are all the steps included in the model necessary? (b) Are the steps in manageable sequence? (c) To what extent does the model address all relevant environmental factors? (d) To what extent is the model usable for a wide range of design projects and settings? (e) Can the steps be completed efficiently under the worst working conditions? (f) Is the use of this model effective? (Klein, 2007)

Richey et al. (2004) identified the design and developmental research data collection methods that include a variety of forms depending on the focus of the research. The data collection methods relate to design, development, and research. The documentation of the design, development, and research deals with “profiling context, work time, expenses, problems encountered, decisions made, adjustment made on the original plans, designer’s reactions and attitudes, or records of concurrent work patterns” (p. 1116). The other aspect of data collection relates to the conditions under which the development and implementation takes place. This documentation of conditions may include factors such as equipment, resources available, participants’ expertise and background, and time (Richey et al., 2004).

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The data methods also considered formative and summative evaluations and issues that relate to learning, transfer, and impact of a framework. Richey et al. (2004) outline the methodology process of conducting the design and developmental research. They outlined the research methodology as addressing mainly three aspects: problem definition, literature review, and research procedures. With regard to the problem identification, attempts are made to establish whether the problems were common to designers and developers. The problem definition should be focused on the aspects of design, development, and evaluation, but not on any particular variables. Furthermore, the problem identification stage should determine if the design and development may occur across a system and whether data will be collected from similar developments (Richey, Klein, & Nelson, 2004).

The second aspect of addressing Type 2 research studies is conducting a literature review. Richey, et al. (2004) suggest that the literature review should address these topics: (a) a description of models, (b) research on the targeted process, and (c) research factors impacting the use of a given model or process.

This study will apply the developmental process and will be conducted in three phases: (a) phase one – the design and development; (b) phase two - formative evaluation; and (c) phase three - revision process. The study will be based on the Type 2 developmental research studies.

Research Goals

This study aimed at developing a school district technology planning framework suited for a developing country based on Rogers' Diffusion of Innovations theory (Rogers, 1995). The research also discussed and identified other elements and practical considerations relevant when developing a school district technology plan.

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Phase One – Analysis, Design and Development

Alignment of the theory and technology planning model. A review of literature identified the issues and elements that were necessary for developing technology framework in DCs. This section analyzed how the DoI theory can assist in the development of a technology framework for school districts. The section also analyzed how the primary components of the DoI theory (Rogers, 1995) support the processes of developing a technology planning framework. In addition, this study considered other factors that apply in the development of a framework to suit the contexts and conditions of DCs. The application of DoI was relevant to this technology planning process in terms of its four elements and the innovation-decision process. In this study, the application of the DoI theory was addressed in two aspects: the four elements of diffusion of innovations and the four stages of the innovation-decision process.

The Four Elements of the DoI

Rogers (1995) defined diffusion as a process that has four elements: (a) innovation, (b) communication, (c) time, and (d) social system. Each element was discussed on how it may be applied in the development of the Framework.

Innovation. Rogers (1995) defined an innovation as “an idea, practice, or object that is perceived as new by an individual” (p. 11). In this case, the proposed technology planning framework was the new innovation that may be used by the technology coordinators to develop a school district technology plan suitable to the contexts and conditions of DCs.

Rogers asserted that there are five characteristics associated with an innovation that explain users’ rate of adoption (Rogers, 1995). The five characteristics of innovation are relative advantage, compatibility, complexity, trialability, and observability. Relative advantage is the

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degree to which an innovation is perceived by others as being better than the previous one used.

Both the technology coordinators and the representatives of different stakeholders will constitute a technology planning team. Stakeholder participation will ensure that both those knowledgeable in technology planning and those less knowledgeable representatives become aware of how a school district technology plan could benefit their schools.

Compatibility refers to the extent to which an innovation is consistent with the existing users' values, needs, and experiences. Given the weak democratic practices in DCs, establishing a technology planning team will ensure that the minority groups such as people with disabilities, women, and groups located in rural areas are represented in the technology planning process. Furthermore, establishing a technology planning team may afford the planning team the opportunity to debate and negotiate a common vision and values to guide the technology plan.

Observability refers to the way potential users see the value and benefit of the innovation to them. Representatives of stakeholders will see the value of technology planning as they engage among themselves and with other experts in the ICT sector. The representatives involved in district planning may take study tours to observe how technology is planned and implemented by other districts with similar socio-economic conditions. Attending conferences, meeting with experts in technology, and reading relevant reports could be another way in which representatives involved in planning could orientate themselves to understand the value of technology planning for school districts. Such efforts will ensure that representatives of a planning team have a clear view on the value and benefits of the technology planning processes. See table 1 below.

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Table 1. Innovation and Technology Planning

Innovation component	Technology planning framework	Questions/ issues
Innovation		
Relative advantage – is the degree to which an innovation is perceived by others as being better than the previous one used	* Where there are no plans, more appreciation will be given to the Framework * Clarify the importance of the technology planning process	Will the planners be clear about the advantages of school district technology planning?
Compatibility – addresses the extent to how an innovation is consistent with the existing users’ values, needs, and experiences are toward the innovation	Inviting stakeholders to appoint representatives to participate in the planning process will ensure that shared values, concerns, and needs are negotiated and agreed upon	Sufficient time should be allocated for stakeholders to negotiate values, concerns, needs, and vision
Observability refers to the way potential users see the value and benefit of the innovation to them	Representatives of stakeholders will understand how the Framework will benefit their schools and communities	Through study tours, conferences, and reports, stakeholders will see the value of the Framework
Literature	Baule, 1997; Lumley & Bailey, 1993; Picciano, 2006; Rogers, 1995	

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Communication. According to Rogers (1995) communication channel refers to how information flows between and among the members of a social system. He further explains that communication channels transmit information through two avenues: mass media and interpersonal channels.

Mass Media Channels. Mass media formats such as radio, television, journals, newspapers, and telecommunications are common channels that transmit information. These channels tend to disseminate information rapidly but are generally perceived to be without credibility and trustworthiness (Rogers, 1995). The technology coordinators may use different forms of communication in order to reach many stakeholders and the public about the technology planning process. Such communication may need to be made at the beginning, during, and at the end of the planning process. Once a school district technology plan is complete, its summary may be distributed through the channels of communication within ministries of education and through the mass media channels. The complete technology plan may also be launched to ensure sufficient exposure and publicity. Using appropriate communication tools, a platform can be created in order to facilitate feedback, debates, and discussions about technology planning processes.

Interpersonal Channels. Interpersonal channels refer to the exchange of information between individuals or to more members of a social system. According to Rogers (1995) this method, although slower, is more effective than mass media. With regard to the Framework, the interpersonal channels include the normal communication channels within ministries of education. Such channels may be used to inform other affected entities within the three tiers of government. Communication within the government will also ensure that key entities become aware of the implications of the technology planning processes. See table 2 below

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Table 2. *Communication and Technology Planning*

Innovation Component	Technology planning Framework	Questions/ Issues
Communication		
“the process by which participants create and share information with one another in order to reach a mutual understanding” (Rogers, 1995, p. 17).	<ul style="list-style-type: none"> * Channels of communication within the government, and ministries of education * Communication with the stakeholders and the public about planning processes * Create a technology platform for engaging the public 	<ul style="list-style-type: none"> * Effective communication will make the public aware of the technology planning process * Clear communication plans and budget should be developed to create awareness about the planning process
Literature	Lumley & Bailey, 1993; Rogers,1995	

Time. Time deals with the length it takes for the new innovation to be adopted within a social system. Time also addresses how the new innovation may be diffused over time. The time element occurs in three ways: the innovation-decision process, the innovativeness of an individual or a social system, and the rate of adoption (Rogers, 1995).

Innovation-Decision Process. The innovation-decision process is the process through which a member of a society becomes aware of the innovation and adopts it. Rogers (1995) outlines five steps that can be taken at this stage: knowledge, persuasion, decision, implementation, and confirmation.

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Innovativeness and adopter categories. Innovativeness addresses the degree to which users adopt the innovation within the social system earlier than other members. Rogers (1995) classifies members of a society into five adopter categories: innovators, early adopters, early majority, late majority, and laggards. Like in many situations, the adoption of the Framework may not be accepted by all school districts at the same time. Some districts will quickly adopt the framework while others will follow at a later stage.

Rate of Adoption. Rogers (1995) refers to the relative speed with which the innovation is adopted by members of a social system. Continuous exposure and involvement in the technology planning processes will enable planners to gain more knowledge about the Framework. The early adoption of the Framework by some districts will expose the late adopters to the importance of developing a school district technology plan.

Rogers (2003) contends that the decision by an organization or individual to adopt an innovation is a process, not an instantaneous act. The process of adopting an innovation by an individual or organization requires multiple actions. In addition, some DCs have a number of projects that may involve a number of schools in a country. The partnerships entered into between government and external organizations are other indications that there is the willingness to use ICT in education (Farrel & Isaacs, 2007). The governments of DCs have sufficient information to make decisions about adopting the Framework. See table 3 below.

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Table 3. Time and Technology Planning

Innovation Component	Technology planning Framework	Questions/ Issues
Time		
Time deals with the length it takes for a new innovation to be adopted within a social system (Rogers, 1995).	* It may take 3-5 years to plan and implement a framework * DCs have technology projects that would help districts to know about the technology planning process	Planners need to view the implementation of a framework as a long-term process
Literature	Baule, 1997; Lumley & Bailey, 1993; Rogers, 1995	

Social System. Rogers (1995) defines the social system “as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal” (p. 23). Members of a social system may be individuals, informal groups, organizations, and other sub-systems. The way the social system is set up will determine the success or failure of the innovation as well as the rate of its diffusion. The structure of a social system may determine who, within the system, could influence other potential users of an innovation. Members in a social system influence one another, with some becoming more influential than others. In a social system, leaders emerge and their opinions carry more weight in influencing other users to adopt and use the innovation. Such leaders tend to have communication networks that may reach many individuals within the social system. In some cases, some leaders serve as the point of contact for change agents. Change

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agents are usually those individuals who will influence members of the social system to get involved with the new innovation that has been introduced to the members (Rogers, 1995).

Ministries of education of governments will be the broader social society in the context of developing the Framework. The technology coordinators and senior officials within the education ministries may serve as opinion leaders who may be the early adopters of the Framework. Such opinion leaders may be the ones to influence other representatives of the stakeholders to adopt and apply the Framework. The other entities to be involved from the ICT sector are the external organizations such as the private sector, civil society, and international organizations.

The issue of social system relates to how the Framework should be introduced and implemented within the education sector. In addition, the Framework should be implemented with the assistance of the stakeholders. Other opinion makers within the district would be individuals who have positions of influence such as district superintendents, principals with good reputations, and district ICT coordinators (Lumley & Bailer, 1993). If these individuals would adopt the Framework, other stakeholders, such as teachers, technology coordinators, community organizations, and the private sector, may follow in the adoption. See table 4 below.

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Table 4. Social System and Technology Planning

Innovation Component	Technology planning Framework	Questions/ Issues
Social System		
<p>“interrelated units that are engaged in joint problem-solving to accomplish a common goal” (Rogers, 1995, p. 23)</p>	<p>* National and regional government officials, district administrators * Representatives from the external stakeholders that include community and non-governmental organizations, private sector</p>	<p>Ensure fair representation of the minority groups</p>
Literature	Lumley & Bailey, 1993; Rogers, 1995	

The Innovation-decision Process and Technology Planning Framework

The innovation-decision process was relevant to the Framework process because it presents how a decision-making unit moves from the initial knowledge to the adoption and implementation of the new innovation (Rogers, 1995). As the innovation-decision process indicates, working with school districts should be based on the understanding that the technology planning process is a process and will take some time to accomplish.

According to Rogers (1995), decision making is not an instantaneous act but a process that occurs over time. The decision process takes place between numbers of series of different

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actions. Rogers (1995) proposed that an innovation-decision process is based on sequential stages, which are: knowledge, persuasion, decision, implementation, and confirmation.

The Knowledge Stage. Rogers (1995) asserts that the knowledge stage “occurs when an individual is exposed to an innovation existence and gains understanding of how it works” (p. 169). Individuals may gain awareness about the innovation when they are exposed to it or when they actively seek more information about it. Other individuals may gain information when they feel a need for a particular innovation. The desire to meet the needs and perceived problems are other factors that encourage individuals to seek information.

The knowledge stage is directly linked to the implementation of the Framework. A school district will serve as a decision-making unit that will need to be exposed to the Framework and gain an understanding of its implementation. Rogers (1995) suggests that there are three important questions about an innovation: “What is innovation?” “How does it work?” “Why does it work” (p. 172). Technology coordinators will be involved in knowing about the Framework and such information may motivate representatives of stakeholders to seek more knowledge about it. The “How does-it-work” question will assist technology coordinators to seek more information about the application of the Framework to meet their needs, conditions, and contexts. The third question, “Why does it work”, may require technology coordinators and representatives of stakeholders to seek more information about the principles that will allow the Framework to work. See table 5 below.

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Table 5. Knowledge Stage and Technology Planning

Innovations Component	Technology planning Framework	Questions/ Issues
Knowledge Stage		
“Occurs when an individual is exposed to an innovation existence and gains understanding of how it works” (Rogers, 1995, p. 169).	Technology coordinators will need to know what is the Framework and how does it work	Technology coordinators will also seek to know the conditions and contexts under which the Framework works
Literature	Rogers, 1995	

Persuasion Stage. Persuasion occurs when an individual (or other decision-makers) forms a favorable or unfavorable attitude toward the innovation. At this stage, the attitude is formed and changed on the part of an individual, but not necessarily in the direction intended by a particular source. At this stage, there is a psychological involvement with the innovation by an individual, who also seeks more information about the new ideas. At this stage, the individual seeks social enforcement from others about an innovation (Rogers, 1995).

When the technology coordinators get to know the potential benefit of the Framework, they would be able to develop a positive attitude towards it. If technology coordinators develop a favorable attitude about the Framework, they have the interest and ability to think creatively in how it may be applied in their school district’s contexts and conditions. Technology coordinators and representatives from stakeholders may provide each with social reinforcement as they gain

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more information about the Framework and its potential benefit to their district. Knowing how to implement the Framework will reduce the uncertainty as the district planners become clear about its implementation and see the disadvantage of not undertaking technology planning in their district. See table 6 below:

Table 6. Persuasion Stage and Technology Planning

Innovations Component	Technology planning Framework	Questions/ Issues
Persuasion stage		
“occurs when an individual (or other decision-making) forms a favorable or unfavorable attitude toward the innovation (Rogers, 1995, p. 174)	<ul style="list-style-type: none"> * Establish what is the Framework and how it can be used * Change of attitude about the Framework * Reinforcement about the Framework learning from other districts with similar socio-economic conditions and context 	Increase awareness about the Framework may generate a positive attitude towards the Framework
Literature	Rogers, 1995	

Implementation Stage. The implementation stage occurs when the individual decides to put an innovation to use. While other previous stages are mental processes of deciding, the implementation stage involves actively putting the decision into practice (Rogers, 1995). At this stage, the individual still has uncertainty about the consequences of the new innovation. The individual may ask himself/ herself questions like: “Where can I obtain innovation?” “How do I use it?” and “What operational problems am I likely to encounter, and how can I

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solve them?” Unlike an individual, organizations tend to experience challenges in adopting a new innovation (Rogers, 1995). The organizational structure and a number of people involved in decision making processes might make it difficult for the new innovation to be adopted in an organization. In cases where adoption of a new innovation takes place, it might take a long time. In some cases, the innovation may need to be reinvented. The reinvention means the degree to which an innovation is changed or modified by the user in the process of adoption to meet their conditions (Rogers, 1995).

At this stage, a district planning team engages in the use of the Framework. The district planning team may consider using the Framework in phases. As a district planning team engages in the innovation, other members may actively or passively reject the Framework. Difference of opinions about the Framework should be expected at this stage. However, change agents within a district planning team may consider demonstrating how the Framework would be developed over time. See table 7 below.

Table 7. Implementation Stage and Technology Planning

Innovations Component	Technology planning framework	Questions/ Issues
Implementation stage		

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<p>“occurs when an individual (or other decision-makers) puts the innovation to use (Rogers, 1995, p. 179)</p>	<p>* District planning team decide to use the Framework</p> <p>* Differences of opinions should be expected as some other district planning team members may actively or passively reject the Framework</p>	<p>The district planning team should encourage the expression of different opinions; even those who may doubt using the Framework</p>
Literature	Rogers, 1995	

Confirmation Stage. The individual seeks confirmation for the decision made about the innovation, and may still change his/ her mind if conflicting or confusing messages arise about that innovation (Rogers, 1995). The individual is influenced by the dissonance or discontinuance.

Dissonance is the state of internal disequilibrium that an individual may seek to reduce or eliminate. The dissonant individual is motivated to reduce his/ her conditions by changing the knowledge, attitudes, or actions. According to Rogers (1995), dissonance reduction may occur based on three conditions. The first one is when the individual becomes aware of a need and seeks information to meet a need. The second condition is when the individual knows a new idea and has a favorable attitude towards it but has not yet adopted it. The third condition is when the individual secures further information that persuades him/ her that innovation should have been adopted. On the other hand, the individual may take discontinuance, which is a decision to reject an innovation after having previously adopted it.

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The district planning team should be aware that there will always be a degree of uncertainty about the application of the Framework. The district planning team should encourage other members to ask questions about the Framework and how it will be implemented to meet the contexts and conditions of their district. Implementing the framework as a district may take some time and consensus should be the basis on each decision taken. The implementation of the framework may take between three-seven years (Picciano, 2006).

The advantage of planning through an organization is that the district planning team considers other operations and regulations that would ensure the successful implementation of the framework. Debates and discussions about the Framework will ensure that the team members address important issues that are related to technology planning and implementation. The district planning team should adapt the Framework to meet their needs and conditions. They may not have to adopt it as it is. See table 8 below.

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Table 8. Confirmation Stage and Technology Planning

Innovations Component	Technology planning Framework	Questions/ Issues
Confirmation Stage		
<p>“At this stage the individual seeks confirmation for the decision made about the innovation, and may still change his/ her mind if the conflicting or confusing messages arise about that innovation (Rogers, 1995, p. 189)</p>	<p>* More knowledge and change in attitudes towards the Framework will reduce their internal disequilibrium of the district planning team</p> <p>* Debates and discussions should be encouraged about the Framework</p>	<p>Decisions on the implementation of the Framework should be based on consensus</p>
Literature	Lumley and Bailey, 1993; Rogers, 1995	

Phase Two-Formative Evaluation

A formative evaluation was conducted based on the draft Framework for school districts in DCs. A selected panel of expert reviewers was requested to make comments and suggestions on the draft. The expert reviewers evaluated if the proposed Framework was feasible for the contexts and conditions of DCs.

Participants and criteria for recruitment

Two types of expert reviewers were selected to evaluate the Framework: type one was for evaluating the DoI theory and type two was for the potential user of the Framework. Two expert reviewers were selected to evaluate the DoI theory, and ten technology planning expert reviewers

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were selected from different African countries to evaluate the Framework as potential users.

Purposeful sampling was used to select participants for the study. This is a process whereby the researcher selects a sample based on experience or knowledge of the group to be sampled (Fraenkel & Wallen, 2006; Russ-Eft & Preskill, 2001).

The DoI theory expert reviewers were selected based on experience and qualifications. Both the theory expert reviewers have completed graduate qualifications and have more than ten years of experience between them in the application of the theory. The selected theory expert reviewers were to determine if the proposed Framework properly conforms to the principles of DoI theory. An evaluation rubric was developed to guide the DoI theory expert reviewers.

For the potential user, the researcher selected ten expert reviewers. Ideally, the researcher would have preferred to select expert reviewers from the countries speaking the French, Portuguese and Spanish languages. Owing to the constraints of resources and time, the researcher only selected expert reviewers who could read and write the English language and were located in different regions of Africa. The expert reviewers were selected based on these factors: their knowledge and experiences of working in ICT in education, familiarity with ICT policies and plans, knowledge about the international technology trends, developments in ICT in education, and knowledge in the planning processes of implementing ICT in DCs. The researcher ensured that the selection of expert reviewers reflected a broad representation of DCs and ensure gender balance. The selected expert reviewers were from national governments, regional organizations, faculty members at universities, and the private sector. An evaluation rubric was developed to guide the expert reviewers to evaluate the Framework.

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Through a formal written letter, the researcher requested the expert reviewers to participate in the evaluation of the proposed Framework. The expert reviewers were given three weeks to evaluate the proposed Framework.

Data collection procedure

This researcher applied for the approval of the Virginia Tech's Institutional Review Board (IRB) in order to ensure that the research protocols are observed. The Board evaluated the research proposal in order to ascertain that the involvement of human subjects was ethical and that the rights of participants were protected. The researcher sent out an official letter to request the participation of the expert reviewers in the study. The review of the proposed Framework document began between February and March 2013.

All communication with the expert reviewers were conducted through electronic mail. As a follow, the researcher telephonically contacted expert reviewers to check if they have questions and concern about research. The proposed Framework document and the evaluation rubrics were made available only in the English language. The expert reviewers answered the evaluation rubrics and made overall comments and suggestions and forward all document back to the researcher by e-mail.

Data analysis. The feedback on the evaluation rubrics and the comments and suggestions made by the both DoI theory and potential user expert reviewers served as the data that the researcher analyzed and used to improve the proposed Framework. The improved is chapter 4 of this research.

Review Guideline Document. The researcher developed the two evaluation rubrics to guide both the DoI theory expert and the ten technology planning experts. The evaluation rubric

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for the DoI theory was developed based on the application of the DOI theory. The evaluation rubric for the theory was to be used by the expert reviewers to determine if the Framework conforms to the DOI theory principles. The evaluation rubric was analyze if the four elements of the DOI theory, namely: (a) innovation, (b) communication, (c) time, and (d) social system, were appropriately applied in relation to the technology planning process. Each element was discussed on how the Framework could be diffused in the context of DCs. The evaluation rubric was to determine if the four sequential stages of the innovation-decision process were appropriately applied according to the DoI theory principles. Those stages are: knowledge, persuasion, decision, implementation, and confirmation. The evaluation rubric for the theory expert reviewers was attached (Appendix O).

The evaluation rubric for the potential technology planning user was developed to guide expert reviewers if the proposed Framework is feasible in the contexts and conditions of DCs. The evaluation was also to establish if the Framework meets the expectations of the expert reviewers. Furthermore, the rubric also sought to determine if the Framework outlines the necessary planning activities and steps. The evaluation rubric to be used by the ten expert reviewers was attached (See Appendix Q).

Phase Three-Evaluation and Revision

After the experts provided feedback, comments, and suggestions, the researcher then revised the document.

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Chapter 4: Technology Planning Framework for School Districts in Developing Countries

The manifestations of the advancement of technology are evident in many fields including military, medicine, and education. Modern society and educational institutions are highly impacted by the use of technology. While other fields have managed to make progress in the application of technology to improve their practices, the education sector has made insufficient progress because of a number of challenges. This is particularly the case in most developing countries (DCs). While governments of DCs recognize the potential of information and communication technology (ICT) to improve their school administration and instructional practices, many face a number of significant challenges (Farrel & Isaacs, 2007).

Many of the challenges are related to poor policies, implementation that is not systemically planned, costs, weak technology infrastructure, lack of online resources, and inadequate staff development programs (UNESCO, 2011). The common threat among the challenges that DCs face emanates from the lack of proper technology planning that is systematic and comprehensive for their conditions (Anderson, 1999; Fishman & Pinkard, 2001; Lumley & Bailey, 1993).

In cases where there is technology planning for schools, it seems that most plans are designed without proper theoretical frameworks. Literature seems to suggest that there are three challenges that relate to the existing technology planning.

The first challenge is that some of these planning frameworks are focused on the deployment of technology equipment and are not founded on sound theories (Farrel & Isaacs, 2007; UNESCO, 2011). The second challenge is that some technology planning frameworks are

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suited for the conditions and contexts of the developed countries, and not for developing countries. The third challenge is that there is lack of systemic planning for technology in general and in the education sector in particular (Gülbahar, 2007; Lumley & Bailey, 1993). Therefore, lack of systematic planning results in situations where school district technology plans developed are not compatible with other governmental plans and ignore pertinent issues relevant to DCs (Baule, 1993; Hawkins, 2002).

A number of different technology planning frameworks for school districts suggest that four main stages should be covered in the planning processes (Anderson, 1999; Baule, 1997; Lumley & Bailey, 1993; Picciano, 2006). These four main stages are: the preparatory planning stage, developments of key documents, implementation, and the post planning activities.

This proposed Framework aims to assist officials working at national, state and school districts in DCs to develop technology plans. Officials working in school districts include, but are not limited to, district superintendents, technology coordinators, and other senior officials involved in the management of school districts. The Framework may also be used by government officials at the state level to develop state technology plans. Furthermore, the Framework can be used as a guide to develop school district technology plans. More importantly, the Framework may also be used to determine needs assessments and guide the development of a vision, mission statements, long-term goals, time-frames and implementation plans.

School district committees dealing with planning facilities, equipment, maintenance and budgets for technology may also use the Framework. The Framework may be used to address the pertinent issues that school districts have to deal with in the planning process such as staff development, acquiring software and hardware, technology integration, and processes of

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improving school administration. The overall purpose of this framework is to develop actions and reflections about creating and maintaining an enabling environment for effective use of technology in schools.

The development of a technology framework should be based on a sound theoretical framework (Picciano, 2006). Diffusion of Innovation (DoI) is the appropriate theory for guiding the development of a technology plan in DCs because it explains how new innovations are adopted by a population (Rogers, 1995). This DoI theory is also relevant to building a basis for the development of a technology framework because it addresses how social change occurs in the life of an individual or an organization (Rogers, 1995). In addition, the theory offers information about three important issues: the qualities' that make an innovation to be adopted, how social networks influence each towards a new innovation, and an understanding of the needs of different users (Rogers, 1995).

Theoretical Framework: Rogers' Diffusion of Innovations Theory

Everett Rogers (1962) proposed the Diffusion of Innovation (DoI) Theory in his first publication in 1962. Although his original research was mainly focused on the field of agriculture, it built the foundational work for other fields as well. He followed up the first editions with other research work that expanded the theoretical foundational work and applications of the DoI Theory in many other areas.

Rogers (1995) defined diffusion as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (p. 5). Expounding the theory, Rogers (1995) indicated that diffusion is determined by how individuals in a social system perceive characteristics of an innovation or attributes it may have. He further indicated

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that diffusion is based on how the attributes help to predict the rate of adoption of new innovations (Rogers, 2003). Rogers proposed the four elements of DoI that may be identifiable in most research studies on the adoption of innovations. These elements are (a) innovation, (b) communication channels, (c) time, and (d) a social system. It is important that one determine how the four elements of the DoI relate to technology planning. In light of the DoI theory, the proposed technology framework in this chapter is the new innovation.

This Framework will result in the production of a written document that guides the activities to develop the technology planning Framework that can be used by school districts in DCs. Using Microsoft® Word, the Framework is developed based on the four technology planning components and how the DoI Theory is applicable in this regard. The Framework is meant to be descriptive rather than prescriptive. It suggests how technology planning could be done at the school district level. The Framework described in this study will guide users in developing appropriate plans taking into consideration the socio-economic and political factors that define the local contexts

This chapter is divided into four phases: (a) Phase 1: Preparatory Planning Stage, (b) Phase 2: Developments of Key Documents, (c) Phase 3: Implementation Plan, and Phase 4: The Post Planning Activities. The chapter has supplementary documents that provide additional information presented in the appendixes. The supplementary documents, added as appendixes, mainly suggest practical approaches and give examples that may be used to deal with specific issues.

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Phase 1: Preparatory Planning Stage

For effective technology planning to take place, there are preparatory activities that need to be conducted by a school district. The main preparatory activity is the setting up of a planning structure to facilitate the planning activities (Baule, 1997). Other activities in the preparatory planning stage are: outlining the terms of references of the planning structure (Lumley & Bailey, 1993), compilation of relevant documents (Picciano, 2006), the identification and selection of representatives by stakeholders (Rogers, 1995), consultation processes (Rogers, 1995), and communication strategies (Rogers, 1995).

The Setting up of Planning Structures. A number of researchers identify the setting up of planning structures as an important step towards developing technology plans in school districts (Baule, 1997; Lumley & Bailey, 1993; Rogers, 1995). Rogers (1995) proposed that a new innovation needs to be accepted within a social system if that innovation is to be adopted. Rogers also suggested that in some case “a new organizational unit is created for the innovation” (p.424). With regard to this planning Framework, a ministry of education, a state education department, a school district, and schools serve as a social system that should accept and participate in the process (Baule, 1997; Lumley & Bailey, 1993). Other stakeholders such as teachers and parents are also part of the social system and should participate in the planning processes.

A number of researchers concur that the setting up of a necessary structure is an important step in the planning of technology within a government system (Baule, 1997; Lumley & Bailey, 1993; Guida & Crow, 2009). The planning structure may be a committee, a team or agency and should consist of different members from stakeholders. A number of primary and

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secondary stakeholders should be identified to ensure an inclusive constituency and broad representation.

Primary stakeholders are those who directly use technology in schools such as teachers, administrators, district officials, and librarians. Secondary stakeholders are those who have a stake in the implementation of technology such as parents, local authority, teacher unions, professional bodies, and community organizations. In this document a planning structure is referred to as the planning committee.

The planning committee should be a manageable group, consisting of 5-8 members (Brody, 1995; Gülbahar, 2007). The overall responsibility of this committee is to oversee the development of a technology plan in closer detail. Ideally, the committee should be given authority and responsibilities to make decisions. The committee will need to have a chairperson who is endorsed by a school district authority and by other stakeholders.

The chairperson should have leadership skills and be able to direct the planning committee towards completing the task. The committee should also have a secretary who is responsible for the logistics of the activities, recordings of the meetings, manage documentation and communication. All correspondence to and from the planning committee should be managed by the secretary. It might be important that both the chairperson and the secretary be employees of a school district. For a sample of a form outlining committee members' responsibilities, see Appendix D.

The other structure is a reference group that consists of representatives from the secondary stakeholders. The secondary stakeholders may include other government entities, international experts in ICT, private sector, tribal authorities and non-governmental

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organizations. A reference group will serve as an agency that the planning committee will present the progress of their work to and receive their ideas, suggestions, and different perspectives back from. The committee may plan to meet with a reference group at least twice during the planning process, ideally at the beginning and at the end. For samples of checklists for the committee and the reference group, see Appendix E.

At the beginning, the committee may meet the reference group to present their plans to conduct a district technology plan. In that same meeting, the committee may invite the stakeholders to submit in writing any suggestions, ideas and issues that may need to be considered in the technology planning. At end of the planning process, the committee may present their draft plans to the reference group. The group may review the completed work and offer further suggestions and comments.

Terms of Reference for the Planning Committee. The committee should be given clear terms of reference with stipulated time-frames (Lumley & Bailey, 1993; Picciano, 2006). The terms of reference should be the basis upon which the work of the committee is built upon. As an entity, a planning committee should identify the roles each member will play during planning processes.

The terms of reference should outline the roles and responsibilities of each committee member. The terms of reference should also indicate how a structure will be set up and what it sets out to achieve. In addition, fair participation of stakeholders may encourage them to take ownership of a technology plan and increase their participation in the implementation plan. For a sample of terms of reference, see Appendix F.

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The Identification and Selection of Representatives by Stakeholders. Other researchers suggested that the identification and selection of representatives of stakeholders is another critical step that the committee should take (Baule, 1997; Lumley & Bailey, 1993; Rogers, 1995). Rogers (1995) suggested that the observability characteristic of innovation refers to the way potential users see the value and benefit of the innovation to them. Participation of representatives from stakeholders will ensure that they understand how the Framework will benefit their school districts and communities.

A committee should identify stakeholders in a district and request them to select representatives to participate in the technology planning process. Participating in the decision-making regarding the plan will afford all stakeholders an opportunity to engage in the planning process and reach consensus on issues that relate to the application of technology in their schools. Therefore, the committee should plan to engage these types of stakeholders during the planning process. Reference group may serve as a list of stakeholders mentioned under Appendix E.

Compilation of Relevant Legal, Regulatory, Reports, and Policy Document. The compilation of relevant documents is regarded as important because it forms the basis upon which the planning is made (Baule, 1997; Picciano, 2006). According to Rogers (1995), compatibility addresses the extent to how an innovation is consistent with the existing users' values, needs, and experiences toward the innovation. The committee will need to read and synthesize knowledge and information from the compiled documents in order to ensure that their planning process is guided and informed by their national government's vision and priorities.

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The government documents to be consulted are from several areas, including legal, regulatory, strategies, policies, and laws that deal with education and ICT matters. Examples of these documents may include curriculum documents, teacher training policies, information and communication technology programs, and human resources strategies. Other documents may be about ICT programs and evaluation reports on the use of technology in education in their country or in other countries that have similar socio-economic conditions as theirs. Studying relevant documents will provide a legal framework and guide the committee as they develop a district technology plan. More importantly, the use of these documents will guide the planning committee to integrate their technology plan and align it with existing strategies and programs. Where available, the committee should also compile other documents such as computer log books and sample of the learner and teacher portfolios of work done on ICT in education. See a sample checklist at Appendix G.

Consultation Plans. Rogers (1995) defines a social system as “interrelated units that are engaged in joint problem-solving to accomplish a common goal” (p. 23). As a result, the committee should create an opportunity to consult and engage different stakeholders. With regard to Rogers’ (1995) definition, the units forming the social system for a school district include a ministry of education, other government entities, and both primary and secondary stakeholders.

Stakeholders should have representation during the technology planning process. Primary stakeholders, as direct users of technology, should have representatives in the committee. The secondary stakeholders, being concerned with implementation, should have their representation in the Reference Group. A committee should have a planned schedule of meetings during the

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planning process that aim to consult with stakeholders in the Reference Group. Therefore, a committee should plan at least two face-to-face meetings with the Reference Group. A committee may also use different forms of mass media and interpersonal channels to encourage engagement and involvement of stakeholders in the planning process.

Communication Strategies. Rogers (1995) argues that an innovation should be communicated overtime within the system. The committee should design a communication strategy to create awareness about the planning processes. The communication strategy should aim to use different mass media and interpersonal channels in order to reach as many stakeholders as possible about the planning process.

The mass media channels such as newsletters and radio may be used to reach the broader public and to provide a platform for discussions and debates about issues that need to be considered in the technology planning process. The interpersonal channels could be those within government and a ministry of education such as meetings and internal briefings to communicate the planning processes. Utilizing a variety of communication channels will ensure that all stakeholders are aware of the planning process. The communication strategy should also guide stakeholders in how they could access the information about the planning process and how they may express their views. Ongoing communication about the Framework will ensure that stakeholders are aware of the issues. Such awareness will encourage stakeholders to work collaboratively and towards a mutual vision and commitment.

Needs Assessment. A number of researchers have suggested that the process to determine the needs assessment is an important step when developing a technology plan (Kaufmann, 1992; Lumley & Bailey, 1993; Rogers, 1995). The committee may need to conduct

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a needs assessment in order to determine data about needs according to the primary and secondary stakeholders. Where a report on needs assessment already exists, it may not be necessary to conduct a new one. Using a survey method, the committee may conduct a needs assessment in order to determine the issues that include the availability of technology, how technology is currently being used, the impact that technology has on teaching and learning practices (Pennsylvania Department of Education, 2011-2012). For additional information, see Appendix H.

Phase 2: Development of Key Documents

The phase for development of key documents deals with the creation of guiding documents that will keep a record of the plans and the processes of school district technology plans. At the end of the planning processes, such documents will serve as evidence of what has been achieved. These documents will also serve as conditions upon which new district officials are employed in future. The documents will guide the implementation of school district technology plans and direct the future activities of school districts and schools.

The committee should be careful to ensure that the documents are guided by, and aligned with, the existing visions and programs of their government at the national, state, and district levels. These documents should describe the vision, mission statements, goals and objectives of a school district. The technology plan should have its own vision, mission, objectives and goals that are specific to the plan but that support the larger district and state goals, especially as it relates to teaching, learning, and education management. The conclusion of a school district technology plan will be completed when accepted by the stakeholders. The secretariat of the

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committee will bear the responsibility of drafting the documents and keeping them safe for future reference.

The committee should consciously work to ensure that the documents are coherent and outline the same vision and programs (Kaufmann, 1992). Key documents should be coherent and provide a comprehensive vision, as well as plans to achieve it. A number of researchers suggest that the technology planning documents should consist of needs assessment, vision, mission statement, objectives. (Farrel & Isaacs, 2007; Kaufmann, 1992; Lumley & Bailey, 1993; Picciano, 2006). This phase also suggests pertinent issues that should be considered when developing a technology plan.

Vision. The committee should facilitate the negotiation of a common vision that is acceptable to most stakeholders (Baule, 1993; Kaufmann, 1992; Lumley & Bailey, 1993). The vision should capture and describe how the committee and the stakeholders view their school district's use of technology in education in the future (Kaufmann, 1992). The vision should also describe a clear picture based on the values and beliefs on the use of technology in education in a district (Kaufman, 1992). Overall, the negotiated vision should portray a comprehensive future where technology is used to support education. For a sample vision, see Appendix I.

Mission Statement. The mission should be a statement that describes how the planner wants to get to achieving the vision (Baule, 1993). In the school district context, a mission statement should indicate the measure that indicate how the committee will know if they have achieved it (Kaufmann, 1992).). The mission statement may also be a motto that captures a school district's vision of educational technology (Lumley & Bailey, 1993). More importantly, a

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mission statement should be able to motivate stakeholders on what they believe to be the importance of the use of technology in education. For a sample mission, see Appendix I.

Objectives. In the book, *Preparing Instructional Objectives* (1965), Mager presented a systematic approach to developing instructional objectives. According to Mager (1975), an objective should indicate how the committee has arrived at achieving the plan. The objective should state what performance is to be demonstrated, who or what will demonstrate that performance, under what conditions the performance will be observed, and what criteria will be used to determine success. Mager (1975) suggested an ABCD Form for developing objectives. The ABCD stands for audience, behavior, conditions and data-criteria (Kaufman, 1992; Mager, 1975).

The A in Magers' (1975) ABCD Form stands for the audience, as well as the target or recipient of the program. With regard to technology planning, the primary audiences are students, teachers, administrators, and other education staff at the school, district, state and national level. The B stands for behavior performance, and the end or result to be demonstrated. The technology plan should state clearly what performance will result in the use of technology in schools. The example of performance would be that teachers and students have access to technology and sufficient opportunity to use it to conduct research and other learning activities.

The C stands for conditions of behavior or accomplishments to be observed. With regard to planning, the committee should state the observable behavior that teachers and students will demonstrate the ability to use technology to access, evaluate information and communicate in the learning activities. The D stands for data-criteria, which refers to the fact that an objective should

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be measurable by stating the number of people affected by program and the time it will take to accomplish it (Kaufman, 1992).

Pertinent issues to consider in technology planning in DCs. Some of the issues raised in this phase may have been already addressed at the national and state levels, while others may need to be dealt with at district levels. The analysis of relevant documents in Phase 2, would give a clear picture of what has been achieved at the national and state levels. Where issues are addressed at the national and state levels, the committee may still need to consider the implications of how they could be implemented in their districts. In considering these issues, careful attention should be paid to how technology would enhance teaching and learning. The focus should not be on technology for its own sake.

Where necessary, suggestions for what a committee may do with regard to some issues may be covered in documents mentioned in Appendix G. The pertinent issues to consider in technology planning in DCs are Professional Development (Baule, 1993; Hawkins, 2002), Curriculum Integration (Anderson, 1999; Lumley & Bailey, 1993); Administrative Applications (Picciano, 2006); Special Education (Lumley & Bailey, 1993); Development of an Educational Content (Farrel & Isaacs, 2007), Indigenous Languages (Munyua, 2000), Community Coordination (South African White Paper on e-Education, 2004); Compliance with national technology norms and standards (South African White Paper on e-Education, 2004); Refurbishment and Disposal of used Technology (Bakia, 2005); Maintenance and Replacement of Equipment (Brody, 1995); Safety and Security (Picciano, 2006); Sustainability (Hosman & Fife, 2008; Owston, 2006; Rogers, 2005); Budget (Brody, 1995; Picciano, 2006); Funding Sources (Lumley & Bailey, 1993); Formalizing partnerships (Evoh, 2006; Olatokun, 2006); Data

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communication and the Internet (Cronje, 2008; Lumley & Bailey, 1993; Picciano, 2006); Bandwidth, Connectivity and Network Security (Cronje, 2006; Picciano, 2006); Software Evaluation (Lumley & Bailey, 2006; Picciano, 2006); and Dissemination of Good Practice of Innovations (Rogers, 1995).

Professional Development. The effective use of technology in schools will largely depend on the knowledge and skills of key role players that include districts officials, school principals, administrators, teachers, learners, librarians, parental representatives, and other community leaders (Baule, 1993; Lumley & Bailey, 1993; Picciano, 2006). It is therefore important that a committee develop a technology plan that includes a program to build the capacity of staff members. The program may suggest ways to establish a professional community that emphasize aspects such as peer support, mentoring, and coaching. The program should also focus on building the basic technology skills and pedagogical skills particularly for teachers and other staff members.

A professional development program should be based on these four components: addressing the needs of employees, provision of incentives, implementation, and evaluation (Picciano, 2006). The planning committee should address a professional program with the understanding that it may take time to bear fruit amongst staff members and it requires a long-term commitment.

Rogers (1995) suggested a model of innovation for individuals or organizations. His innovativeness model is measured across five categories, namely; laggards, late majority, early majority, early adopters, and innovators. A staff development program should consider these

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categories in building the knowledge and skills of staff members' involved in the applications of technology in a school district.

Curriculum Integration. The critical element of applying technology in schools is integrating it into the curriculum in order to enhance the teaching and learning practices (Baule, 1993; Lumley & Bailey, 1993; Picciano, 2006). Using technology in teaching and learning means that teachers need to have sufficient knowledge of the instructional theories and learning processes. The teachers should also have the basic understanding and knowledge about using technology effectively according to the different subjects (South African White Paper on e-Education, 2004). It is therefore important that curriculum integration should be prioritized in the staff development programs in technology plan.

Strategies to improve instructional practices using technology can be accomplished if they are systemically planned and implemented over long time (Picciano, 2006). To implement effective instructional strategies requires the involvement and commitment of teachers and school principals. The strategy may include a forum for the exchange of ideas and collaboration between those who are knowledgeable and those who need further assistance. A technology plan should establish priorities to train teachers at different levels in the applications of technology in schools.

Technology integration may be based on the five stages of innovation in the DoI theory, which are entry, adoption, adaptation, appropriation, and invention (Rogers, 1995). Sandholtz, Ringstaff and Dwyer (1997) apply these five stages of innovation in the Apple Classroom of Tomorrow Project on how teachers integrate technology into the curriculum. The training of teachers to integrate technology may be based on these five stages.

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Administrative Applications. Using technology for administrative purposes is very important to ensure that schools have reliable data and information that is managed efficiently and is secured (Baule, 1993; Picciano, 2006). A district may select and recommend a number of data management systems for their own administration and for schools (Picciano, 2006). The recommended data management system should be generic and have critical aspects such as storage, and retrieval processes and procedures, collection, analysis, and enable the creation of reports (Picciano, 2006). In addition, data management systems should allow schools to collect different types of information such as students' names, addresses, parents' contact details and much more.

Special Education. The technology plan should outline the tools and mechanisms that would alleviate hindrances that people with disabilities experience (Fennema-Jansen, Edyburn, Smith, Wilson & Binion, 2003; Picciano, 2006). A planning committee should consider a variety of technology input and output devices to assist teachers and students with disabilities. The technology plan should be based on the premise that all children can learn and will take advantage of opportunities and programs that meet their learning needs (Lumley & Bailey, 1993).

Creating Mechanisms to access Online Content. At the national level, the critical challenge for ministries of education is to facilitate the access and distribution of online content that supports the curriculum (Farrel & Isaacs, 2007, p. 34). A committee should ensure that a variety of educational content is available in hard copies and electronic forms to support teaching and learning activities. The committee may identify and recommend online content resources that are suited for their national curriculum that teachers and learners can use. School districts

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may work with entities such as libraries, science centers, and museums in order to increase access to digitized materials to schools.

The committee should identify and recommend initiatives where online content that support school-based curriculum is available in their own languages (Gyamfi, 2005; Ihmeideh, 2009; Paterson, 2007; Warschauer, 2004). The development of open educational resources (OERs) projects is another avenue that the committee may investigate to establish if online the online content is available in their indigenous languages (Thakrar, Zinn & Wolfenden, 2009). The details of the activities are outlined in Appendix J.

Indigenous Languages. Several researchers observe that most of the available online content is in the English language, and as a result it excludes the majority of the citizens of DCs, who use many diverse languages (Arias & Clark, 2006; Habib, 2003; Munyua, 2000; Nour, 2006; Swart, 2006). The committee should seek to collaborate in initiatives and opportunities that aim to produce local content in indigenous languages. Such programs may also translate existing content into indigenous languages and make efforts to adapt the online content to local curriculum and contexts (Chitiyo & Harmon, 2009; Mahlck & Chapman, 2004).

Community Coordination. The committee should consider ways to incorporate the creation of opportunities to cater to groups in the non-formal and informal sectors (Lumley & Bailey, 1993; South African White Paper on e-Education, 2004). The committee should consider how a district can facilitate the involvement of community organizations that represent the youth, illiterate individuals, small and medium enterprises, women, adult learners and populations located in rural areas.

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The involvement of consultants is another critical group that needs to be considered. Staff members from the neighboring districts that are advanced in educational technology may serve as inexpensive consultants. Such consultants may help the planning committee to avoid mistakes made in other districts (Baule, 1997).

The committee also needs to consider the legal and financial implications of collaboration between schools and communities (South African White Paper on e-Education, 2004). In addition, the committee may need to consider how schools could work in partnerships with the other institutions such as community libraries, museums, and academic institutions.

Compliance with National Technology Norms and Standards. The committee should ensure that their plan is guided by and is in compliance with the national norms and standards that cover areas related to technology such as: hardware, software, buildings facilities, educational content, safety and security, and technology networks (South African White Paper on e-Education, 2004). Adhering to norms and standards will ensure that a district technology plan relates to and is compatible with other ICT initiatives in their country.

Refurbishment and Disposal of used Technology. There are a myriad of technology projects in DCs that facilitate the donation of software and used computers from the developed countries (Bakia, 2005; Jhurree, 2005; Monitoring and evaluation report: NEPAD e-Schools Demo Project, 2007). The committee should suggest a systemic strategy that guides the minimum standards before accepting used equipment. The process of refurbishing used technology should include how to keeping used parts that may be reused on other equipment.

Another important aspect linked to refurbishment of used equipment is the disposal of obsolete equipment (Williams, Kahhat, Allenby, Kavazanjian, Kim, & Xu, 2008). A lack of a

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systemic approach to disposing obsolete equipment might lead to a number of challenges related to the environmental pollution and health issues. The environmental pollutions include toxic levels from technology such as mercury, lead, cadmium, arsenic, and beryllium (Williams, et al., 2008). The other challenge with regard to disposal of obsolete equipment relates to inability by DCs to implement acceptable practices to remove data (Williams, et al., 2008). Data that is not removed from old equipment means that it can still be accessed once the equipment is disposed of. The solution is that a disposal plan should include the normal procedure to remove data before obsolete equipment are disposed of.

Maintenance and Replacement of Equipment. The committee should consider how computers will be maintained and replaced over time (Brody, 1995). Such a plan should include upgrades, maintenance, and renewal of equipment based on a clear budget that accommodates the recurring costs.

Safety and Security. The committee should consider how to curb the theft and vandalism of equipment in schools (Picciano, 2006). Giving local community members access to technology after hours may increase their awareness of the potential of technology. The committee should seek the involvement of community members in the safety of school facilities. Community members should be invited when schools are determining the safety solutions on school facilities in order to encourage their involvement and commitment.

The committee should seriously consider building mechanisms for schools' information security. The committee may suggest minimum measures such as firewalls and virus protection software that schools should adhere to in order to protect the security of district confidential data and their users (Picciano, 2006). The measures should address policies of the Internet safety and

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appropriate use of technology in schools. The key to the security of information is to make users aware of the dangers lurking when one is using the Internet.

Sustainability. Sustainability is defined as the extent to which programs continue to benefit the beneficiaries beyond their life span (Honadle & Vansant, 1985; Paterson, 2007; Owston, 2006; Rogers, 2003). There are obstacles to the sustainability of programs in DCs that include recurrent costs, poor institutionalization, and non-involvement of local ownership.

A number of researchers suggested that sustainability should be considered at the initial planning processes and also when a project is about to end (Munyua, 2000; Ofori-Ansa, 1983; Tedre, Bangu & Nyagava, 2009). Other researchers suggest that the cost of software, hardware, bandwidth, and staff training should get sufficient attention from the planners, so that they may not later become major barrier to sustainability of programs (Bosch, 2004; Cisler, 2005; Edmundson, 2007; Munyua, 2000; Paterson, 2007).

To ensure the sustainability of technology programs in DCs, the establishment of public-private partnerships is regarded as another avenue to access resources such as funding and skills (Hosman & Fife, 2008; Njanji, Kwemain, & Taku, 2010). Partnership can be established with external organizations such as foundations, development agencies, non-governmental organizations, and other international bodies such as the UN Bodies. More importantly, the long-term solution for sustainability of technology programs is to integrate the ICT expenditure within normal government budget processes (SAIDE, 2006).

Budget. The committee should develop a technology budget based on the normal procedure and processes within their school district systems (Brody, 1995; Lumley & Bailey, 1993; Picciano, 2006). In consultation with other entities within a school district, the planning

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should prioritize according to their needs and available resources (Picciano, 2006). The committee should ensure that the implementation costs are accurately estimated. The priorities may include aspects such as centralizing or decentralizing technology facilities, hiring of a consultant, buying in bulk, hardware, software, and consideration of free resources.

Lumley and Bailey (1993) suggested that the budgeting should be conducted in these areas: capital cost, developmental costs, operating costs, expanding costs, technical support, and staff development costs. The capital costs include the initial acquisition of equipment and facilities. Development costs are start-up costs that include acquisitions of hardware and software, staffing, office and furniture. Operating costs are costs that deal with maintenance and repair, utilities, expendables, and security. The expanding costs deals with future expansion of facilities, equipment and programs. The staff development costs address the training costs, and consultants' wages (Lumley & Bailey, 1993).

A special budget should be considered to make technology integration a reality in schools. To make technology integration succeed in school, another part of the budget should be allocated to train principals and their leadership teams to provide effective leadership in schools (Lumley & Bailey, 1993).

Funding Sources. Once a district technology plan is complete and accepted by key relevant stakeholders, an effort should be made to examine the other available sources of funding (Lumley & Bailey, 1993; Picciano, 2006). According to Picciano (2006), there are a number of major sources of funding for school districts that include state and school district budgets, other governmental entities, and donations from private sector and international organizations.

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School district or state budgets are the primary sources of funds for implementing technology in schools. Within state and school district budgets, two aspects should be established: one for administrative support and the other for instructional purposes. The committee should explore ways for accessing other funds from other entities within their governments. Such entities may be the national departments and other governmental entities that have initiatives that may support ICT in education.

Donations are other potential sources of funding to support technology implementation in school districts. Foundations, donors, grant agencies, individuals, parent-teacher organizations, small local businesses and international corporations are unique sources of funding that the school district should aggressively explore in order to access resources for technology programs (Archibugi & Pietrobelli, 2003; Picciano, 2006). The communities may also play some roles in raising funds for maintenance.

Establishing Partnerships. There are studies that suggest that the establishment of partnerships is a viable option to access resources that include funding, goods and services of ICT, and training programs (Evoh, 2006; Olatokun, 2006; Roy, 2005). Partnerships may be established between school districts and other organizations. The committee should establish generic terms and conditions for establishing a partnership for their schools (Bell & Juma, 2008; Bruno et al, 2004). For example, a memorandum of understanding is identified as another option of formalizing a partnership with other organizations (Beaudoin, 2009; Cardoso, 2008).

Data Communication and the Internet. Data communication systems continue to advance in size and sophistication (Cronje, 2008; Lumley & Bailey, 1993; Picciano, 2006). Such systems enable organizations to communicate with each other quickly and efficiently and be able

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to share data. Data communication systems enable organizations to build local area networks (LAN) and wide area networks (WAN) (Lumley & Bailey, 1993). In most cases, LANs may be used within organizations such as school, and WANs may be utilized by larger entities such as school districts. With regard to school districts, data communication systems may enable communication and sharing of information with libraries, museums, and administrative resources (Picciano, 2006). School districts WAN may be used to access other networks way beyond their boundaries and countries.

Within the education sector, the Internet offers an opportunity to create information and increases access to information literacy and research resources (Cronje, 2008; Picciano, 2006). In addition, the Internet enables users to communicate through the electronic mail. For communication purposes, a school district may create different mailing lists, online discussions, and electronic bulletins that different stakeholders can use to share information and exchange ideas. School districts may develop their own website that serves as conduit of information about all educational issues (Picciano, 2006).

The committee should consider negotiating the bulk access of connectivity solutions with different ICT service providers for schools in order to access affordable bandwidth and connectivity (Cronje, 2006; Picciano, 2006). Accessing broadband connectivity will enable schools to connect different online resources through the Internet. The planning committee should also focus on dealing with the network security in order to protect data of their schools.

Software Evaluation. The committee should include a process of evaluating and selecting the appropriate software to determine whether it meets the needs of their beneficiaries (Lumley & Bailey, 2006; Picciano, 2006). The other important criteria should be how software

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identified fits the needs for teaching, learning, and school management. Overall, the criteria for software evaluation may include efficiency, ease of use, documentation of hardware requirements, suppliers and cost (Lumley and Bailey, 2006; Picciano, 2006).

Dissemination of Good Practice of Innovations. The committee should develop mechanisms to identify successful cases and find effective ways to disseminate the adoption of a good practice a school district (Pelgrum & Law, 2003; Rogers, 1995). In order to promote successful innovations within different institutions, technology coordinators should be involved in the learning process and be careful to consider conditions that will foster success.

Establishment of a Technology Structure within a School District Office. The success of the implementation of the technology plan will depend on the structure within school districts (Brody, 1995). Establishing the human resources infrastructure will ensure that the potential elements within a technology plan are achieved (Brody, 1995). Where such a structure exists, the planning committee must examine if it is productive. Where such a structure does not exist, the committee should recommend the creation of various technology coordinator positions in order to implement the technology plan. See more details in Appendix K.

The Elements of a School District Technology Plan. A school district technology plan process should result in a planning document with key elements and related issues (National center for technology planning, 2001). The elements and related issues may need to be presented in the order that they generally appear in most documents outlining technology plans. A school district technology document may need to consider the elements suggested by the National Center for Technology planning (National center for technology planning, 2001), which are in Appendix L.

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Phase 3: Implementation Plan

The implementation phase is identified as an important step in the development of a school district technology plan (Baule, 1993; Kaufman, 1992). The phase has two aspects; the development of the Technology Plans and its implementation. Of the three phases of technology planning, the implementation stage takes a lengthy period of time (Rogers, 2005). More importantly, the implementation plan should be part of the key planning documents outlined in Phase 2.

The development of the Technology Plans should have aspects that are linked and will offer practical steps for coherent and systemic planning (Kaufman, 1992). The development of the implementation plan should consist of the objectives, strategy to achieve the objective, responsible structure, time-frame, and cost implications. A sample of the implementation plan is shown in Appendix M.

As the last step, the committee should present the final implementation plan document to stakeholders for purposes of ownership and accountability. For the same reasons, the implementation plan should also be included in the consultation and communication strategies. According to Rogers (2005), problems of implementation are more complex when it is the organization involved and not the individuals. It is therefore important to develop monitoring and evaluation strategies to address challenges that emerge during implementation, which is the rationale behind the post planning activities discussed below.

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Phase 4: Post planning activities

The committee should draft long-term strategies to deal with possible implementation challenges. These strategies should be incorporated in the monitoring and evaluation plan, which is a critical component of technology planning.

The committee should describe how the implementation, resources and impact of their plan will be monitored and evaluated based on the vision, mission, objectives and the implementation plan. The monitoring and evaluation process may provide information that enhances the revision of a technology plan. Effective implementation of the monitoring and evaluation strategies will ensure that the objectives of the technology plan are achieved and increase the chances of benefiting teachers and students in schools (Kozma, 2008).

Monitoring. Monitoring is the process of keeping track of program activities to ensure their fidelity to the goals and objectives of the plan. Monitoring is another important aspect that the planning committee should tackle (Pelgrum & Law, 2003). Given the huge investment of technology and expectations associated with educational technology, there should be a clear strategy to manage the implementation plan. The monitoring process should provide data on specific implementation challenges and successes. The committee should develop a long-term monitoring strategy that incorporates revision of technology plans over time (Lumley & Bailey, 1993).

Evaluation. Evaluation is a process of gathering and analyzing data about the technology plan in order to provide feedback about its implementation successes and challenges. Evaluation may be conducted by district officials who are implementing the plan or external agents such as independent experts. The evaluation may be conducted during or after the implementation. The

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committee should develop a long-term evaluation strategy designed to inform future decisions about the technology plan (Lumley & Bailey, 1993). Some of the management decisions may result in revision of the plan (Buale, 1993). Owing to the fact that technology is changing at the rapid rate, the committee should continuously review and revise activities of the technology plan.

Ideally, the committee may facilitate an annual meeting where stakeholders are invited to review or revise the technology plan. Revisions of the plan should be approved by key stakeholders and be shared through available channels of communication.

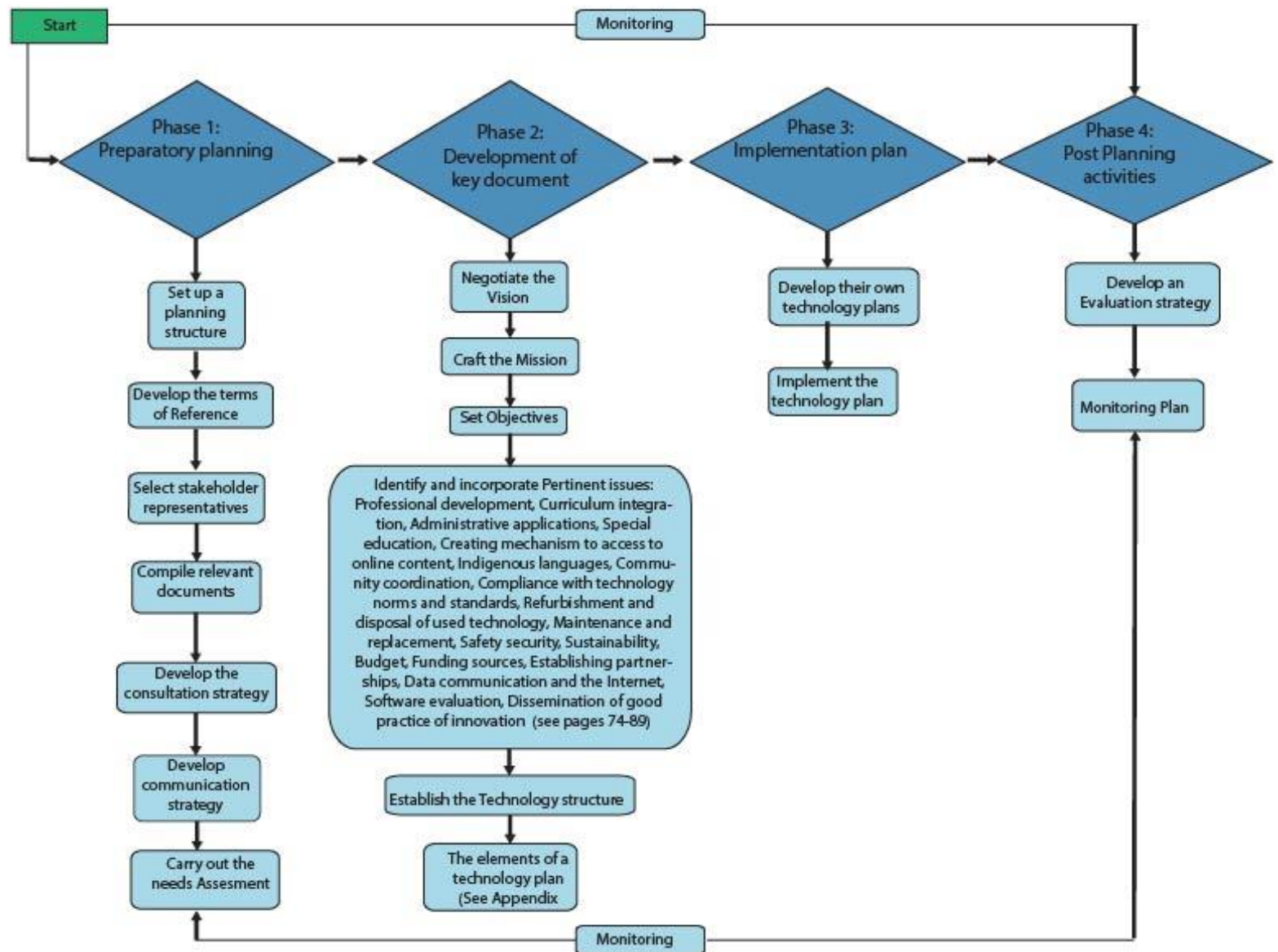
This evaluation strategy should establish time frames to determine if the objectives of the plan are met (Lumley & Bailey, 1993). The evaluation strategy should stipulate indicators which will be used to establish if a school district plan meets the vision, mission and objectives.

In addition, the evaluation process should shed some light on the performance of the technology structure that implement the technology plan (Love, 2004). The success of the implementation depends on the knowledge and skills of its employees. More importantly, the evaluation should also indicate if the resources, policies, and budget are enabling the structure to be successful.

The monitoring and evaluation processes discussed above should be participatory where stakeholders are invited from Phase 1 to Phase 4. See a sample of a monitoring and evaluation plan in Appendix N

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Figure 1. Graph Illustrating the Planning Process



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Chapter 5: Results, Data Analysis and Revision

This chapter reports on the feedback from the expert reviewers on the proposed technology planning Framework. The chapter includes a description of the participants and the feedback on the Framework from the selected expert reviewers. The revision process based on the feedback and comments from the expert reviewers is also included.

Participants

Two types of expert reviewers were selected to evaluate the Framework: one type was for the DoI theory and the other for the potential user of the Framework. Purposeful sampling was used to select participants for the study. This is a process whereby the researcher selects a sample based on experience or knowledge of the group to be sampled (Fraenkel & Wallen, 2006; Russ-Eft & Preskill, 2001).

DoI Theory Expert Reviewers. Two DoI theory expert reviewers were selected to evaluate if the proposed Framework conformed to the principles of the theory. The expert reviewers selected were male and female. The male lived in the USA and has sufficient experience in technology planning for schools and knowledge in the application of the DoI theory. The other expert reviewer was a female who was a professor at a college in Malawi. She applied the DoI theory in her graduate studies. They both have between five to ten years experiences after studying the principles and application of the DoI theory. Their ages range between 35 and 55 years.

Technology Planning Expert Reviewers. Ten technology planning expert reviewers were selected from different African countries to evaluate the Framework as potential users. The technology planning expert reviewers were professionals from African countries who have knowledge and practical experience in the application of technology in schools. Seven of the participants were males and were three females. The experts came from different backgrounds; some

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from government, private sector, academic institutions and inter-governmental organizations. These expert reviewers were to evaluate if the proposed Framework was feasible and was suitable for the contexts and conditions of DCs. Collectively, these expert reviewers have been involved in technology planning for between ten to fifteen years. The average ages range between 35 to 55.

The potential user expert reviewers were divided into two groups: group 1 and group 2. Group 1 was to evaluate phases 1, 3, and 4 of the Framework that dealt with the pre-planning activities, implementation, and monitoring and evaluation. Group 2 was selected to evaluate phase 2 of the Framework. Phase 2 addressed the issue of developing key planning documents and pertinent issues relevant for DCs.

Both the theory and technology planning expert reviewers were requested to evaluate the proposed Framework based on different evaluation rubrics. All twelve expert reviewers were asked that, if possible, they could evaluate the whole Framework in addition to their assigned sections.

Evaluation Rubrics. Two evaluation rubrics were developed to guide both the DoI theory and technology planning expert reviewers to evaluate the Framework. Through e-mail, the Framework and the evaluation rubrics were sent out to all expert reviewers. Telephonic follow ups were made with each expert reviewer to ensure that they acknowledge receipt of the e-mailed documents and to answer any questions. The overall length of the pages of the Framework to be evaluated by each experts reviewer was 15, excluding appendices. For both evaluation rubrics see Appendices O and Q.

Results

Feedback from the DoI Expert Reviewers.

Both theory expert reviewers sent back their feedback based on the evaluation rubric. The reviewers commended the Framework because it aimed at applying best practice within the

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context of a developing country. One expert reviewer indicated that the Framework included some aspects of the DoI theory. Another expert reviewer indicated that there were certainly social systems identified in the plan. Both indicated that the Framework dealt with technology as an innovation because technology was ever-changing hence at any point in time one would have to deal with issues of novelty. One expert expressed a view that the Framework took care of issues of communication by suggesting development of structures at different levels.

Weaknesses. One expert reviewer indicated that the Framework did embody other existing technology planning frameworks. In his view, the researcher would benefit from knowledge and expertise from existing technology frameworks and that monitoring its implementation would best be suited to the application of DoI theory.

Suggestions not incorporated and the reasons why. The first suggestion made was that the DoI theory was not necessary for the development of the plan. In his view, it was however relevant for monitoring and innovation. No action was taken because the DoI theory should inform all stages of planning and implementation. Monitoring and evaluation was an integral part of the whole process.

The second suggestion was made that the Framework itself was general in nature. The expert reviewer explained that it could have been better if one specific case (e.g., a district) was selected on which to either apply or theorize implementation of the Framework. The reason why this suggestion was not incorporated was because the point raised will be covered during the pilot phase of the Framework.

The third suggestion was that the Framework should provide any information that might help to determine how long it will take to reach critical mass in order to have a sense of return on

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my investment. The reason why this suggestion was not incorporated was because such information can only emerge during the implementation phase and not the planning phase of the Framework. In addition, the return on investment may emerge during the monitoring and evaluation processes. The comments from each DoI expert reviewers are covered in Appendix P.

Feedback from the Technology Planning Expert Reviewers

Out of 10 ten technology planning expert reviewers, only five sent back their feedback. In Group 1, four experts out of five reviewers responded and forwarded their feedback based on the evaluation rubric.

Group 1: Two expert reviewers indicated that the Framework was applicable in developing countries' contexts and conditions. In their view, the Framework was applicable because it addressed the broad challenges that schools face. Others indicated the Framework was valuable because it presented important areas such as professional development, refurbished computers, and technology integration to improve teaching and learning. Two expert reviewers disagreed that the Framework could be applicable in DC's contexts and conditions. The other expert reviewer argued that the Framework was not applicable because it did not consider issues of cultural attributes of society and adult literacy.

Three expert reviewers agreed that the Framework met their expectations the reason being that it may work in the contexts of their countries. The other reason given was that it covered the core ICTs components such as policy, compliance, and innovation. One of the expert reviewers suggested that the Framework should include more information about technology integration and research, highlighting the role of academic institutions. Another expert reviewer stated that the Framework should describe the involvement of respected politicians as champions

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of the technology initiatives in order to give them a high profile within government and other stakeholders.

Three expert reviewers agreed that the steps in the Framework were presented in the right order. Their main reason was that the Framework included needs assessment, emphasized consultative approach, and capacity building of teachers as important part. One expert reviewer indicated that there was not a right order because contexts and conditions were different in DCs. He further argued that the Framework should have indicated more specific ways in which ICTs can be used to support curriculum development and administration of schools.

Three expert reviewers indicated that the Framework can be useable, practical, and cost effective. The reason given was that it provides a step-by-step guide on how district officials could modify it to suit their specific situations. One expert reviewer felt that the Framework was not cost effective because it did not provide cost models that could be utilized to achieve sustainability of technology programs. In his view, the stakeholders would be interested in getting the cost of models to be utilized in the implementation of technology programs.

Expert reviewers were also asked to give general thoughts whether the features of the Framework would be practical in the contexts and conditions of a school district in a developing country. One expert reviewer suggested that the Framework should not be generalized to all DCs. He argued that it might have been better to design a plan focused on one country as an example giving the specific socio-economic and political conditions.

Group 2: Only one expert reviewer out of the five responded and forwarded his feedback based on the evaluation rubric. He commended the researcher for developing a Framework based on a sound theoretical basis. The expert reviewer indicated that the proposed Framework was

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feasible in DCs. He suggested that the Framework should warn potential users against rhetoric discourse that argues that the application of ICT will automatically result in efficiency and improved educational outcomes.

The expert reviewer also indicated that the Framework could be applicable in a school district in a DC's contexts and conditions. In his view, the Framework offered a practical approach to encounter the rhetoric of educational technology campaigns and the actual use of technology to support teaching and learning in the classroom. In response to the question as to whether the Framework met expectations, the expert reviewer argued that serious considerations should be given to the fact that not all DCs are the same. The expert reviewer argued that there was no best way to develop a framework. He suggested that the best Framework would be the one that is efficient and effective. The expert reviewer further added that it was not important for the Framework to follow a specific order.

In response to the question as to whether the Framework is useable, practical and cost effective, the expert reviewer agreed because it could be modified to suit specific situations. The comments from expert reviewers were also covered in Appendix W.

Suggestions not incorporated and the reasons why. Suggestions were made which were not incorporated for a number of reasons. The first suggestion made was that the Framework should mention factors that mitigated against successful implementation. The suggestion was not incorporated because the expert reviewer did not mention these mitigation factors.

The second suggestion made was that the Framework should take cognizance of cultural attributes of society especially with regard to the safety and security, communal buy-in, and

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provision of equipment security. This suggestion was not incorporated because it was already covered in phase 2 of the Framework.

The third suggestion stated that the Framework should build on sustainable models similar to the adoption of mobile money in Kenya. The suggestion was not incorporated because the following factors affecting sustainability have been considered in the Framework: funds, capacity building of human resources, integration of the Framework school districts plans, and ongoing technical support. The other reason was that the expert reviewer did not provide more information about sustainability model used in the Kenyan project.

The fourth suggestion was that the research should study at least one area in order to get abreast with the contextual characteristics so that the propose Framework could be based on a specific area. The suggestion was also not taken because the Framework was developed for different contexts and conditions in DCs and can be modified. The comments from expert reviewers were covered in Appendix R.

Revisions

There were minor revisions recommended that would not impact the development of the Framework. Revisions made are those points raised by expert reviewers that were deemed most important for improving the Framework. Other responses received from expert reviewers did not necessarily warrant significant changes be made to the final product. Below is the summary of the revisions made:

- The Framework be implemented in a school district to implement the framework before deploying to others district. The sentence explaining that the Framework is the innovation was included in paragraph 2 under the heading “Theoretical framework: Rogers’ Diffusion of Innovations Theory” in chapter 3.

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- Moving “Needs Assessment” component from phase 2 to phase 1 and also do the same in Figure 1 in page 29. The reason suggested by one expert is that the “Needs Assessment” will guide the user to determine the type of documents needed in phase 2.
- Rephrasing the information in under the heading “Development of an educational content” from creating content to using online content. The information was rewritten to encourage teachers to use available online content to create it. According to another expert reviewer the creation of content may be more complex for teachers in schools because they have other myriad challenges.
- Putting the heading “Select Stakeholders Representatives” before “Compile Relevant Documents” in phase 1 and in Figure 1 in page 29. The reason suggested by another expert reviewer is that some stakeholders’ representatives might have access to or bring some of the relevant documents.

Summary

The results from this study were expected to provide the feedback on the proposed technology planning Framework that could guide school districts to develop a plan. The feedback received from expert reviewers was valuable and informative in order to improve the Framework. The final document is a technology planning Framework in Chapter 4 designed to guide school districts to develop their own comprehensive technology plans.

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Chapter 6: Discussion

This chapter considers the potential contributions of this study to the field of instructional design and technology and to the area of educational technology planning for schools in DCs. Factors for considerations are suggested that may be used by the future researchers who may need to modify the proposed Framework. Limitations of the study are outlined. In the end, recommendations for future research based on the findings of this study are made.

Potential Contribution of the Study

The study outlines the development of a procedural guide to develop technology plan for school districts in DCs. The study used the principles of developmental research where a description, analysis and evaluation are applied to a final product (Richey, Klein, & Nelson, 2004). The final product is a framework that suggests a process and elements to be considered in order to develop a school district technology plan. Therefore, this study contributes to the body of literature and debate about the application of a developmental research.

Another contribution of this study is the application of DoI theory. The study aligned the principles of the theory with the elements of the technology planning processes. In other cases before the DoI theory was used for introduction of new equipment, technology integration, and in many other aspects (Rogers, 2005). The researcher is not aware of any study that proposes a technology planning Framework based on the DoI theory to guide school districts in DCs to develop their technology plans.

The study also contributes to the body of knowledge of the field of instructional design and technology by contributing to one of the five domains of Association for

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Educational Communications and Technology (Seels & Richey, 1994). Specifically, the study contributes to the management domain that deals with the management of resources, facilities, projects, and delivery systems (Seels & Richey, 1994). The Framework will add more information about processes of planning and implementing technology in schools districts in DCs.

One of the strengths of this study was its focus on the creation of a system, starting with inputs, outputs, and feedback. The Framework will facilitate the technology planning process. Ideally, potential users of the Framework may need to adopt it to fit their conditions and situations. In that sense, the Framework is descriptive rather than prescriptive. It is the process rather than the product which is the greatest value of the Framework.

The study has implications to educational technology in developing countries, in general, and the implementation of technology planning, in particular. The study provides an opportunity for governments in developing countries in consultation with other organizations to consider systemic technology planning approach for schools. Engagement on technology planning will hopefully encourage the discussions on how technology can be used to enhance the teaching and learning in schools.

Literature indicated that the prevalence of technology in schools was focused on pilot programs and policy development (Farrel & Isaacs, 2007; Trucano, 2009). In addition literature also indicated that there was lack of proper planning at state and districts levels for schools (Kumar & Best, 2006). The proposed Framework was developed based on the established DoI theory and the body of literature that emanates from contexts and

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conditions in developing countries. The significant contribution of this study may be that it focuses the debates and discussions about technology planning in developing countries.

More specifically, this study proposes a new approach to develop plans by other government agencies other than the external organizations.

More importantly, this study also provides some innovative approach that offers a possible option to technology planners in DCs. The proposed Framework provides generic guidance to educational technology planners to review and modify it for their own purposes. The proposed Framework suggests that different stakeholders should participate in the planning processes. The Framework provides the steps and processes of technology planning that planners can use not only for their school districts, but may modify it in order to develop their technology plans for their national and state departments.

Literature indicates that most technology planning and implementation was influenced by external organizations (Warschauer, 2003; World Bank, 2006). This study empowers governments in DCs to design their own technology plans and determine their own agenda. The study provides another option for technology planning approach that governments in DCs may need to consider.

Another critical point raised in the literature review is the exclusion of some stakeholders in the technology planning processes (Cisles, 2005; Tinia, 2003). This study extends the body of literature because it advocates for the inclusion and participation of different stakeholders. To ensure participation, the study suggests that the Planning Committee should develop a consultation plan. Such a plan may ensure that communication and engagement with stakeholders is effective and encourages them to take

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ownership of the technology plan.

This research may be useful to a broad spectrum of experts involved in educational technology planning from local, state and national level. Such people include the ministers of education, officials from educational structures such as state education departments, academic scholars, external organizations and development agencies involved in ICT in education.

In my reflection, I realized that the development of a technology planning framework should embrace the principles of systemic theory. While I did not mention the systemic theory in this study, its principles are embraced in the process of developing the Framework. To facilitate the development of the Framework, one needs to consider a number of components. Such components include the issues emerging from the literature, application of the theory, assessment of other frameworks, and engagement with the experts. The study was complex because it required systemic thinking in aligning different parts, consistently maintaining interaction between the parts in order for the Framework to function effectively.

Limitations of the Study

The proposed Framework was developed as a generic guidance specifically for school districts in developing countries. All phases in the Framework are geared to the conditions, contexts, and processes of DCs. Expert with experience in technology planning were selected from different parts of Africa to review the Framework. The limitation is that most experts in the evaluation were not involved in technology planning at school district level but only at the national and state levels. Therefore lack of experience at the school

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district level may hinder them in providing sound feedback.

The socio-economic conditions and political contexts are diverse among the DCs. Furthermore, there are other diversities within the different regions of DCs. As a result, the Framework may not sufficiently cover all diverse aspects and different components that exist between DCs and within countries.

The researcher proposes a framework but given the academic system and conditions, will not have the opportunity to implement in order to test its feasibility. Implementing the Framework will provide tangible and practical feedback that serve will the researcher to revise the initial proposed document.

Owing to lack of resources, the researcher liaised with the experts through electronic mail. It would be have more beneficial if the researcher had had the opportunity to conduct interviews with the experts.

The other important limitation was resources to accommodate common languages used in developing counties, which are: French, Spanish and Portuguese. Owing to lack of resources for translation and interpretation, the researcher could not participants from countries that use these languages.

Recommendations for Implementation

The researcher suggests that the policy makers consider piloting the proposed Framework in at least three school districts in their countries. The three school districts may be from rural, peri-urban and urban settings. Piloting the Framework may raise issues regarding the planning processes and implementation that technology planners may need to address before up scaling in the whole country.

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Both the external organizations and local entities involved in technology for schools should work in collaboration with the ministries of education during the pilot and replication phases of the Framework. In order to foster this collaboration, policy makers should encourage the formation of the school district planning committees that would implement the Framework at the school district levels. It is recommended that within a period of four years this Framework may need to be reviewed in the light of success factors and challenges emerging from the implementation.

Suggestions for Future Investigations

The researcher suggests that future researchers may need to evaluate the implementation of the proposed Framework in order to determine if it is feasibility in a school district located in a DC. Future researchers may need to work collaboratively with a school district to modify the Framework based on their conditions and contexts. Ideally, it might even be better if a researcher work collaboratively with a school district to implement a framework. Future researchers may also need to consider how a technology planning framework may be reviewed and improved in order to accommodate new technology devices.

And to understand if technology planning is effective in different contexts and conditions, a longitudinal study should be explored. Such a study may explore how a framework may be employed in different school districts in various DCs. This type of research, while it may be lengthy, expensive and challenging may help capture accurate data about technology planning in developing countries.

Future researchers may need to consider how to engage expert reviewers on their proposed frameworks through other means of communication other than the electronic mail.

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Conducting interviews might be a better option as compared to sending documents through e-mail. Ideally, the combination of the two might provide rich information and data.

Summary

This study emerged from the educational technology field aiming at improving technology planning in developing countries. The concept of technology planning is rather complex because it is affected by different aspects within and outside government. A proper technology planning process will require careful consideration of affected entities and participation of external organizations. However, a lot of technology planning in DCs is generally based on some frameworks that are not founded on a theoretical framework. The proposed Framework will encourage DCs to consider developing comprehensive technology plans for school districts.

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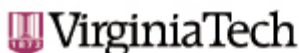
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Appendix A: IRB Protocol



Office of Research Compliance
 Institutional Review Board
 2000 Kraft Drive, Suite 2000 (0497)
 Blacksburg, VA 24060
 540/231-4606 Fax 540/231-0959
 email irb@vt.edu
 website <http://www.irb.vt.edu>

MEMORANDUM

DATE: November 16, 2012
TO: Barbara B Lockee, Lesiba Joseph Malapile
FROM: Virginia Tech Institutional Review Board (FWA00000572, expires May 31, 2014)
PROTOCOL TITLE: Development of a technology planning framework for school districts in developing countries
IRB NUMBER: 12-765

Effective November 16, 2012, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the New Application request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

<http://www.irb.vt.edu/pages/responsibilities.htm>

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: **Exempt, under 45 CFR 46.110 category(ies) 2**
 Protocol Approval Date: **November 16, 2012**
 Protocol Expiration Date: **N/A**
 Continuing Review Due Date*: **N/A**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

Invent the Future

FRAMEWORK FOR SCHOOL DISTRICTS IN DEVELOPING COUNTRIES

IRB Number 12-765

page 2 of 2

Virginia Tech Institutional Review Board

Date*	OSP Number	Sponsor	Grant Comparison Conducted?

* Date this proposal number was compared, assessed as not requiring comparison, or comparison information was revised.

If this IRB protocol is to cover any other grant proposals, please contact the IRB office (irbadmin@vt.edu) immediately.

FRAMEWORK FOR SCHOOL DISTRICTS IN DEVELOPING COUNTRIES

Appendix B: Invitation of Participants

Dear Sir/ Madam

November 10, 2012

Request for your participation as an evaluator of a technology planning framework for school districts in developing countries

I am conducting a research study in this topic “Technology planning framework for school districts in developing countries (DCs)”. In this study I propose a technology planning framework that will guide the planning, deployment, maintenance, and disposal of technology in school districts in DCs. To ensure that the proposed Framework is relevant for the conditions and contexts of DCs, I request you to participate as an expert reviewer to evaluate and comment on the proposed Framework. The following are the minimum qualifications that experts need to have:

- A degree in either education or in computer science or in ICT
- More than 10 years-experience in technology planning and implementation in schools in a developing country
- Worked for either government, private sector, academic institution or non-government organizations in ICT in education
- Be able to read and write in the English language

Each expert will be requested to:

- Answer an evaluation form that will be send out together with the proposed Framework
- Offer the overall comments and suggestions on the Framework document within a four weeks period. The document will be less than sixty pages long. The proposed Framework and an evaluation form will be sent to you through e-mail. Your answered evaluation form, comments and suggestions would be incorporated into document in order to improve it.

I will be happy to answer any questions you have about the study. You may contact me at (540) 505 8044 and e-mail address: sjose08@vt.edu or my faculty advisor, Professor Barbara Lockee, phone number, (540) 231-9193 and e-mail address: lockeebb@vt.edu if you have any related questions or problems. Thank you for your consideration.

.....
 Sandy Malapile
 PHD Canditate
 Virginia Tech, USA
 540 505 8044 (sjose08@vt.edu)

FRAMEWORK FOR SCHOOL DISTRICTS IN DEVELOPING COUNTRIES

Appendix C: IRB

Informed Consent for Participants in Research Projects Involving Human Subjects

Title of Project: Development of a Technology Planning Framework for schools districts in Developing Countries

Investigator: Sandy Malapile

I. Purpose of this Research/Project

The purpose of this study is to develop a technology planning framework for school districts in developing countries (DCs). The Framework will be used by government officials working in school districts to develop technology plans based on the contexts and conditions of the developing countries.

II. Procedures

The proposed Framework document will be send out to you through e-mail. You will then be asked to read and answer the questions in the evaluation rubrics. You are welcomed to make any additional comments and suggestions about the Framework. After answering the questions and making your comments, you will then be asked to e-mail the evaluation rubrics and your overall comments back to the researcher.

III. Risks

Apart from reading and commenting on the document for approximately 1:30 hours, there are minimal risks associated with the present study.

IV. Benefits

FRAMEWORK FOR SCHOOL DISTRICTS IN DEVELOPING COUNTRIES

No promises or guarantees of benefits have been made to encourage you to participate. However, by participating in the study, you will be playing an important role in the development of technology planning processes suited for the developing countries.

IV. Extent of Anonymity and Confidentiality

Every effort will be made to hide your identity in any written work resulting from this study.

Pseudo names will be used to identify you in any written materials. The researcher will try to minimize the possibility of identifying other people you may mention. Fake names will be used in any printed materials. Written feedback on the Framework and evaluation rubrics will be saved in a protected file on the researcher's computer. The researcher is the only individual who will have access to your written feedback. All data will be destroyed after dissertation defense of the study.

VI. Compensation

There will be no money given to you for participating in this study.

VII. Freedom to Withdraw

You are free to stop participating in this study at any time. You may feel free to not answer any questions in the evaluation rubric or make comments.

VIII. Subject's Responsibilities

I voluntarily agree to participate in this study. I have the following responsibilities:

I agree to answer questions honestly. Initial _____

I agree to allow the researcher to use my comments and suggestions in the Framework.

Initial _____

I agree to allow the researcher to use a non-identifying direct quote. Initial _____

FRAMEWORK FOR SCHOOL DISTRICTS IN DEVELOPING COUNTRIES

X. Subject's Permission

I have read the Consent Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent:

_____ Date _____

Participant signature

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Appendix E: Sample of a Checklist for a Planning Committee

Appendix E is developed to provide supplementary information to suggest checklists for setting up a Planning Committee and a Reference Group.

Sample of a Checklist for a Planning Committee

Primary stakeholders	Name of a representative
An official from the school district office	
A representative of principals	
Representatives of teachers	
Representatives of administrators and librarians	
Representatives of parents	

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Sample of a Checklist for a Reference Group

Secondary stakeholders	Name of a representative
National and state government representatives	
A district technology coordinator	
Representatives from teacher unions and teachers' professional bodies	
Private sector	
Tribal authorities and community organizations	
Non-governmental organizations (NGO's)	
Representatives from international organizations	
International experts in ICT (optional)	

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Appendix F: Terms of Reference

These are Samples of the Terms of Reference for a Planning Committee and a Reference Group.

For a Planning Committee

The planning committee will develop a guide on the use of technology for schools.

Specifically, the planning committee will:

- Provide leadership and direct all activities of the planning committee
- Organize the meetings and manage the activities of the planning committee
- Serve as the secretariat that keeps record, files and information about the planning activities
- Coordinate communications and consultation activities with other stakeholders and the public
- Perform any other tasks as school districts and other stakeholders directs regarding technology planning.

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For a Reference Group

The Reference Group will consist of other stakeholders that are not involved in the daily activities of the planning committee. Specifically, the Reference Group will provide feedback and raise other suggestions and ideas that might not covered by the planning committee.

Specifically, the Reference Group will:

- Participate in the activities organized by the planning committee to develop a school district technology plan
- Provide feedback on the activities and technology planning documents
- Assist in any way the planning committee may ask regarding technology planning activities

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Appendix G: Relevant Documents**Compilation of Relevant Legal, Regulatory, Reports, and Policy Documents**

Checklist of the relevant documents

Documents
Policies: Education, information and communication technology, curriculum, education management information
Strategies and programs: Developmental plans, human resource, technology infrastructure, National, state and district strategies
Reports: Monitoring and evaluation of ICT initiatives, funding opportunities, educational technology programs
Use of technology in education: Computer log books, sample of the learner and teacher portfolios of work done on ICT in education
Academic documents: Books, articles, and websites and conferences

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Appendix H: Needs Assessment**Needs Assessment**

- When conducting Needs Assessment this issues should be considered:
 - Clear focus on the targeted stakeholders such as teachers and principals
 - Making resources available
 - Understanding that it will take time to conduct needs assessment and to analyze such a data
 - Clearly identify technology that could be used by teachers immediately if it was available

- Areas to cover in Needs Assessment:
 - Professional development
 - Facilities
 - Hardware and software
 - Technology integration
 - Leadership and stakeholder participation
 - Budgets and funding opportunities

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Appendix I: This Sample of a Vision, a Mission and Objectives

The information was developed by Williamsburg County School District for their technology plan. Please ensure that your technology plan supports and be aligned with the school districts' vision, mission, and objectives (Williamsburg County School District, 2012).

Vision:

- All children will score at or above the 50th percentile on all standardized tests.
- All students will graduate.
- All students will be employed or enrolled in a post-secondary program within one year after graduation.

Mission statement:

The mission of the Williamsburg County School District, a proud, rural community striving for excellence, is to guarantee all students a quality education by providing an innovative curriculum, relevant resources, and competent staff.

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Sample of the objectives and strategy:

Objectives	Strategies
Increased use of computer labs and provide accurate teaching and learning resources	<p>A. Provide additional computers to all schools using a variety of funding sources.</p> <p>B. Add additional computer labs to all schools.</p> <p>C. Analyze student performance data and other appropriate information to identify educational strategies and needed technology resources to support learning objectives.</p> <p>D. Effectively utilize available technology assessment systems and tools to evaluate our students' performance.</p>

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Appendix J: Educational Content

The Planning Committee should undertake the Following Activities about the Educational Content:

- Determine if the education online content is already availability at the national and state levels
- Set up subject committee to identify and evaluate the online content for their schools that is offered at no cost
- Create a repository of the online educational content recommended by the subject committees. The content may be structured according to the subject, for example for math, science, etc.
- Create policies that would guide the access and use of freely available content

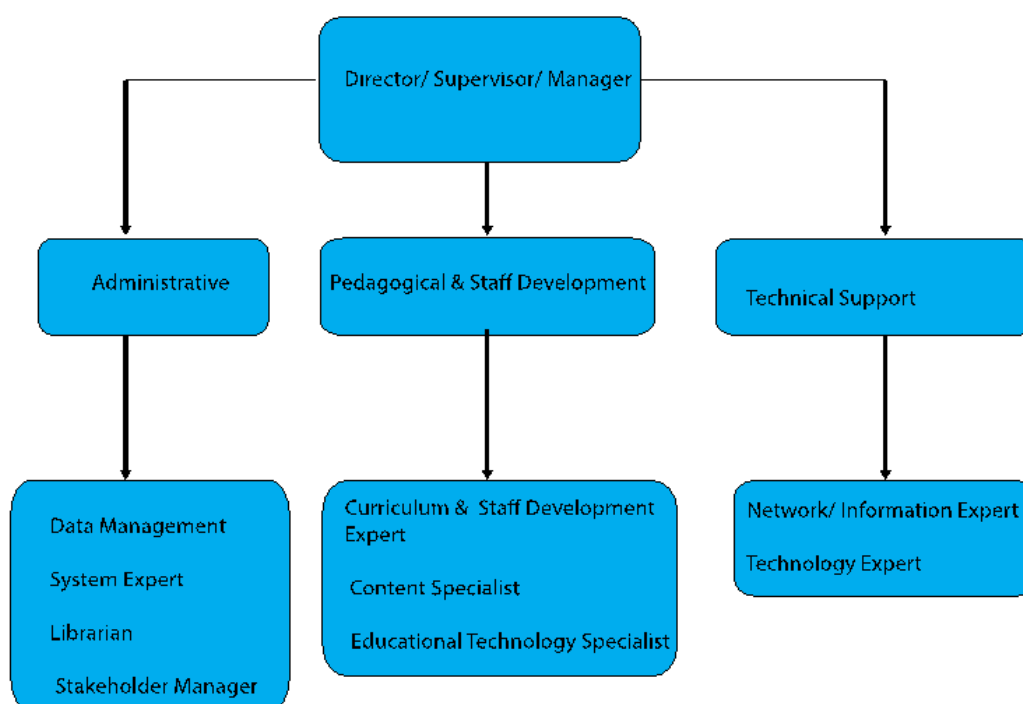
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Appendix K: Technology Support Unit

In light of the technology plan, the planning committee should revise job positions and descriptions, suggest a staff development program and review allocation of staff members. Based on the elements of the technology plan, the planning committee may suggest the technology positions and the job descriptions. Overall, the technology coordinators should be able to work with, and take advantage of its capability applicable for schools. The job aspects may be in these categories: administrative, pedagogical coordinator, technical and network support. Other positions may be added as the needs arise.

The technology planning structure should have a clear staff development program that ensures that staff members upgrade and refresh their skills and knowledge. More details about staff development programs are covered in Phase 3: Staff Development.

A proposed technology unit within a school district may look like the one as follows:



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Appendix L: Elements of Technology Plan**The Common Elements of a School District Technology Plan Document**

The information was developed in the Guidebook for Planning, Version 2.0. by the National Center for Technology planning (2001).

Cover Sheet Title

Table of Contents

Executive Summary

Introduction

Purpose of this Technology Plan

Core Values

Beliefs about Technology

District Background

The setting up planning structures

Terms of reference for the planning committee

Compilation of relevant legal, regulatory, reports and policy documents

The identification and selection of representatives by stakeholders

Consultation plans

Communication strategies

Needs assessments

Vision

Mission statement

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Objectives

Consideration of Pertinent Issues:

Professional development

Curriculum integration and planning

Administrative applications

Special education

Development of an educational content

Indigenous languages

Community Coordination

Compliance with national technology norms and standards

Refurbishment and disposal of used technology

Maintenance, replacement and refurbishment of equipment

Safety and security

Sustainability

Budget

Funding resources

Formalizing partnerships

Data communication and the Internet

Software evaluation

Dissemination of good practice of innovations

Monitoring and Evaluation

Budget Bibliography Glossary

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Appendices

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Appendix M: Technology Implementation Plan

This is a Sample of a School District Technology Implementation Plan.

The plan outlines the issues and practical ways in which are linked and ensure the considerations of the relevant activities.

Objectives	Strategy	Responsible agents	Time-frame	Resources	Activities
Provide each schools with 4 computers and 1 printer for administrative purposes	Procure computer from local and external suppliers	District office	From January to December 2013	District office budget and external organizations	Develop the budget, Mobilize funds within the school district or external organizations Compile a list of schools Count the number of computers to be procured Develop the computer and printer specifications Advertise for the suppliers to provide quotations Select the best suppliers Award the tender to the best supplier

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Appendix N: Monitoring and Evaluation Matrix

Program Monitoring and Evaluation Matrix - School District Technology Plan

Evaluation question	Target Performance Indicators	Source of data	Method of data collection	Person responsible for data collection	Time frame
To what extent is the district plan visible to stakeholders?	a) Number of public advertisements placed in electronic and print media; b) Number of stakeholders expressing knowledge of the plan	Management records of stakeholder consultative meetings	a) Analysis of documents b) Surveys/interviews with stakeholders	External evaluator	Once during the planning process
To what extent are the objectives of the plan being achieved?	c) Number of teachers undergoing professional development d) Number of computers supplied for administrative purposes	a) Training plans b) Signed delivery notes	Analysis of documents	School technology coordinator	Quarterly
e) To what extent are the expectations of stakeholders being met? f) Management at ministry and	j) Number of teachers surveyed who express satisfaction with plan k) Number of	Monitoring reports	Surveys, focus groups	External evaluator	Once during the planning process

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schools g) Students h) Teachers i) Parents	current and past students surveyed who express satisfaction with program				
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Appendix O: Rubric for Evaluation for the Theory Experts

Rubric for Evaluation by a Diffusion of Innovations Expert Reviewers

Using the following questions as a guide, evaluate the proposed school district technology plan Framework based on the Diffusion of Innovation (DOI) theory. Please provide as much feedback as you can so that I can use it to revise the Framework.

1. Having reviewed the proposed Framework for school district, would you say it conforms to the principles of DOI theory?

Please explain your answer

Elements of DOI theory:

Elements	Definitions	Your explanation
Innovations	Rogers (1995) defines an innovation as “an idea, practice, or object that is perceived as new by an individual” (p. 11).	
Communication	Communication channel refers to how information flows between and among the members of a social system (Rogers, 1995)	
Time	Time deals with the length it takes for the new innovation to be adopted within a social system. Time also	

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	addresses how the new innovation may be diffused over time (Rogers, 1995)	
Social System	Rogers (1995) defines the social system “as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal” (p. 23).	

3. Do you think that the proposed technology planning Framework deviates from the general principles of DOI theory? If so, explain
4. From your knowledge as the DOI expert, how do you think each of the issues identified in questions two and three above would specifically be addressed in order to improve the Framework?
5. Are there any other recommendations you would like to make that could improve this Framework with regards to the alignment with DOI?
6. Bearing the elements of DOI in mind, what else would you like suggest in order to make the Framework better?

Thank you very much for participating in this study.

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Appendix P: Feedback from DoI Experts Reviewers

	Feedback from DoI Expert Reviewers		Action Taken	
Strengths	Reviewers			
		1	2	
	The value of the Framework comes in applying best practice within the context of a developing country	✓		No action required
	DoI Theory is likely to provide valuable data during the needs assessment as well as during Phase 4	✓		No action required
	I believe that the technology plan does include some aspects of the DoI theory	✓	✓	No action required
	There are certainly social systems identified in the plan	✓	✓	No action required
	Framework deals with technology as an innovation because technology is ever-changing hence at any point in time one would have to deal with issues of novelty.		✓	No action required
	The Framework ensures that people at different levels are sensitized and given the information needed for them to make informed decisions and choices. Such activities can only be done within a given space of time		✓	No action required
	This Framework takes care of issues of communication by suggesting development of structures at different levels and communication strategy which would ensure that communication takes place in a systematic manner.	✓	✓	No action required
	The different phases developed (preparatory to post-planning) reflect the fact that innovation will be adopted over time		✓	No action required
It brings up a different and practical approach to dealing with issues of technology diffusion		✓	No action required	
Weaknesses	The Framework does not seem to embody other existing technology planning	✓		Phase 1 of the Framework covers the analysis of documents, policies

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	framework. It would benefit from knowledge and expertise from existing technology frameworks and that monitoring its implementation would best be suited to the application of DoI theory.			and other planning issues, including existing frameworks, that are in a school district
	The DoI theory is not necessary for the development of the plan, it is however relevant for monitoring an innovation and explaining how it is being used	✓		No action taken because the DoI theory should inform all stages of planning and implementation. Monitoring is an integral part of the whole process
Suggestions	I suggest that you provide a clear link on what is it about the proposed Framework (by phase) that is aligned to DoI. For instance: describe DoI elements and how they inform the planning phase etc. It should not be left to the reader to deduce the link.		✓	No action because the issues are covered in chapter 3.
	It should be clear that the “pertinent issues” will be incorporated into the documents to be developed. It was not as clear when I read the Framework		✓	No action taken because there is a statement that indicates that planners should include the pertinent issues in the planning Framework
	In terms of DoI Theory, would it be more appropriate to monitor the communication channel between the end users to determine how well the innovation is adopted	✓		No action taken. The suggestion is covered in the application of DoI to technology planning
	While the Framework itself is general in nature, could one specific case (e.g., 1 district) be selected on which to either apply or theorize implementation of the Framework?	✓		Action taken is that the suggestion has been included in the recommendations
	Please consider how you might emphasize the educational use of the devices in the decision-making process, no matter what is purchased	✓		Emphasis has been added.

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Appendix Q: Rubric for Evaluation for Technology Planning Expert Reviewers

Rubric for Evaluation of the Framework by the Experts Reviewers on School District Technology Planning Framework

The following rubric is designed to seek feedback from you as to whether the proposed school district technology planning framework is feasible in the contexts and conditions of a developing country (DC). The framework will be used by technology coordinators to develop a school district technology plan. Please note that your feedback on the proposed framework will assist me to modify and improve its effectiveness. I therefore ask you to provide as much as possible on the spaces provided under the feedback columns. Following the rubric, you will find a few additional questions giving you the opportunity to explore the framework in its entirety and offer some additional feedback. Please provide as much feedback as you are able and feel free to direct any questions to me at any time throughout the review process.

Question	Feedback
1. Is the proposed framework feasible?	If yes, explain how. If no, what should be done to improve its feasibility?
2. Can the framework be applicable in a school district in a DC’s contexts and conditions?	If yes, explain how. If no, what should be done to improve its applicability?
3. Does this framework meet your expectations?	If yes, explain how. If no, what should be done to meet your expectations?
4. Is the suggested process of developing the	If yes, explain how.

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framework the best way possible?	If no, what should be done to improve the process of developing the framework?
5. Are all of the steps included in the right order?	If yes, explain how. If no, what should be done to improve the ordering the steps?
6. Is the framework useable, practical, and cost effective?	If yes, explain how. If no, what should be done to improve the framework to be useable, practical, and cost effective?

Additional Questions

1. In general, do you think the features of this framework would be practical in the contexts and conditions of a school district in a developing country? If yes, explain why.
2. If answered no in the question above, please explain what would make this framework more difficult to implement?
3. Looking at the framework as a whole, what would you want changed in order to improve its potential to improve the development of a school district technology planning?

Thank you very much for participating in this study.

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: Feedback from Technology Planning Expert Reviewers

	Feedback from Expert Reviewers					Action Taken	
Strengths		Reviewers					
		1	2	3	4	5	
	The proposed framework is feasible because, it is anchored on sound theory	✓	✓			✓	No action required
	This Framework takes care of issues of communication	✓					No action required
	The steps in the Framework are clear and in the right order	✓	✓				No action required
	The Framework considered the broad challenges of the district schools in DCs.		✓				No action required
	It is consultative in nature, with clear vision and objectives.		✓		✓		No action required
	It does not assume the needs of the district school, but allows for a process to conduct need assessments		✓				No action required
	This Framework addresses the core ICTs in education components required for successful implementation			✓			No action required
	The Framework advocates for customization to suit for specific conditions			✓		✓	No action required
	Some of the steps identified are linked to the state of readiness of DC ICT capacity.			✓			No action required
	The Framework also covers important areas such donation of computers, online content, information management, teacher training and participation of stakeholders				✓		No action required
	The additional information in the appendices makes the framework more practical				✓		No action required
Weaknesses	The Framework says little about integration with alternative academic, research and development houses in order to tap into indigenous knowledge systems			✓			No action taken because issues of this nature are normally dealt with at the national level

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Suggestions	Need assessment should be moved from phase 2 to phase 1.				✓		Need Assessment was moved to phase 1.
	It could help if you added more detail in need assessments appendix				✓		No action because the Expert Reviewer does not give specific suggestions
	Consider factors that are likely to mitigate against the successful implementation of the framework in the context of a developing country				✓		No action taken because the Expert Reviewer does not mention the mitigation factors. Phase 2 in general accommodates this concern
	The Framework should take cognizance of the culture attributes of society especially when it comes to safety and security (communal buy in and provision of equipment security etc),			✓			No action taken. Phase 2 addresses these issues to accommodate this concern
	The Framework should also address the issue of adult literacy through communal involvement in terms of using such investments as centers of social activities			✓			No action required because the focus of the Framework is on schools
	Build sustainable models similar to the adoption of mobile money in Kenya.			✓			No action required. The following factors affecting sustainability have been considered in the Framework: funds, capacity building of human resources, integration of the Framework school districts plans, and ongoing technical support
	The Framework should include the politicians in the list of stakeholders	✓					Action was taken. The proposed list of stakeholders includes politicians
	The research should study at least one area (get abreast with the contextual characteristics) and then propose a framework that can be used in a named area	✓					The action was taken. The researcher recommended a pilot project to test the Framework