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Competence Network for e-Inclusion and Assistive Technologies

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ABSTRACT: Information and Communication Technology (ICT) has changed how people communicate, transfer knowledge and perform everyday tasks. Access to internet is an important factor in African countries, where availability of computers and smartphones constantly increases. ICT-based assistive tools allow Persons with Disabilities (PwDs) to learn, work in a well-paid job and participate in social activities. However, suitable assistive tools are often not available and unaffordable to people with disabilities. Meru University of Science and Technology (MUST) has established various resources in the sector of Assistive Technology (AT), including various Open Source designs for alternative computer input solutions under Competence Network for e-Inclusion and Assistive Technology (CNEAT) program. The objective of the program is to establish, collect, extend and share knowledge, tools and best-practice models for affordable Assistive Technology (AT) and its application. MUST established AT centers for learners living with disabilities in Igoji Small Home, Ala Kara small home and Athi Special School in Meru County. The assistive devices were easily configurable (FlipMouse) and usable for persons without limbs. 90% of users prefer to work using the assistive devices and 80% of users prefer to use the system frequently. 60% of the users found it easy to use and the various integrated functions of the system, while 80% felt very confident using the system. The Schools lack ICT devices that can enable them to access learning content provided by the Kenyan Government. Consequently, AT Centre at MUST has established training programme for information technology and engineering students with a view of fabricating FlipMouse and FABI for learners with disabilities. ATs would thus, raise self-efficiency of PWDs and hence reduce poverty for Sustainable Development.

Key words: Assistive Technologies, Sustainable Development, e-Inclusion, Open Source, ICT

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I. INTRODUCTION

ICT-based Assistive Tools allow individuals, groups and organizations improve their productivity by employing ICT aided technologies to improve performances. More importantly, ICT based technologies have changes lives of otherwise less productive human resources like physically challenged persons in the society.

In recognition of these important roles played by Assistive Technologies for disadvantaged persons, Meru University of Science and Technology (MUST), University of Zimbabwe and the University of Applied Sciences Technikum Wien established various resources in the sector of Assistive Technology (AT), including various open source designs for alternative computer input solutions under Competence Network for e-Inclusion and Assistive Technology (CNEAT) programme. The aim of the program was to establish Assistive Technology centre in Kenya and Zimbabwe in order to share knowledge, tools and best-practice models for affordable Assistive Technology. The centres are expected to serve as referral units for disseminating Assistive Technology support services for physically challenged persons.

The primary objective of this project was to establish infrastructure, programmes of learning and networking activities fostering Assistive Technologies and e-Inclusion in the target countries, thereby reducing the marginalization of persons with disabilities. Key aspects are the dissemination of knowledge and best-practice models for the creation and application of low cost assistive solutions. It further supplements the global efforts of improving quality of life of the persons with disability.

This project contributes to achieving the implementation of the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) in particular article 9 on accessibility, enabling persons with disabilities to live independently and participate fully in all aspects of life as well as articles 24 (rights to education) and article 27 (rights to benefits of work and employment). The Convention is intended as a human rights instrument with an explicit, so-economic development dimension. It reaffirms that all persons with all

types of disabilities must enjoy all human rights and fundamental freedoms, including freedom from marginalization and poverty. It clarifies and qualifies how persons with disabilities can effectively exercise their rights. The Convention marks a paradigm shift in attitudes and approaches to persons with disabilities from viewing them as objects of charity and social protection to subjects who are capable of claiming rights of decision-making for their lives based on their free and informed consent as well as being active and productive members of society (UNCRPD, 2006).

The project also contributes to national development strategies of the Government of Kenya (GoK) as envisaged in the Kenya Vision 2030 (GoK, 2016). The objective of the Kenya Vision 2030 Social Pillar is investing in the people of Kenya in order to improve the quality of life for all Kenyans by targeting a cross-section of human and social welfare projects and programmes specifically through education and training (Gok, 2016). The vision further spells out the need for empowering different cadres of human resources by availing opportunities for advancing their capabilities to be more productive. Persons with Disabilities (PwDs) form the bulk of these special categories of human capital to be developed through assistive technologies, tailor-made training and skills enhancement for self-reliance. Legal and situational frameworks have also been instituted to legitimize the position and importance of persons with disabilities. The Government of Kenya has adopted a number of laws and policies pertaining to persons with disabilities, including their right to productive and decent work and access to basic services (GoK, 2010).

In addition, Sub-Saharan African countries including Zimbabwe has embraced the spirit of improving human capital assets as envisaged in Sustainable Development Goals (SDG) no. 1 (no poverty), no. 8 (decent work and economic growth) and no. 10 (reduced inequalities) (SDG, 2016). Given the vulnerable nature of persons with disabilities, there is dire need to cushion them against extreme poverty, promote decent work and economic growth for them and reduce inequalities through specialized ICT-based support, education and training. Assistive Technologies is one such instrument for empowering PwDs out of abject poverty and enhance their dignity.

Locally, existing efforts of the academic partners to support persons with disabilities and their families would raise their integration into the society socially and economically. The outcomes focused by the three (3) partner institutions namely Meru University of Science and Technology, Muranga University of Technology and Kenya Methodist University under Competence Network for e-Inclusion and Assistive Technology (CNEAT) is meant to transform less recognized and utilized human capital to more productive labour. This transformation is expected to change household incomes, reduced social dependence and improve the image disadvantaged persons amid the larger society.

II. LITRATURE REVIEW

The Centre for Assistive Technologies (CATs) follow a "bottom-up", demand-driven approach that promote open knowledge, creativity and self-entrepreneurship. The CATs also act as coupling interfaces between the academic teaching and the practical application of prototypes in the real world, to solve concrete social challenges. Information on the quality of the prototypes flows back to the academic institutions – a valuable input for the evaluation and refinement of their Research and Development (R&D).

A webpage is provided, collecting information from peers, best practice models, and construction guidelines, making results of the CNEAT available to the public and to other initiatives supporting persons with disabilities. The 3 partner universities in Kenya and other stakeholders are instrumental in exchanging and building up their experience in the application of Assistive Technology.

A common problem of traditional academic educational strategies is the gap between theoretical knowledge and practical application and crafts. An education system that only emphasizes memorizing and ignores doing, making and thinking does not promote critical thinking abilities and a propensity to solve seemly intractable problems. Increasing impact of engaging in scientific and design problems is been felt in the innovation world. These bottom-up involvements use tinkering and design as models for both research and public engagement. It democratizes science and initiate a type of grassroots science diplomacy, support research in developing countries, offer a convergence between philosophy and design and connect the creative practices of thinking and doing. The prototypes addresses the present technological, social and political challenges and inspire citizens to learn and engage in the development and regulation of these technologies (Conway &Seward, 2009).

III. THEORETICAL ANALYSIS

Assistive Technology is a well-designed intervention for making life richer and better for PwDs. Theoretically, every person is endowed with different levels of competence from another. However, research affirms that competencies can be modified and developed from different perspectives and approaches. Thus the Theory of Competence Development underscores need for competence upgrading and competence renewal where such competencies are either lacking or inadequate.

Competency is described as set of knowledge, skills, behaviors, and attitudes related to task success or failure. The competence levels of the members of a society are influenced by various factors such as individual specific characteristic, organizational resource base, decision-makers ways of perceiving competence and negative attitudes about the task to be done (Dessler, Balkin&Cardy, 2010). Thus, competency profiling and mapping helps in determining effective learning and development approaches by identifying the behaviours, knowledge, skills and attitudes that are necessary for successful performance in a task. Competency-based education and training support learning by focusing on competencies needed for job performance, mechanism for measuring competence, framework for enhancing competence and means of determining how well learning has occurred (Gomes, 2007). Applications of competence mapping techniques have shown significant benefit to individuals, groups and organization in keeping abreast with occupational demands (Yuvaraj, 2011).

In this study, persons with disabilities at Igoji Small Home, Ala Kara Small Home and Athi Special School in Meru County, Kenya all have certain capabilities that have been suppressed by the physical challenges. These challenges have socially and culturally negated the human potentials inherent in the pupils of these schools. Based on the foregoing theoretical framework, Assistive Technologies is applied to the research situation as a validation of promised competence development among the beneficiary institution`sPwDs. More specifically, manipulative skills to utilize the assistive technologies, basic knowledge to handle Assistive Tools and restructuring of the beneficiary attitudes from disabled person to able but challenged person would form critical components of competence development in this project.

IV. APPLICATION

Open government data has reengineered the public sector by adoption of a service oriented approach (SOA) (Nasr, Gross, & van Deursen, 2010). This is in the focus of increasing government flexibility and simplifying IT infrastructure so as to fulfill the government objectives. The existing rapid change and evolution in Kenya government has forced IT to innovate constantly; to make governments flexible, efficient, reduce complexity and minimize costs. Open data has been applied through web portals to provide basic public service through the government. The services include application for certificate of good conduct, searching and registration of business name, driving license application and renewal,filing of revenue collection, death and birth registration.

By opening up data to the public sector governments have been able to provide timely information and public services to its citizens round the clock (Chakravarti & Varma, 2008). Open data also enables citizens to conduct their transactions through government provided portals. This transforms the government from places where the government merely advertises their achievements to the public to interfaces where governments provide efficient services to its citizens. The CNEAT project intends to enble the PwDs to enjoy the digital services offered by the government.

The approach of the CNEAT project is a combination of traditional educational methods characterized by academic lectures and scholarships with novel strategies for sharing knowledge and creating innovative solutions to local problems. Consequently, the CATs serves as places for experimentation, collaboration and innovation development. It is open not only to university members but also to other stakeholders and individuals. This is an approach for making assistive devices and rehabilitation technology available to local communities in Kenya who may not afford to acquire personal devices for home use. CATs offers number of resources and potentials to the clients. There is space for meetings with engineers, students, caretakers and end users. The end users and their families can test existing tools, select tools and propose adjustments for individual use together with experts. Specific tools can also be bought or borrowed for testing at home so that families can find out if a device or solution really fits their needs.

Student-Client relations can be established through participatory solution design and development. University students can develop concrete solutions for a particular person and the same solution could then be also useful for others with similar characteristics. In addition, commercially available off-the-shelf solutions such as Augmentative and Alternative Communication (AAC) devices, special input devices, eye tracking, face tracking solutions and accessibility software are available at the centre. Novel tools which were created by local innovators, in the course of student projects or in scientific work can also be evaluated with end users. This gives opportunity for modification or an improvement on the existing technologies.

Necessary documents and information for working with end users will be provided. This will include informed consent, ethical regulations, legal rules, hygienic and safety guidelines and evaluation forms. CAT would avail manufacturing resources such as rapid prototyping tools, Computer Aided Design (CAD) tools, design software in collaboration with existing laboratories of the partner universities. Access to these resources is granted for university members and students who work on CAT-related projects and external innovators who want to implement viable ideas in the sector of inclusive design. MUST university workshops can be accessed for building low cost / low technology assistive solutions such as special mounting solutions or grip aids and soldering by innovators.

V. RESULTS AND DISCUSSIONS

After training and demonstrations of AT at the three (3) pilot PwD schools in Kenya namely, Igoji Small Home, Alakara Small Home and Athi Special School, an evaluation of the uptake of the technology was carried out to find out the ease of Configuration and Usability of the assistive devices.

When asked to comment on the ease of configuration of the FlipMouse (Finger- and Lipmouse) device, the users indicated that the FlipMouse device were easily configurable and usable. The users further indicated that the assembly of the FABI (Flexible Assistive Button Interface) device was easy. The software installation steps were equally easy to follow and configure. It was also established that the software was compatible with existing computer devices. Summary findings is presented in figure 1.

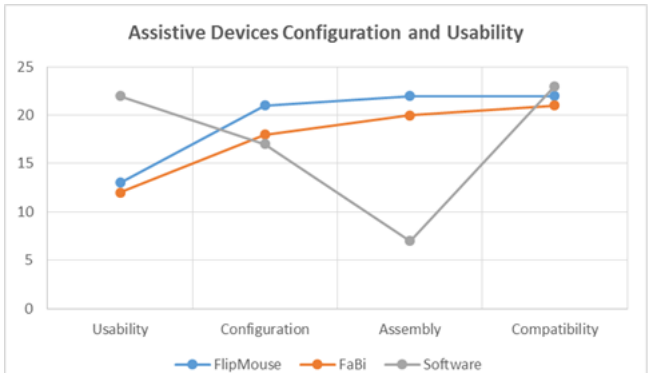

Figure 1: Usability, Configuration, Assembly and Compatibility.

VI. CONCLUSION

Assistive Tools are important innovative technologies in the researches for the decolonizing the spirit of disability with regards to human wellness. In this paper, customized Assistive Technologies disrupted the natural setup of persons living with disability. This is the first time Assistive Technology is applied in the region with such high levels of user-maker participation. Customization of the hardware and software becomes pretty fast and feasible when local inputs of device development are envisaged. Compared with other methods, the method proposed by Assistive Technologies in Zimbabwe and Kenya is more suitable and flexible on the assistance of persons living with physical disability. The broad applicability of the programme will be reviewed when the results from the users over time with comments are received. The proposed technologies are applicable to persons with physical disability.

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