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A Research Programme Consortium on
Implementing Education Quality in Low Income Countries

BRIDGING THE DIGITAL DIVIDE?

Educational Challenges and Opportunities in Rwanda

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By

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Abstract

The digital divide creates and is also a reflection of inequality in society, preventing those with no access to Information and Communication Technology (ICT) resources and electricity supply from accessing the benefits of globalisation and participation in the knowledge-based society. This paper contends that, despite national efforts in providing an enabling policy environment and opportunities for teachers, learners and communities in Rwanda to take advantage of the potential of ICT, increasing numbers of members of social groups (girls, rural teachers and learners, communities) continue to subsist outside the margins of the knowledge society. The digital challenges in education are immense and require a combination of efforts to realise the basic tenets of social justice, that is, redistribution, recognition and participation. It argues further that the digital divide in Rwanda might not be narrowed simply by distributing material digital resources to schools but by recognising the challenges of marginalised social groups in schools and classrooms and ensuring their involvement in the pedagogical process. An EdQual research project is carrying out action research with science and mathematics teachers and learners to establish strategies for making use of existing ICT facilities to enhance pedagogy.

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Introduction

The linkage between Information and Communication Technology (ICT) and social justice generates discourse about the potential of ICT in promoting social change on the one hand and exacerbating social inequalities on the other. Realisation of either effect is related to the level of state intervention or inaction. This paper interrogates this relationship by focusing on the use of ICT in pedagogical processes in Rwandan schools and how this throws light on the nature of the digital divide and social justice within the education system. The concept of social justice is approached from the standpoint of *redistribution*, *recognition* and *participatory* dimensions as advanced by Nancy Fraser (2001). These dimensions have a particular application in situating the nature and impact of ICT and explaining the digital divide in the process of addressing the problem of marginalised schools and communities. Rwanda, like most developing societies, has experienced marginalisation with regard to both a lack of equitable access to material digital resources in schools, and an inability to get into the mainstream of social change processes due to a preclusive cultural domain that discriminates according to gender, incomes and status. In addition, there has been a lack of active engagement by teachers and learners in educational empowering processes due to a virtual lack of "social arrangements that permit members of society to interact with one another as peers" (Fraser 2001). It is in this context that the mainstreaming of ICT in education can be discerned to benefit from ICT resource redistribution in schools, and a recognition of the socially marginalised's participation in the knowledge economy without social encumbrances. It is argued, therefore, that social justice can be realised through ICT-enabled education that is buttressed by redistribution processes, recognises and integrates marginalised schools and social groups, and facilitates participation in social change processes in schools. Such education processes would help close the existing digital gap in Rwanda. This framework informs our analysis of the relationship between the digital divide and social justice with particular emphasis on the use of digital resources in basic education in Rwanda.

It is presumed from the outset that ICT can enhance social inequalities (based on gender, income and class) in contexts where existing social inequalities predetermine the ease of communication and access to the knowledge society. Thus, schools that are endowed with ICT infrastructure are better positioned to draw benefits that arise from continued access and use of ICT for teaching, learning and communication. On the contrary, schools lacking in ICT infrastructure would not benefit from new knowledge, skills and traits that emerge with access to digital technology. It is further assumed that deliberate interventions in teaching and learning with ICT facilitates the realisation of social justice by making available ICT resources in schools, and hence contributing to bridging the digital divide that may exist both between schools and within schools. In essence, the digital divide is a reflection of social injustice and existing social inequalities that may also assume technical, economic, national, regional and global realities.

Data Collection Methodology

The findings presented in this paper are drawn from a five year ongoing research programme on implementing education quality in low income countries (EdQual) that started in 2005-2010. The research is being carried out through the collaboration of partner universities in Rwanda, UK, Chile and South Africa, inquiring into the use of ICT in basic education in schools and marginalised communities in Rwanda and South Africa. The overall design of the research was conceived as a collaborative action research enquiry involving researchers in the four countries working with teachers and learners in Rwandan and South African schools. This paper, however, only draws on data from Rwanda, where the majority number of participating schools and teachers came from.

The research design was a cyclical action research carried out in phases, first in six schools with an additional six schools brought on board in the second year. Researchers from Kigali Institute of Education (KIE, the EdQual host institution in Rwanda), visited twelve partner schools at least once a month, from January 2007 to January 2009 and worked with not more than four mathematics and science teachers per school on using ICT to support teaching and learning. Schools included three primary schools and nine lower level secondary schools.

Methods of data collection included use of questionnaires, video recording of lessons, classroom observations, focus-group interviews with learners and teachers separately, usually through the use of stimulated video recall. Teachers also kept a record of their work that was discussed from time to time with the KIE researchers along with their lesson plans during the schools visits. In addition, data was collected during the annual teacher training workshops that brought together all the teachers in the participating schools. During such workshops, teachers not only received training on using ICT in teaching and learning from the team of researchers collaborating in the study, but also had time to share experiences, learnt from each other and reflected on their practice. Ongoing data analysis was a significant feature of the research as it progressed through the different stages starting with the immersion phase, when a number of schools were visited before selecting those to work with, throughout the baseline studies carried out and the interventions in schools.

The Global Digital Divide and Social Justice

This paper is informed by a variety of literature on the digital divide and social justice. In particular it borrows from Nancy Fraser's argumentation on social justice dimensions of *redistribution, recognition and participation* and how they interrogate inequality and inequity in a knowledge society. To this extent the digital divide is considered to be a reflection of skewed material (technological) resource distribution in society especially in favour of high income and/or technologically endowed regions. Maldistribution of technological resources consequently engenders the emergence of social divides based on access to ICT resources. The use of the term 'digital divide' has become prominent in the education realm to describe variances of accessibility, utilization and networking among teachers and learners around the world. In this respect, resultant patterns of social exclusion and marginalization have been discerned. This scenario is relevant because ICT and education have become intimately intertwined as the role of ICT in enhancing quality in the educational process has become more recognized.

The digital divide, according to Africa News:

> is not just countries without computers it is also when you have a computer but you do not know how to use it. This is what happens in third world countries that do have little access to computers. They cannot use them because they do not have the means of education to learn. (Belden 2004)

Lack of knowledge to use digital equipment is thus a debilitating factor that has been attributed to social parameters such as gender, age, income, race, educational background, geography and disability, among others (Selwyn and Facer 2007). At the global level, the digital divide reflects the existing economic divisions in the world today and continues to have implications on social justice. While richer countries, for example, are able to provide Internet facilities and other information technologies to their citizens in their educational settings, learners from poorer countries where Internet and other technologies are not easily accessible are not benefiting from the information age and cannot, therefore, compete in the global economy. In the same vein, disparities in terms of access to information technologies also exist among groups of people within richer and poorer countries based on their social economic status, rural/urban and gender differences. This means that some social groups worldwide are facing exclusion from both educational opportunities and overall access to technology. The following analysis illustrates the depth of the digital divide in different regions.

Regional maldistribution of material resources has been recorded across the globe according to gender, income, age, location and in the USA, Republic of South Africa or Australia, according to race groups (Cisco 2006). In this respect we can delineate a North-South cleavage characterised by technological, digital and income disparities. In the current post-modern technological development agenda the North South divide would describe a digital divide between social groups that have access to the Internet and those that do not. This would further encompass differences in skills that people of the North and South have, that is, the divide between peoples who are at ease using technology to access and analyze information and knowledge and those who are not. Such differences have not facilitated interactivity between the peoples of the North and the South, especially in terms of sharing knowledge and skills that would create prudent impacts on social livelihoods. To a large extent, therefore, most social groups in the South have remained unrecognised hence strengthening the stereotypes that have existed overtime.

A key feature of the global digital divide lies in the frequency of use and the extent of accessibility to ICT infrastructure by social groups in the countries of the North. This explains the magnitude of participation by social groups in these countries and provides a solid comparative framework between countries of the North and the South. Statistics from Canada (Statistics Canada 2008) in their 2001 Internet Use Survey provides a diversity of statistical data with regard to social and regional gaps recorded within the country in the use of ICT based on age, rural vs urban areas, country of origin, income and education. The United States of America and the European Union also depict versions of the digital divide with gaps recorded in various population groups. Pew Internet for example, records that "55% of adult Americans have broadband Internet connections at home, up from 47% who had high-speed access at home in 2007" (Pew 2003). A striking feature of the digital divide has been experienced in China where there are 253 million Internet users and the Internet population grew by 20% in 2006 (CIA 2009). However, this figure relates to less than a quarter of the Chinese population who have access to the Internet and the digital divide is growing in China due to factors such as insufficient infrastructure and high online charges (Spencer).

Africa has recently recorded an increase in the proportion of its population being connected to various forms of ICT, especially in mobile telephony although a large proportion remains unconnected (World Summit on Information Society 2005). The International Telecommunications Unions reports that "less than 3 out of every 100 Africans use the Internet, compared with an average of 1 out of every 2 inhabitants of the G8 countries" (ibid). It further states that 75% of Africa's 26 million fixed lines are found in just 6 of the 55 African countries. Whereas Africa has an average of 3 fixed lines per 100 people, the Americas region has an average of 34 fixed lines per 100 people (ibid). This scenario describes a generalised understanding that those countries that are endowed with modern digital resources tend to report improved livelihoods while those with fewer digital resources comprise the have-nots of the world. This may explain the internal social configurations in individual countries (Mehra (2004) most particularly those associated with the problem of persistent poverty and social inequality (Servon 2002); a theme which Fraser (2001) has identified as being crucial in understanding the problems of emerging knowledge economies. According to Fraser (2001) social injustice is a consequence of poverty, exploitation and inequalities arising from misrecognition of cultural varieties that enrich society. Recognition would hence facilitate the mainstreaming of modern skills across cultures and make possible a "multimodality of technological access and use" (Fraser 2001, Selwyn and Facer 2007).

Selwyn et al, (2007) observe that there have been both optimistic and pessimistic beliefs about integrating technology into education. On the one hand, this has been seen as a significant opportunity to reduce social inequalities in educational participation, while on the other hand pessimists point towards the capacity of technology-based learning to increase levels of social exclusion from learning. They observe further that cost continues to be the biggest barrier to formal learning, and it is not clear whether technology based education will eliminate this. This is more so when the cost of IT equipment is still high, and where facilities are provided by the government or support organisations; opportunity costs, transport costs and other institutional

barriers remain, especially for the poorer groups. In the case of Africa, the concept of marginalization captures the notion of underserved constituencies which include scattered and rural populations, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities and the elderly as well as all others who for reasons of cost or time constraints are unable to enrol.

Marginalisation, poverty and social inequality on the African continent can, therefore, be fairly attributed to a lack of accessibility to development information arising from a general absence of related access to ICT infrastructure by a large percentage of its population. This has, as a result, made possible a resurgence of disparate marginalised and vulnerable groups that are susceptible to preventable communicable and reproductive diseases, and malnutrition, etc. In an increasingly globalising world such despicable deprivation of a majority of a continent's population spells a certain level of state inability to offer social cushions. This scenario is best captured by data from the International Telecommunication Union (World Summit on the Information Society 2005).

The gender dimension of the digital divide also emerges strongly in the discourse on social justice. In Fraser's (2001) analysis, the dimensions of recognition and participation aptly capture the debate on gender discrimination in the knowledge society. Misrecognition, according to her, "consists in the depreciation of group specific cultural identity by the dominant culture and the consequent damage to group members' sense of self", (Fraser, 2001: 7). This has been supported by a rigid patriarchal structure that emasculates the potential of women in society under the pretext of adhering to age-old traditional practices. It has, in turn, caused social dislocations in society based on inherent exploitation, discrimination, and stereotyping, in essence marginalising the women folk to the social periphery. This argument has been developed further by Huye and Sikoska (2003); Kennedy, Wellman, Klement (2003) and UNDP/UNIFEM (2004).

Wajcman and Lob (2006), take the argument further by introducing a technofeminist approach which is optimistic about opportunities opening up for women. "Indeed (we) see digital technologies as being fundamentally transformative, unlike previous technologies that were more biased towards the masculine gender. (Wajcman and Lob, 2006: 3). They argue that early concerns about women being left out of the communications revolution and being victims of the digital divide, now seem misplaced. "A proliferation of mobile phones, the Internet, and cyber cafes are providing new opportunities and outlets for women (ibid)". They argue categorically that "while early adopters of the Internet were overwhelmingly men, recent data from the USA shows no gender difference in Internet use", (ibid: 2). The situation in Africa, could, however, provide a different version of the story. In China female Internet take-up rose from 12% to 39% by 2005. Wajcman and Lob, however, refer to the rise of cyber-feminism in which it is posited that the:

> virtuality of cyberspace and Internet spell the end of the embodied bias for sex difference. This blurs the boundaries between human and machines and male and females, enabling their users to choose their disguises and assume alternative identities. The basis of cyber-feminism is that digital technologies are based on brain rather than brawn, on networks rather than hierarchy and they herald a new relationship. In cyberspace all physical bodily cues are removed from communication. As a result our interactions are fundamentally different because they are not subject to judgments based on sex, age, race, voice accent or appearance. (ibid: 4)

As a result, Fraser suggested that:

> members of the misrecognised groups must reject such pictures in favour of new self-representations of their own making. Having refashioned their collective identity, moreover, they must display it publicly in order to gain the respect and esteem of their society at large. (Fraser, 2001:8)

Mottin-Sylla (2004) in the *African Environment* online journal posits that there is a definite digital gender divide in Francophone Africa, as in other parts of Africa. However, it avers that:

> an analysis of the gender divide cannot be summed up by disparities in terms of access: for women, ICTs are not just another tool. Their strategic importance is linked to that fact that

> they can be used to fight the issues at the root of women's marginalisation and isolation, because ICT provide for expression and community action, p.30.

Making ICT available to various social groups therefore enhances active participation, and this is as applicable to the social field as it is in education. Its absence locks up the potential of vulnerable and marginalised groups and justifies social injustice in poor societies. There is, nevertheless, a crisis of digital resource availability in the developing world which exacerbates social injustice and inequality. Available global data presents a depressing picture of unequal access to ICT infrastructure, knowledge, skills and information between continents. The digital divide, and hence social injustices, are worse in countries that do not have adequate resources to invest in science and technology but have to grapple with the basics of daily livelihood. As a result, the effects of poverty continue to subsist within marginalised population groups categorised particularly according to location, gender, age, education, socio-economic status and even race.

Nature of Digital Divide, Social Justice and Policy Framework in Rwanda

Due to social inequalities, Rwandan schools and sections of the population traditionally left out from the mainstream education benefit less from the introduction of ICTs in education. The 1994 Genocide introduced a population group, which to this day is more vulnerable, and without extra assistance may not fit well into the mainstream development process. These include the orphans, child-headed households, and widows, all of whom are susceptible to the forces of marginalization. To tap them will require concerted efforts including the use of modern ICTs to ensure that they acquire knowledge and skills that will make them useful members of society.

Schools in Rwanda can be categorised as urban and rural. Urban schools tend to be well resourced as opposed to rural schools. Urban schools benefit from economies of scale and externalities which exist as a result of urban planning and development. The urban schools therefore have an opportunity to benefit from good road networks, electricity and fixed and mobile telephone networks. Rural schools tend to lack most of the amenities of urban areas and yet the number of children in rural schools is more than that in urban schools. Rwandan schools are also commonly categorised as private and public, whereby, in most instances, public schools are resource advantaged as opposed to the many emerging private schools. It is also the public schools that admit the better performing students, the majority of whom (60%) are usually male students, and where the reverse is also true for the private schools with majority female population (Rwandan Ministry of Education, 2006). This may have implications for female students' participation and access to ICT facilities. However, there are a few private schools which are elitist and hence have the resources to invest in information communication technologies and these are growing in number.

In Rwanda marginalization and being disadvantaged can also be applied to gender disparities. Women are likely to be more disadvantaged than men in terms of access to information and communication technology. In a review conducted by Derbyshire (2003), it was reported that more girls than boys are likely to be deprived of opportunity to gain ICT related knowledge and skills since less girls than boys access secondary school and higher education in the first place. Once in school, girls have less access to the limited computers since they are out-competed by boys. Other issues highlighted were: girls were less confident in using computers, and teachers, as well, exhibited biases against girls through having lower expectations about their competences. It was noted however, that girls benefited more from internet access especially as regards accessing information on reproductive health and sexuality, which information is usually difficult to get from parents and other adults given the conservative nature of the society, (*ibid.,* 2003).

In order to circumvent the problems of inaccessibility and participation in the use of ICTs as noted above, there must be a deliberate policy to close this divide. In Rwanda a number of initiatives to promote ICT use have been put in place, , however, strategies to include the more disadvantaged groups are yet to be outlined. Nevertheless, the pivot of the national policy framework in Rwanda has been the engagement of the population in building a modern and middle-income knowledge-based economy by 2020. This has been framed within a context of past social, economic and political injustices that were visited on the population for a long time since colonial times. The Vision 2020 expressly states that ICT would be a driver of all sectors of the economy. Notwithstanding this, however, an Infodev Survey conducted in 2007 in Rwanda found that only 7% of the population had ever used the Internet and 71% had never heard about it (Farrell 2007: 7). The same report summarises that by 2004, per 1000 Rwandans there were 3 telephone mainlines, 16 mobile subscribers, 65% population covered by mobile telephony, 4 personal computers and 2 TVs (ibid).

In the education sector only one secondary school had a computer by 2000. However, by 2007 over half of primary and secondary schools had computer hardware and over 2000 teachers had been trained in basic ICT skills. It was envisaged then that by 2008 all secondary schools would have Internet connectivity. Of course quite a number of developments have taken place since 2000 to concretise access and use of ICT in the country. The number of mobile subscribers has increased by leaps and bounds, let alone the number of TVs, fixed lines, Internet cafes, and the number of women that have access to Internet, especially in the urban areas. These figures demonstrate the efforts toward digital resource redistribution that Rwanda has affected in a span of 15 years after the 1994 Genocide. Resource redistribution is therefore a key element in attainment of social justice in the education sector, especially through equitable distribution of ICT infrastructure and empowering teachers with ICT skills for teaching and learning. The education sector has also been buttressed by a communications infrastructure that is albeit young (Farrel 2007, Daily Monitor 2005).

The mainstreaming of ICT into the sectors of the economy has followed a deliberate policy that would ensure equitable resource redistribution and identification of sub-sectors that would require additional resources to attain parity. The mainstreaming of ICT in education targets awakening sections of the population and redirecting the national energy into materialising the knowledge economy. In addition, education would instil a conscience of "independence and give voice" (Fraser 2001) to the teachers and learners especially with the increased use of ICT for teaching and learning. In this regard a participatory framework for realising justice in schools must focus on pedagogical reform to empower teachers who in their pursuit for continuous professional development would require "institutionalised patterns of cultural values that express equal respect for all participants and ensure equal opportunity for achieving social esteem" (Fraser 2001). Teachers would require values that do not demean or deny participation based on gender, regional or economic status of the learners. ICT has been eulogised to instil participatory values and its absence is a drawback in the attainment of social justice in the classroom.

The role of education is crucial for young people in Rwanda who comprise 70% of the Rwandan population, with over 50% aged 18 years and below (UNICEF 2007). The Government has notably instituted the use of ICT in basic and secondary education for purposes of empowering the youth to actively participate in the envisaged knowledge economy. This has been facilitated by the creation of an ICT unit in the Ministry of Education which oversees mainstreaming of the use of ICT in the non-tertiary sector, in particular (Rwandan Ministry of Education 2008). To a large extent the actions of the Ministry have seen an expansion of ICT infrastructure in Rwandan primary and secondary schools and the teaching of basic ICT skills to teachers and students since 2005.

The ICT in education policy is thus a crucial building block towards attainment of digital literacy among teachers and learners and will hopefully close the digital divide and attendant social injustices that exist in the country. This applies to all sections of the education sector from basic to tertiary level. Apart from envisaging an increased *access* to basic education for all, both formal and

non formal, using ICT as one of the major tools for learning, teaching, searching and information sharing the ICT in education policy intends also to improve the *quality* of basic education and promote independent and *lifelong* learning, especially for secondary and tertiary education, etc.

The ICT policy environment that aims at resolving the digital divide in Rwanda is further strengthened by the National Science, Technology and Innovation Policy of 2005. This policy spells out the importance of ICT as lying "less in the technology itself than in its ability to create greater access to information and communication in underserved populations" (Republic of Rwanda, 2005, p. 26). It focuses on the application of knowledge and information technology in the fields of intelligence systems and decision making. To achieve this, the policy proposes to, among others things, promote the use and integration of science and computer literacy in schools and in various workplaces as well as intensify training efforts in technical and scientific fields to advance absorption and understanding of the technologies.

Rwanda has also focused on the promotion of science and technology disciplines in the whole education system from primary to university level supported by a modern ICT infrastructure (Rwandan Ministry of Education 2006). The One Laptop Per Child initiative was officially launched in October 2008 and has so far supplied over 5000 laptops in three districts and the government planned to procure 50,000 more laptops in 2009 (Karuhanga 2008). At secondary level, pupils in science section take mathematics, biology, chemistry, physics and information technology in different combinations. Since 2007, ICT was also officially introduced as a subject in the secondary school curriculum. The Ministry, however, laments that:

> enrolment in science, technology and related fields remains low let alone the supply of laboratory equipment. Out of 64936 students in the second cycle of secondary education, only 13282 are in science streams and of these girls account for only 4138. Girls' participation in science and technology is still much lower because of gender stereotyping (Rwandan Ministry of Education).

At the higher education level, teacher training institutions such as the Kigali Institute of Education (KIE) admit a disproportionate number of students into science combinations. Since 2005 KIE has been admitting over 60% of trainee teachers into science disciplines such as biology, chemistry and education, physics, mathematics and education, ICT and education. In addition, all teacher trainees attend compulsory classes in ICT throughout their four year training period. It is envisaged that the graduates will venture into the knowledge economy that the country has set its future hopes onto. The implication of these actions in the education system in Rwanda for the digital literacy are encouraging as well as daunting.

The (Rwandan) National Information and Communication Infrastructure (NICI) Policy of 2000 also recognises ICT-driven education as a driving force for development. Education policy actions associated with NICI include the use of ICTs for formal and informal education, improvement of formal and informal education in ICTs, raising of public awareness of ICTs, helping educational institutional improve their business processes and promotion research and development (Republic of Rwanda 2007, Harrison 2005). The Daily Monitor Supplement (2005) sums up the sentiments of the government of Rwanda with regard to ICT in development: "as a nation we have decided that developing a highly qualified and skilled human resource is one major way we are going to take our country forward. But you cannot develop a potential human resource without tapping ICT as a tool," he said. "ICT plays a very big role; information is power. When people are informed, they are able to make big and informed decisions and Information is the primary product of ICT" (Quote from a Minister in the Rwandan Government, Daily Monitor Supplement, 2005).

Field Research Findings on the Use of ICT in Schools and the Quest for Social Justice

Can the use of ICT in schools in Rwanda promote the principles of social justice, in schools? From the outset it could be argued simply that the digital divide and hence social injustice would be adequately addressed by increased use of ICT in schools. The question that has lingered, however, as resources have been supplied to schools, is whether the schools have the capacity to utilise them for attainment of ICT-inspired pedagogy in the classroom. Is ICT-led pedagogy relevant to the educational needs of the schools and their learners or is it a top-down led initiative of national actors removed from the peculiarities of school environments?

Research conducted by the EdQual team between 2005 and 2008 found that basic ICT infrastructure that may impact on the provision of quality education exists in both primary and secondary schools. From the data collected during the baseline survey and immersion phases of the project in 2006, it was found that the least equipped primary school had 2 functional computers and the most equipped school had 7 functional computers. The least equipped lower secondary school had 11 functional computers and the most equipped had 32 functional computers. In 2007 most of the secondary schools in Rwanda, had been supplied with 20 new computers, each from the Government. These computers had basic Office software and could handle graphics especially for computer simulations. In addition, individual schools got computers from donors or as a result of own their initiatives or by chance. Within the project schools, however, there are still schools which are disadvantaged and have not benefited from the Government-initiated computer project. Teachers have had to be creative to ensure that learners still pursue their ICT lessons using the few available computers.

The frequency of accessibility to computers by learners is varied. During the field survey in 2007 it was found that slightly above 52% of learners among the schools surveyed have access to computers for one hour per week. Below 30% of the respondents have accessibility of up to 3 hours a week and below 10% have access of less than 30 minutes in a week and once a month[1]. This implies that schools may be restricting learners to have easy access to the available computers or that schools may have restricted the use of computers to simple learning of ICT skills rather than using them as tools for learning other subjects or performing teaching and learning activities. In particular, most rural schools are the worst affected by this inequality in access to ICT resources.

The integration of schools in their immediate environments is one aspect of ensuring accessibility to ICT resources in schools. In interviews with schools administrations it was acknowledged that the Government encouraged schools to work with communities in the use of ICT. However, 50% of the schools surveyed in 2006 indicated that they were not able to allow the neighboring community to use the ICT resources in the schools. Reasons for this ranged from scarcity and vulnerability of computers, unreliability of Internet connection, costs for technical support and electricity. These reasons seemed universally valid for all schools in this survey. It is apparent, however, that schools were not in favour of connecting with the neighbouring communities especially if it had to do with facilitating accessibility to the school's equipment. This may necessitate deliberate intervention by the state, particularly in encouraging income generation in schools as a drive towards self-sustenance and less reliance on public remittances from the state.

The building of a knowledge economy based on the potential of education systems requires close interaction between education actors who share in the values of the nation and the education system. Evidence from teacher training workshops in 2006, 2007 and 2008 as well as discussions with teachers during the monthly school visits, indicated that there was lack of collaboration and interaction between administrators and teachers in the use of ICT for administrative tasks and for teaching and learning. A number of administrators are possessive of the ICT resources and control

[1] Eight students were picked from the participating classes in each school.

accessibility to the computer labs to the detriment of use by learners and even some teachers. Data also indicates that the use of ICT for teaching is mainly limited to the teaching of ICT skills rather than as a tool for subject teaching and learning in mathematics and science. In this case, the full potential of ICT resources in schools has not been exploited by teachers and even learners.

The issue of participation and recognition of variety in the classroom emerged during the surveys. During focus group discussions with learners in project partner schools, it emerged that boys tend to be more exposed to the use of ICT outside school than girls, and therefore boys tend to be more involved in ICT-assisted lessons. This challenges the assertion by teachers that boys and girls participate equally in ICT assisted lessons. When asked whether boys and girls are equally motivated to use ICT, 71% of the teachers who use ICT in teaching and learning indicated that both sexes equally have the enthusiasm and motivation in using ICT in class.

The level of teacher professionalism in using ICT was raised and data from school visits in 2006 and 2007 reveal that the level of ICT skills among teachers, especially with regard to its use as a teaching and learning tool is low, notwithstanding government efforts to equip schools with computers and the short training given in ICT skills. By contrast, those teachers in NEPAD (New Partnership for Africa's Development) e-schools were intensively trained as part of this demonstration project. In general, most of the teachers in Rwandan schools have this handicap, which might be a major contributory factor to the somewhat deflated enthusiasm in the mainstreaming of ICT use in the normal teaching and learning process.

Teacher and learner enthusiasm in the use of ICT in the classroom is high, and this could bolster the level of participation in classroom activities. Data collected since June 2007 indicates that learners appreciate the use of computers for learning sciences (biology and mathematics):

> "We use computer to research about different things"
> "We learn much more, even some things the teacher does not tell you, you can learn through searching the computer"
> "When the teacher draws something on chalkboard it is not the same as seeing the drawing on computer. He might forget some of the things but on computer we see everything"
> "Using computers assists in discovering other things and this makes you curious to keep trying and in the end you learn much more"
> "Computers help in keeping concentration on the subject and not doze off"

Teachers also appreciated the use of ICT in teaching sciences. A biology teacher was of the opinion that:

> "If you plan well you can cover much in a shorter period. In the usual class it is difficult for us since students cannot see the diagrams/simulations and yet we do not have other teaching aids, so you have to teach a little every time, say the same lesson would take about 3 lessons, yet here it takes one lesson and that is ok."

A chemistry teacher was of the opinion that:

> "When students are on a computer they feel interested and motivated. Secondly with experiments for example you are able to combine the lesson (theory) and practicals (experiments). When you go to the lab, students become more active and participate. In chemistry all lessons can be taught using computer since there are some experiments on Internet that can be downloaded. Normally chemistry is a science that requires doing experiments. In a situation where there are no labs using a computer can serve better."

Notwithstanding teacher motivation and enthusiasm in using ICT, classroom observation during the monthly visits showed that integration of ICT in regular teaching and learning was not done in almost all schools. In a few schools and rare cases where ICT was used, the teaching and learning

was even more teacher-centered than could have been expected since less time was accorded for student participation in an ICT enabled class. This implies that the availability of ICT in schools may not necessarily lead to attainment of equality and equity in schools.

The use of digital materials supplied to schools was further investigated by focusing on the extent of utilisation of the e-Health Program in selected schools in Rwanda. The e-Health Program was designed to promote health literacy among school administrators, teachers, learners and the neighbouring communities with regard to HIV/AIDS, tuberculosis, malaria, sexuality, nutrition, condom use and reproductive health. It was found that five of the six schools surveyed had never used the e-Health materials to empower their learners, administrators and even the neighbouring communities on themes related to their daily livelihoods. This was happening amidst an acknowledgement that the digital divide can be addressed through employing digital tools at the school level.

The e-Health Program is found only in six NEPAD e-school Demo Project schools. Whereas the supply of the equipment narrowed the resource gap it, however, did not narrow the skills gap due to impediments within individual schools. Field research conducted in 2008, however, found that all the Rwandan e-schools were relatively conservative in the use of the e-Health Program. A discussion with a focused group of science teachers in the respective schools showed that these teachers did not use the software for purposes of promoting health literacy. It was also found that whereas all the six schools had the software on their servers only up to three of the twenty computers in each school could access the server thereby denying accessibility for a majority of teachers and learners to the health software. Two schools had never used the health point software and one school used it to supplement teaching content in science subjects, especially biology.

An important element in the e-school project was the involvement of the neighbouring communities in using the ICT infrastructure for social activities as well as self-learning. During the baseline survey in 2007 and the field survey conducted in 2008, it was found that the neighbouring communities to all the NEPAD schools had not had a chance to utilise the e-school. This was contrary to the aim of the NEPAD secretariat of empowering communities where the schools were located, especially in the rural areas of Africa. Schools blocked accessibility to what they called "outsiders" ostensibly for "fear of damage to equipment and cutting down on the cost of electricity"[2]. Accessibility for learners was controlled by the school administration, normally twice a week. Teachers, however, have unlimited access to the computer lab, which is normally intensively used during break times and specific periods when the teachers do not have lessons to teach. The ICT champions in three boarding e-schools indicated that neither teachers nor learners were allowed into the schools computer labs on weekends. The increasing accessibility to computers outside school by teachers and learners could hence be attributed to the schools "policy" of disallowing accessibility on non-school days and hours.

Apart from failure to exploit the huge potential that the ICT equipment in schools provides, e-schools have also been slow in exposing learners to the information contained in the e-Health Program. An evaluation of the program's digital content showed partly that it was designed and produced in South Africa and most probably influenced by a neo-liberal educational standpoint. The rationale for the program is not given, and little emerges in the program that connects the learners to their immediate social environments outside South Africa. There was hence an apparent sense of alienation on the side of frontline implementers at the school level. This is a definite cog in the wheel of efforts to use ICT to realise educational objectives.

Almost all teachers (93%) in all the Rwandan NEPAD schools surveyed in 2008 were of the view that some of the information contained in the health program was too lurid and that it would not be appropriate to expose learners to the stark facts of say reproductive health and HIV/AIDS transmission. This position was strongly held by a school in Southern Province. In fact, all learners

[2] Field Notes and Data

in the school had not had the chance to use the programs at school. Even teachers found it a "waste of time" or "against cultural beliefs" to be seen sitting at a computer watching and listening to some "information that is not culturally sensitive". These sentiments point to the fact that digital content needs to be culturally sensitive and locally generated. The above sentiments concur with the arguments advanced by Heemskerk, Brink, Volman and Dam (2005) who argue that, "the issue of how to be considerate of different cultural values and taboos in the images used in a program is one of the more complex issues in the design of culturally sensitive educational materials". In essence, the digital divide could also be a consequence of such typical alienation caused by digital content designers.

The Challenge of the Digital Divide for Education in Rwanda

The opportunities emanating from a proactive ICT policy framework in Rwanda provide a basis for attaining social justice and the efforts to narrow the digital divide in the country. The policy framework has had a downward effect on pedagogy in schools and hopefully on the traits displayed by teachers and learners in educational practice. It is presumed that government intervention into the social and economic status quo is crucial, especially in providing physical and human resources to attain the dimensions of redistribution, recognition and participation that form the crux of understanding social justice in emerging economies.

The education sector in Rwanda enjoys considerable political will and a supportive leadership in the design and implementation of programs for mainstreaming of ICT in schools. Political will is buttressed by a declarative national aspiration expressed in the Vision 2020 that identifies ICT as a crosscutting issue in all sectors and in particular the pillar of human resource development. This has seen the formulation of forward-looking proactive policies in the Ministry of Education and implementation of schools-based ICT projects.

Teachers and learners in Rwanda are generally very receptive of ICT ideas and innovations. This has facilitated the introduction of computers in schools and the teaching and learning of basic computer skills. During the annual EdQual teacher training workshops, teachers exhibited ambition and motivation in learning new concepts and familiarising themselves with new innovations and techniques of using ICT in the teaching and learning of mathematics and science. The learners' enthusiasm was exhibited during the monthly observations in schools by EdQual researchers. Most notable was the eagerness to use computers to solve mathematical problems and use simulations in the science especially chemistry, physics and biology. Tapping the motivation and enthusiasm today would herald a new era towards building capacity to narrow the gaps that exist in the use of ICT in various sectors of the economy.

Informal out-of-school learning is a prominent feature of ICT use in education in Rwanda though it has gone unrecognised in the design of school curricula and continuous professional development of teachers. Teachers' and learners' enthusiasm in ICT use was primarily exhibited by the frequency of computer use outside school. Learners were especially outgoing in accessing computers with 79% having used computers outside school for various activities including reading about sports, sending and reading emails, reading news on the Internet, listening and searching for music, playing games, watching films, and looking for information concerning schoolwork. Asked where they access the Internet, the vast majority (90%) of young people indicated that they accessed it in Internet cafes (for day school learners, and during holidays for boarding school learners). The ability of learners to have a higher accessibility to computers outside schools emerged as an obvious challenge to schools to rethink their policies towards ICT use inside schools.

The dimensions of social recognition and participation arising from out-of-school learning emerged with an inquiry into gender and rural differences in the use of ICTs outside school and the potential for exacerbating the digital divide. In interviews carried out with teachers and students in 2008, it was observed that learners from rural areas and particularly girls in the urban areas may be at a

disadvantage when it comes to acquiring ICT skills informally. This can be illustrated by the following quote:

> Some learners have computers from home and know something, others come from the village and have never seen the computer; the computer is like an animal to them. So you have to treat these differently, you have to start from scratch…so this is not only a gender thing but what experience one has had.' Interview with teacher

Also from an interview with students, one of the girls explained why some boys may be better with computers than girls:

> Student: Boys usually do better on the computer, the practical part…
> Interviewer: Where do boys learn this?
> Student: Boys interact with other people or go to internet cafes, whereas girls are usually at home.

It should be explained here that in most homes in Rwanda it is a common feature for girls to stay at home and take care of household chores while boys may be free to spend time outside the home. It would not be uncommon to find that among families who own computers boys will have more access to use the computer. This raises issues of inequalities amongst young people and the different ICT knowledge and skills that they bring into the classrooms and how this impacts on their learning.

The Rwandan ICT in education scenario faces considerable challenges which might impinge on the ability to address the digital divide as well as realise social justice in education. First and foremost, accessibility and use of computers in schools in Rwanda is hampered by a variety of factors. Schools generally complain that equipping schools with computers and other ICTs is costly and no individual school can do it alone. Furthermore, the cost of maintaining the equipment, even for donated equipment, is usually transferred to the schools themselves. This has led some schools to restrict student access to the computers in order to 'protect' them (computers).

A conspicuously observable factor in the challenges of ICT usage in schools is the problem of overcrowding in computer labs. In the partner schools surveyed it was found that five students share a computer during class sessions. This was evident in government supported schools. Some private schools had a ratio of 1:2 during class sessions.

Though the Internet has been eulogised as a window to the world, a majority of Rwandan schools lack Internet connectivity; either due to lack of resources to connect or lack of electricity to power the computers. An extreme case of the need for Internet connectivity, however, was demonstrated by the management of one of the secondary schools in Southern Province. The school decided to locate its 20 computers at the shopping centre 5 kilometres away. It also employed a security guard to protect the equipment. Its 351 students and 14 teachers take shifts to use the equipment to meet their educational needs. Notwithstanding the distance from the school, students and teachers were enthusiastic about using the equipment just like their urban counterparts.

The challenge for Rwanda is not availability of ICT equipment. The country needs to invest more resources in capacity building targeted at acquiring relevant ICT skills and using the skills to materialise the integration of ICT in the educational administrative and pedagogical processes. So far, ICT teaching in schools is limited to the basics of using a computer as a clerical tool and not necessarily as a tool for teaching and learning. A few resourced schools in Kigali and a couple of NEPAD e-schools, however, have tried to integrate ICT in the normal teaching and learning processes. This indicates that there is a need to move beyond physical resource distribution to schools.

There is evident high turnover of teachers, either leaving the teaching profession or changing schools especially from public to private schools. This phenomenon has inconvenienced a number

of schools that spent their resources in training such teachers in the use of ICT for teaching and learning. As a result, teachers tend to be overworked in the face of limited ICT facilities in schools.

There is a tendency to generalise the learners' use of ICT in the classrooms. Teachers indicated that there was no difference in ICT use between boys and girls. This, however, poses problems due to the fact that there is an apparent discrepancy in exposure to ICT resources between boys and girls. Most critical is that rural learners were more disadvantaged as a result of cost and energy factors. The issue of the digital divide and realisation of social justice therefore remains pertinent as the country moves further into attaining knowledge society status.

Concluding Remarks

The digital divide in Rwanda is real. With a sizeable proportion of the population being digitally illiterate the country needs to invest in the basics of literacy and numeracy in order to grow a culture that would appreciate the potency of science, mathematics and technology. This would serve as a foundation for further investments in the ICT domain that would catapult the economy into the modern digital age. Schools serve as a pinpoint for the realisation of the country's dreams and it is vital that the youth be deliberately focused on. The opportunities identified above would also serve as challenges especially with a view to their sustainability over time.

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