A Review on the Challenges that Hinder Sustainable Implementation of ICT as a Subject in Rural Zambia

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***Abstract*—The paper attempted to bring out the challenges that hinder sustainable implementation of Information communication Technology (ICT) as a subject in rural Zambian schools. The methodology employed in carrying out the exercise included the review of relevant literature published from printed and electronic sources including research studies, evaluation reports, government policy documents, donor policy documents and project reports, newspaper reports and so on. Among the most notable factors that emerged as challenges that hinder sustainable implementation of ICT as a subject in schools in rural Schools in developing countries such as Zambia are; Lack of electricity, Inadequate ICT teachers to teach the subject, high pupil-computer ratio and lack of enough ICT learning and teaching materials. Given the challenges above, the paper proposes an implementation framework. The framework reflects the four players that might influence the successful implementation of ICT as a subject in the rural schools of Zambia. These players are the Government, School administration, Cooperating partners and Colleges and Universities.**

***Index Terms*—Information and Communication Technology (ICT); zambia; rural schools; ICT subject**

I. Introduction

The Zambian Government through the Ministry in General Education rolled out a new curriculum from early childhood education to Secondary School in 2013 [1]. The new Curriculum adopted the learning and teaching of ICT as a subject. Schools in both urban and rural setting were expected to implement the new curriculum. The inclusion of ICT as a subject into the school curriculum in Zambia was long overdue. Although ICT has the potential to improve the well being of a nation and it's citizenly to a great extent, developing countries like Zambia are far from reaping these benefits because of certain barriers. Among the notable among the many challenges is the lack of computers. The Zambian government in an effort to mitigate this challenge has partnered with cooperating partners to make computers available in most of the schools in Zambia. For instance the Computers for Zambian Schools Trust (a partnership between the Ministry of Education, Zamnet, SchoolNet Zambia, the Beit Trust, the British High Commission, HSBC, the British Council and Computers for Africa Schools project) are providing computers to schools across the country [2]. A project known as the Computers for Zambian Schools has embarked on a project to train ICT teachers, distribute hardware and provide technical support to schools, and recycle computers in partnership with a South African Company [3]. A nongovernmental organization known as, The Africonnet ischool has also come on board and have embarked on a project aimed at creating a National ischool Network in Zambia by connecting schools across the country via internet and by providing access to learning material on the ischool website [4].

This study explored other challenges apart from availability of computers that hindering sustainable implementation of ICT as a subject in public schools in rural Zambia. The whole study was based on literature study. This paper presents a comprehensive discussion on the challenges that hinder sustainable implementation of Information Communication Technology (ICT) as a subject in public schools in rural Zambia. Further, paper offers a number of recommendations to reduce these challenges and maximize the beneficial use of ICT in education.

The paper is organized into five sections. Section one consists of introduction and organization of the assignment Section two provides the available literature on similar studies, a detailed discussion is given in section three, section four proposes a framework and finally section five concludes.

II. Similar Studies

Similar studies have been carried out in both developed and developing countries aimed at identifying challenges that inhibit sustainable ICT implementation in Schools. For instance a study carried out in Kenya that reviewed ICT in education in Kenya identified Cost of ICT Infrastructure as a major challenge that hampers efficient ICT implementation. He argued that despite a typical claim that investing in ICT is cost-effective, as well as the continuous decline in ICT prices, the entire cost of possession of ICT including software, hardware,

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upgrading, maintenance, development and acquiring right skills remains high. He further argued that Investing in ICT for schools might be perceived as an additional cost, and supporting significant ICT implementation is a problem experienced by many schools in developing countries, mainly those that rely on donor support [5].

The above observation was supported by a study that reviewed the use of ICTs to enhance teaching and learning in East African schools, it was also observed in this study that, one of the greatest challenges in implementation of ICT in school was balancing educational goals with economic realities. Because implementing ICT requires large capital investments, schools need to be prudent in making decisions about what models of ICT will be implemented and be conscious of maintaining economies of scale. Ultimately it is an issue of whether the value added by implementing ICT offsets the cost, relative to the cost of alternatives [6]. The study further identified burglary as a challenge in the implementation of ICTs in Schools. He argued that the fact that computers are still very expensive in developing countries, makes them a target for thieves who usually have ready markets to another party at a much less figure. This has made many schools to incur extra expenses trying to burglar proof the computer rooms. This extra expense makes some schools shy away from purchasing computers for their students.

Aduwa-Ogiegbaen and Iyam [7] in their study argued that "a formidable obstacle to the use of information and communication technology is infrastructure deficiencies. Computer equipment was made to function with other infrastructure such as electricity under controlled conditions". They further argued that when electricity supply is not stable and constant, it is difficult to keep high-tech equipment such as computers functioning, especially under extreme weather conditions as obtained in African countries.

Dzidonu [8] identified lack of well trained teachers and low levels of teachers' ICT skill and knowledge as a major obstacle in implementation of ICT in schools. The author argued that for efficient implementation of ICT in schools, there should be adequate personnel that have correct skills. Where such skills are missing, it would be difficult to fully implement the technology in schools.

Jenkin [9] identified the isolation of rural schools from the urban education mainstream as an obstacle that makes it difficult for ICT related resources and facilities to reach them. He argued that there were limited transport resources to these areas, where scholars usually walk long distances to school.

Furlonger [10] identified lack of computer hardware and software as challenges in the implementation of ICT in rural schools. He reported in his work that it is unlikely that you will find a computer lab in rural schools, yet alone someone with knowledge of the Internet, unlike urban schools.

Naidoo [11] identified lack of physical infrastructure as a hindrance to the sustainable implementation of ICTs in rural schools. He argued that more than 90% of public rural schools do not have the right infrastructure to conduct ICT lessons. The subject of ICT requires that a separate and permanent, well secured, if possible with good ventilation such as air- conditioned room should be made available to conduct lessons and this has not been the case. In short, most rural schools do not have computer laboratories to store and conduct lessons effectively.

Andoh [12] identified lack of enough teaching materials and other reference materials such as enough text books for ICT as one of the challenges to the successful and sustainable implementation of ICT as a subject in rural public schools. This is because the majority of these schools do not have the capacity to buy necessary learning and teaching materials to carter for everyone.

Butcher [13] identified the high pupil-computer ratio as a serious challenge worth noting as many pupils will share one computer which is not supposed to be the case. This may lead to high tear and wear including short life span of the computers. The ideal scenario is supposed to one computer per pupil but this is not the case on the ground.

The similar studies reviewed above mostly looked at the implementation of ICTs in Schools in general and yet our review is looking at the introduction of ICT as subject in rural Schools and while developing countries may have similar challenges, the Zambian context presents various unique challenges that affect the successful implementation of ICT as a subject in rural schools.

III. Factors Affecting the Successful Implentation of ICT as a Subject in Zambian Rural School

Although the Government of Zambia is committed to implementing of ICT in education and ICT as a subject, the process is hindered by a number of barriers. The barriers identified above are common in most developing countries including Zambia. The review identified the following barriers as inhibitors to the sustainable implementation of ICT as a subject particularly in Zambia: i) Cost of general ICT Infrastructure ii) Lack of Knowledge, Skill and qualified teachers to teach ICT in schools iii) Lack of electricity iv) Lack of ICT Teaching Materials v) high cost of implementation vi) High Pupil to computer ratio and vii) corruption and viii) Poor Timing and poor planning

A. *Cost of General ICT Infrastructure*

Despite a typical claim that investing in ICT is cost-effective, as well as the continuous decline in ICT prices, the entire cost of possession of ICT including software, hardware, upgrading, maintenance, development and acquiring right skills remains high [14]. A study that looked at the reasons for under use of ICT in education: in the context of Kenya, Tanzania and Zambia, identified cost of ICT as one of the factors hindering the efficient use of ICT in education [15]. A project known as SchholNet Zambia observed that Investing in ICT for schools might be perceived as an additional cost, and supporting significant ICT implementation is a problem

experienced by many schools in developing countries such as Zambia [16].

B. Lack of Knowledge, Skill and Qualified Teachers to Teach ICT in Schools

According to [17], the success of educational innovations depends largely on the skills and knowledge of teachers. Teachers' lack of knowledge and skills is one of the main hindrances and challenge to the sustainable implementation of ICT in public rural schools in Zambia. There is generally a shortage of ICT teachers in Zambia. Until 2015, when the ICT curriculum was introduced in Teachers training colleges, there was no direct program that trained teachers in both education and ICT disciplines. To be an ICT teacher, one had to further upgrade his/her computing skills outside the educational program to diploma level or higher. Those who complete pure diploma or degree programs in ICT-related disciplines preferred joining the information industry rather than work in education, due to differences in remuneration.

C. Lack of Electricity

Many schools are still not yet connected to electricity; Zambia being a developing country, the government has not been able to connect all parts of the country to the national electricity grid. Consequently those schools that fall under such areas are left handicapped and may not be able to offer computer studies. According to the Zambia energy regulation board website, only 25% of the Zambian population has access to electricity and in the rural areas, the level of access is less than 5% [18]. The ministry in charge of education in Zambia was asked by a newspaper reporter as to how rural schools that are have no electricity would implement the mandatory policy to introduce ICT subjects in all schools, his response was "In this regard, the students in areas where there is no electricity will be learning theory for some time till their schools were connected to the power grid" [19]. ICT cannot be done in theory because it is a practical subject.

D. High Cost of Implementation

The World Bank observed that given current budgetary and resource constraints, a widespread investment in ICTs in education is probably not possible in most developing countries [20]. This is true for Zambia a developing countries who annual Gross Domestic Product (GDP) of 6.0 percent and being one of the poorest countries in the world with 60 percent of population living below poverty line. There is widespread poverty in Zambia, mainly caused by fast population growth and systemic youth unemployment, remains Zambia's main economic challenge [21].

E. Lack of ICT Teaching Materials

The author of [22] in his paper entitled Integrating ICT in Zambian High Schools, identified lack of ICT teaching materials as a hindrance to the successful integration of ICTs in Zambian schools.

F. High Pupil to computer ratio

According to [23] in his study of entitled Measuring ICT in education in sub-Saharan Africa: A call for action revealed that the Pupil to Computer ratio in Zambia was standing at 145: 1.

IV. Recommendations

The paper has identified that the effective implementation of ICT in education in Zambia is impeded by a number of constraining factors. The recommendations on overcoming the challenges that hinder sustainable implementation of ICT as a subject in rural schools is summarized in the following framework as depicted in Fig. 1, which is designed to understand the recommendations in a specific context of ICT subject implementation in rural schools of Zambia. The framework reflects the four dimensions and the issues might influence the successful implementation of ICT as a subject in the rural schools of Zambia.

The effective and sustainable implementation of ICT in public rural schools requires commitment from the government of Zambia, administrators in schools, Cooperating partners and Colleges/Universities. School authorities need to be provided with adequate ICT facilities and resources for effective implementation of the ICT subject.

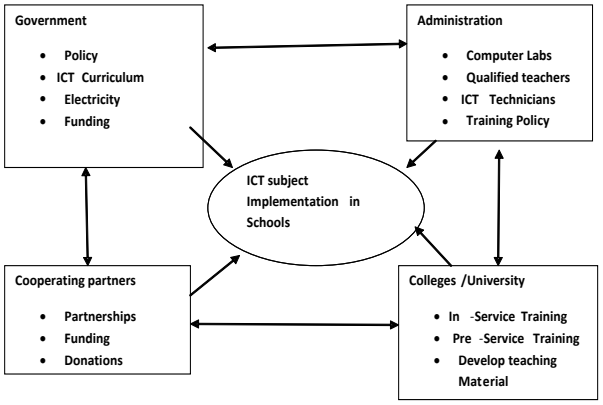

Figure 1. ICT subject implementation framework (Author)

A. The Government

To ensure successful implementation of ICTs as a subject in rural schools of Zambia, the government should first of all provide an enabling environment through the national Policy on ICT by understanding interpreting its implementation adequately. The government should facilitate and sponsor the development of the Curriculum through the Curricula development centre and the ministry of Education. The government also through the ministry responsible for education should work with the Zambia Electricity Company and the Rural Electrification Authority (R.E.A) to expedite connection of electrical power supply to some rural schools. The government should also invest in green energy such as solar to provide power to rural schools.

B. Cooperating Partners

Cooperating partners should come on board and supplement the efforts by the government by getting into partnerships with the government and other organization to donate ICT equipment to rural schools.

C. School Administration

The school administrators should provide an enabling environment for the introduction of ICT as a subject. Adequate Computer Labs should be provided to reduce on the pupil to computer ratio; qualified teachers should be identified and employed. It is also imperative that the schools engage technical support that will ensure that repair services and technical information is provided. The schools should have training policies that would allow in-service teacher training in ICTs.

D. Colleges and Universities

Vigilant attention needs to be given to both pre and in-service teacher training in ICTs. Colleges and universities should come on board and invest in training of in-service and pre service teachers in ICT.

V. Conclusion

Whereas results indicate that ICT has penetrated many sectors including banking, transportation, communications, and medical services, the Zambian educational system seems to lag behind. There are a number of important factors that have emerged from the study that hinders sustainable implementation of Information Communication Technology (ICT) as a subject in public schools in rural Zambia. These include Cost of general ICT Infrastructure, lack of knowledge, skill and qualified teachers to teach ICT in schools, lack of electricity, lack of ICT teaching materials, high cost of implementation, high pupil to computer ratio and poor timing and poor planning. This paper shows the link between the four players required for the successful implementation of ICT as a subject in rural schools. This led to the proposal of a framework which would assist into the understanding of the barriers influencing adoption and implementation of ICT as a subject and the measures to required overcoming the barriers.

Adoption and implementation of ICT as a subject is a continuing and challenging process that involves many organizational constraints. A clear framework to understand the constraints influencing the implementation of ICT subjects in schools is required to improve effectiveness. Therefore, our proposed framework is offered as a means to increase understanding of adoption and implementation of ICT as a subject.

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