Information Communication Technology reskilling framework for empowering Knowledge Societies in Uganda

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Abstract: The worldwide trend towards digitalization aims at creating knowledge societies that shapes the way we live, communicate, learn, and work. Achieving this requires developing skills for innovative use of digital technologies, with education, ICTs, science, technology, and innovation forming the pillars that support this initiative. To effectively participate in a knowledge society, individuals should have multicity of skills that enable them to engage in multiple jobs through reskilling or upskilling. The upskilling programmes are seemly not readily available. This study investigates ICT reskilling framework to enable creation of solutions that could provide a platform through which individuals can obtain skills required for job market without formal education/career path. The study concludes that ICT reskilling platform enables production of multiple skilled human capital. It is recommended that the government and private institutions develop initiatives to promote digital reskills/upskilling through lifelong learning in forms of innovation hubs. In addition, efforts should identify countermeasures that can support the establishment of ICTs in underserved communities, providing broader access to a variety of ICT resources.

Keywords: Digitalization, Knowledge society, Reskilling/Upskilling, information communication technology (ICT), Lifelong learning.

1. Introduction

The world's increasing digitalization has brought about the emergence of knowledge societies. These communities are formed, shared, and leveraged to enhance individuals' well-being by utilizing knowledge [1]. The constant evolution of information technology has yielded a wealth of data that can be transformed into knowledge and insight. This data has provided fresh perspectives on societies and their endeavours. The progressive digitization of the world has given rise to knowledge societies [2]. These societies are created, disseminated, and utilized to improve people's lives through the use and application of knowledge. The continuous development of information technology has resulted in an abundance of data that can be processed into knowledge and wisdom [3]. This data has opened up new ways of understanding societies and their activities. Data technologies enable people to live, interact, and learn from how they interact with their environment [4]. This allows for improving the way society behaves continuously. Consequently, it influences the world of work. For example, a society that relies on agriculture can change its farming methods by adopting new practices based on previous farming practices.

For a society to be a knowledge society and actively participate in the information economy, it needs to have foundational elements that support and define its capacity to generate, utilize, and disseminate knowledge effectively [5], [6]. These elements are known as the four pillars of the knowledge society - Education, Information and Communication

Technologies (ICT), Science, Technology and Innovation (STI) [7]. Together, these pillars contribute to the establishment of a society that values and leverages knowledge as a primary driver of social, economic, and cultural progress. They are the structural components upon which the concept of a knowledge-based society is built. The integration and utilization of technology are crucial components of progress. It allows us to access, create, manage, and share information and knowledge effectively. This includes digital infrastructure, connectivity, digital literacy, and the efficient use of ICT tools for communication and knowledge dissemination [8]. Furthermore, promoting and supporting innovation, research, and development across various fields encourages scientific inquiry, creativity, and the pursuit of new ideas, technologies, and solutions to address societal challenges and enhance progress which can be done through provision of quality education and lifelong learning opportunities is essential

The education system in Uganda is divided into primary, secondary, and tertiary levels, which are governed and regulated by the government and its agencies [9]. Primary education involves seven years of study, while secondary education lasts for six years and is further divided into four years of lower secondary and two years of upper secondary. Students can choose to study science subjects or arts in upper secondary, with a focus on a specific course at the university. Tertiary education can range from two to five years, depending on the nature of the course. While subjects taught at the secondary level impart basic knowledge and skills, some students may find it challenging to transition into the workforce due to the limited scope of these subjects (Cervera & Cantabrana, 2015).

Following completion of secondary school, students have the option to pursue tertiary education. This encompasses a diverse range of institutes, colleges, and universities that offer technical and vocational training, as well as academic and professional programs. The National Council for Higher Education (NCHE) is responsible for regulating these institutions, with the aim of producing graduates who are equipped to enter the workforce and make meaningful contributions to the economy within their specialized fields [11]. Tertiary education places a strong emphasis on the development of specialized knowledge and skills, while also providing opportunities for lifelong learning [12], [13]. However, as the knowledge and skills acquired can be highly specific, many graduates face challenges in securing employment, thereby creating a disconnect between the education system and its intended outcomes [14]. For example, a doctor specializes in medical practice, while a teacher focuses on educating students in a particular subject. However, this specialization can sometimes limit flexibility and cross-disciplinary skills. To address this issue, a reskilling program that focuses on multidimensional skilling could prove highly effective. This study, therefore, designed a framework for reskilling and upskilling individuals across various sectors.

1.2 Objectives

The purpose of this study was to propose a reskilling/upskilling framework for emergent Knowledge Societies

This has been achieved through the following objectives

1. Propose a reskilling/upskilling framework
2. Using the framework abstract view of the reskilling/upskilling program is presented

Methodology

The study employed a deductive cross-sectional approach, drawing from a literature review of 120 articles sourced from Scopus-indexed journals. The aim was to identify components of the ICT-based reskilling framework. These identified components underwent validation through qualitative interviews with five ICT specialists, who were specifically chosen for

their expertise in ICT Training. Additionally, five education and training experts, and five human resource practitioners were also interviewed.

The articles were selected based on keywords that included reskilling, upskilling, innovation, ICT training, education, challenges in university education, and modelling knowledge societies, focusing on the reskilling domain within the framework for preferred systematic reporting[15]. From the initial selection 120 articles from the search databases, 57 articles were deemed suitable for in-depth analysis. Subsequently, these 57 articles were thoroughly examined to formulate a framework. This rigorous methodology was employed to ensure the accuracy and reliability of the research findings, particularly in the context of reskilling the upskilled workforce[16].

In addition to identifying the framework's components, the interviews conducted to verify the components of the framework, subsequently, other information about reskilling was discovered. The initial interview guide consisted of 15 questions. However, following a pilot study, the questions were refined to 10 clear and concise questions to ensure interview consistency. Participants were selected based on their expertise in reskilling, Respondents' details were kept confidential throughout the interview to maintain anonymity and confidentiality. Participants were informed about the study's purpose and assured of the confidentiality of the information they provided. They were given the choice to decline to answer any questions. The collected data were transcribed, coded and analysed. The results where presented in the study

Technology Description

In this section, a skilling framework was proposed through literature review and expert review.

Components of Reskilling framework

An effective framework for reskilling or upskilling aimed at empowering a knowledge-based society generally consists of several crucial elements. Firstly, conducting a thorough needs assessment to identify skill gaps and analyze industry trends and technological advancements is vital. This information is then used to develop tailored training programs that cover both technical and soft skills [17]. Integration of technology and promotion of digital literacy ensures accessibility and relevance in a rapidly digitizing world [18]. Establishing a lifelong learning framework encourages continuous skill development, with pathways for upskilling throughout an individual's career[19]. Collaborative partnerships involving government, educational institutions and industry stakeholders amplify resources and expertise is a necessary component [20]. Effective monitoring and evaluation mechanisms track program effectiveness and participant outcomes, informing iterative improvements [21]. Supportive policies and adequate funding are crucial for sustaining initiatives and fostering an inclusive learning environment, addressing barriers to access and equity [22]. Incorporating these components into a cohesive model not only empowers individuals to navigate the complexities of the knowledge economy but also cultivates innovation, adaptability, and resilience essential for societal progress and prosperity.

In the context of reskilling and upskilling, the learning environment is evolving in several key areas[23]. The dynamic and adaptive approach to education emphasizes practical, industry-relevant skills, flexibility, and a lifelong commitment to learning, which caters to the needs of individuals navigating a rapidly changing job market. Table 1, describes Components of reskilling model as portrayed in literature.

Table 1: Components of reskilling model as portrayed in literature

Component	Top level activities	Medium level activities	Target audience	References
Identifying skill gaps	• Workforce Analysis • Employee skills assessment. • Prioritizing skills gaps • Resource allocation • Implementation and delivery • Continuous improvement.	• Competency Mapping • Performance Appraisals • Learning Analytics • Job Observations and Shadowing • Benchmarking • Project Assignments and Rotations • Mentorship and Coaching	• Remote workers • Employees • Unskilled individuals • Drop outs	[20], [24] [24]
Supportive policies	• Flexible learning • Leadership and commitment • Lifelong learning culture. • Collaboration with education institution • Metrics and data driven insights	• Peer learning and networking. • Customized training programs. • Access to external learning resources. • Learning management systems.	• Government Agencies • Legislators and policy makers. • Educational institutions. • Employers and industry leader • Researchers and policy analysts.	[25], [26]
Funding	• Budget allocation and planning • Securing grants • Monitoring and evaluation • Adaptability and innovation. • Policy and legislative advocacy		• Government agencies • Private sector • Educational institutions. • Donors and crowd funding platforms. • Labor unions	[27], [28] [29]

The proposed Reskilling Framework

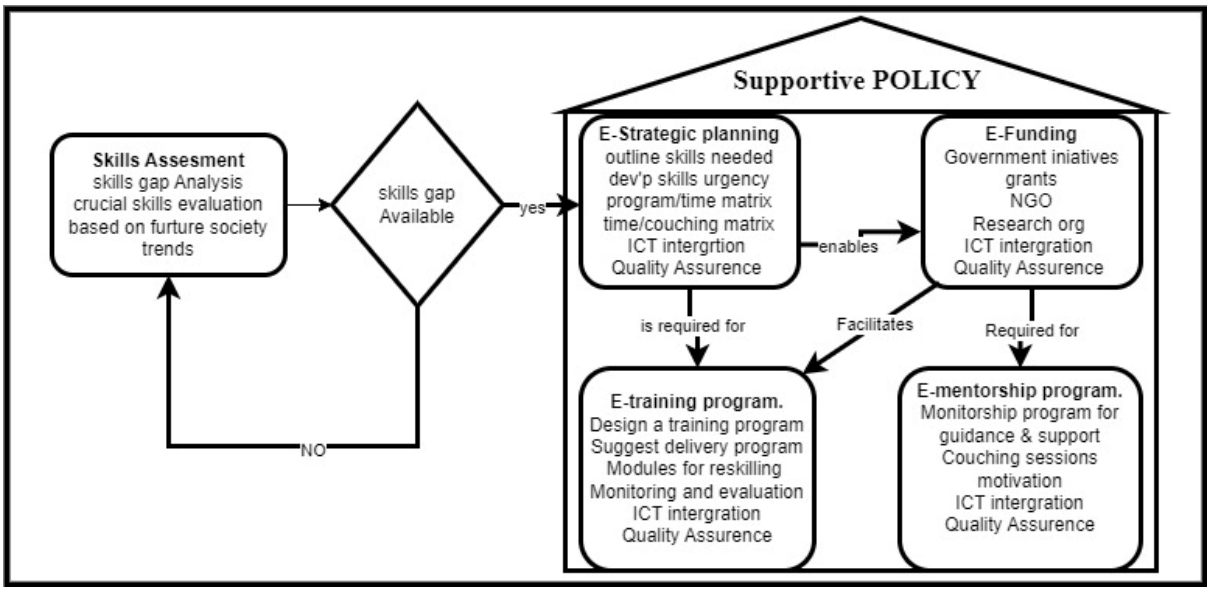


Figure 1: Proposed framework for ICT-Based reskilling

In Figure 1; a framework for ICT based reskilling is proposed. The framework provides a structure that can govern reskilling and upskilling in the knowledge society and employment world. The component of the framework include; skills assessment, e-strategic planning, development of e-training programs to meet the skills gap, e-mentorship, couching and e-funding being governed by the supportive polices. To create a knowledge society, the skills that require society to grow must be identified. For example, to transform a society based on peasant agriculture to one rooted in knowledge-based agriculture, it's vital to pinpoint areas requiring expertise, such as modern agricultural practices within daily routines. Once skill gaps are recognized at the community level, a strategic plan must be devised. This plan delineates the necessary skills, outlines initiatives, and formulates funding strategies to foster skill development. Upon approval of such a strategic plan, programs tailored to modern agriculture are designed, delivery methods crafted, modules developed and methods of delivery thought of. At this level, quality assurance, monitoring and evaluation of this program is initiated and after all has been developed, groups in society are identified to deliver these programs. This is can be done through mentoring and couching program, the skills are imparted and evaluated for functionality through quality assurance. To ensure progress, funding is availed. This could be initially through government initiatives like parish development model (PDM), Crowd sourcing, grants and research initiatives. To enable proper rolling of such activities supportive policies are required

Developing the reskilling program

In this section, an abstract view for developing a reskilling/upskilling program has been presented. First ICT reskilling process is presented followed by objects for reskilling solutions are presented

ICT reskilling process

Figure 2 below; illustrates the journey that individuals and organizations go through during various stages of reskilling in a knowledge-based society. Users interact with the system to access the platform and search for resources such as courses, certifications, and assessments, which include learners, trainers, and HR personnel. Once users enroll, they undergo assessments to evaluate their current skills and identify areas for improvement. Based on the assessment results, the system creates a personalized reskilling plan. The platform offers a

range of reskilling programs with materials from skills development catalogs tailored to each learner's goals and needs. Those who struggle to find suitable training options can return to the assessment and goal-setting stage for further refinement. Users participate in the learning and training process, using resources such as courses, interactive exercises, and mentorship opportunities. Throughout the training, individuals can track their progress using system monitoring tools and receive feedback to adjust their learning strategies. After completing courses, users assess their newly acquired skills and improve existing ones. Upon successfully finishing the required learning paths, users receive certifications and credentials to validate their skills. The framework measures the impact of reskilling on individuals and organizations for lifelong learning, providing insights into return on investment and areas for improvement. Based on outcomes, the system offers feedback and updates reskilling programs to enhance the future of learning.

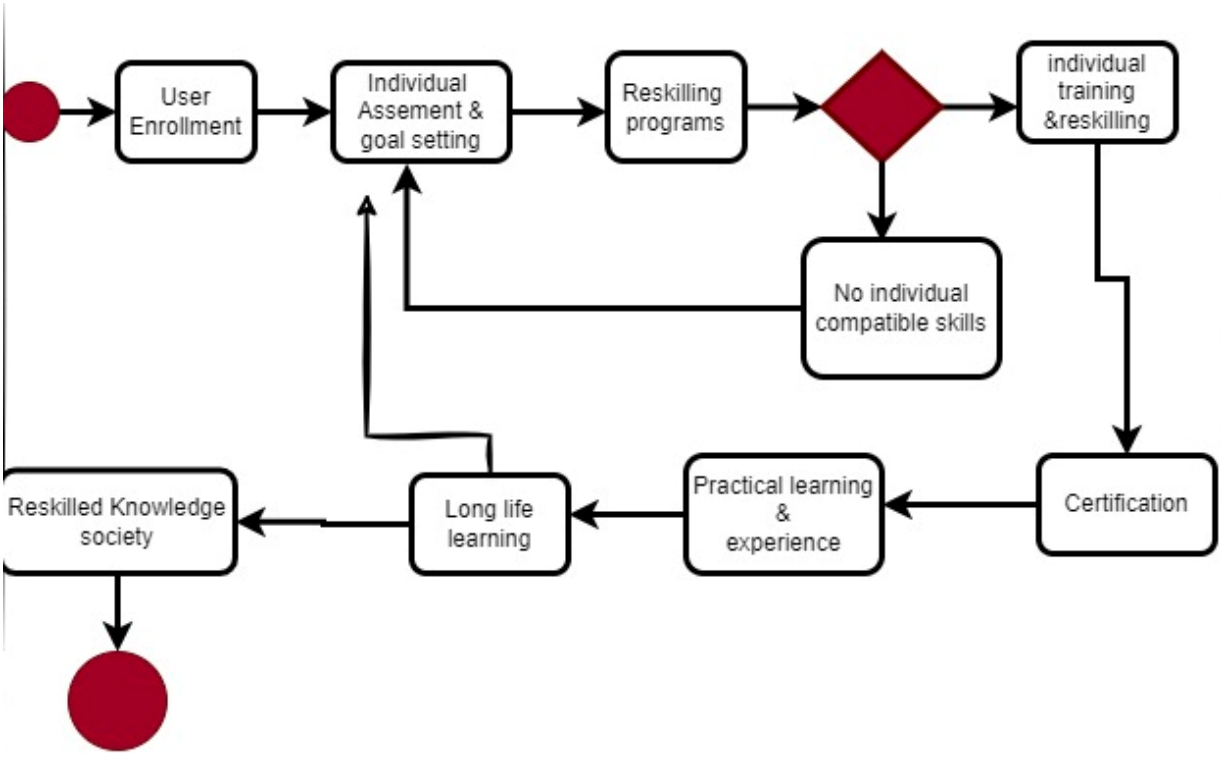


Figure 2: ICT reskilling process

Objects required for developing reskilling program

An effective reskilling program for a knowledge-based society requires a comprehensive and strategic approach to its development. It should begin with users logging into the system to gain access to the reskilling workplace. Then, a needs assessment should be conducted to identify the specific digital skills gaps and demands of the community. It is crucial to collaborate with local employers, educators, and community leaders to gain a better understanding of the most relevant and high-demand skills. Aspiring learners can then begin their journey of training and education to identify a suitable program that meets their academic and career goals, enabling them to secure admission and achieve success in their chosen field. The program should include essential digital skills that can help learners succeed in today's rapidly evolving digital landscape, such as data analysis, coding, cybersecurity, and digital literacy.The program design should align with industry standards and emerging technological trends, providing learners with valuable and up-to-date

knowledge. The training program offers a range of instructional materials, including videos, reading materials, and interactive exercises, designed to enhance learning outcomes. Assessment tools have been developed to evaluate learners' understanding of the material covered, with progress tracking features integrated into the program to enable learners to monitor their progress over time.

To ensure equitable participation, providing participants with access to ICT infrastructure such as computers, internet connectivity, and digital devices is crucial. Public access points in community centers, libraries, or schools can improve accessibility and inclusivity. The program should offer a blend of online and in-person experiences to accommodate diverse learning styles and preferences. Engaging teaching methods such as gamified learning can enhance knowledge retention and application. Mentorship and support programs can provide guidance to participants throughout their reskilling journey. Connecting learners with industry professionals provides them with valuable advice and potential career opportunities. Assessment and certification processes can help measure participants' progress and grant credentials that enhance employability. The entire reskilling program is overseen by governing bodies, who evaluate and measure the program's success through output indicators such as improved employee skills, enhanced job performance, increased adaptability, and career advancement opportunities within the workforce. Community outreach initiatives can help promote the reskilling program and encourage participation from diverse groups, including underrepresented populations. By increasing awareness and engagement, the program can make a broader impact on the knowledge society.

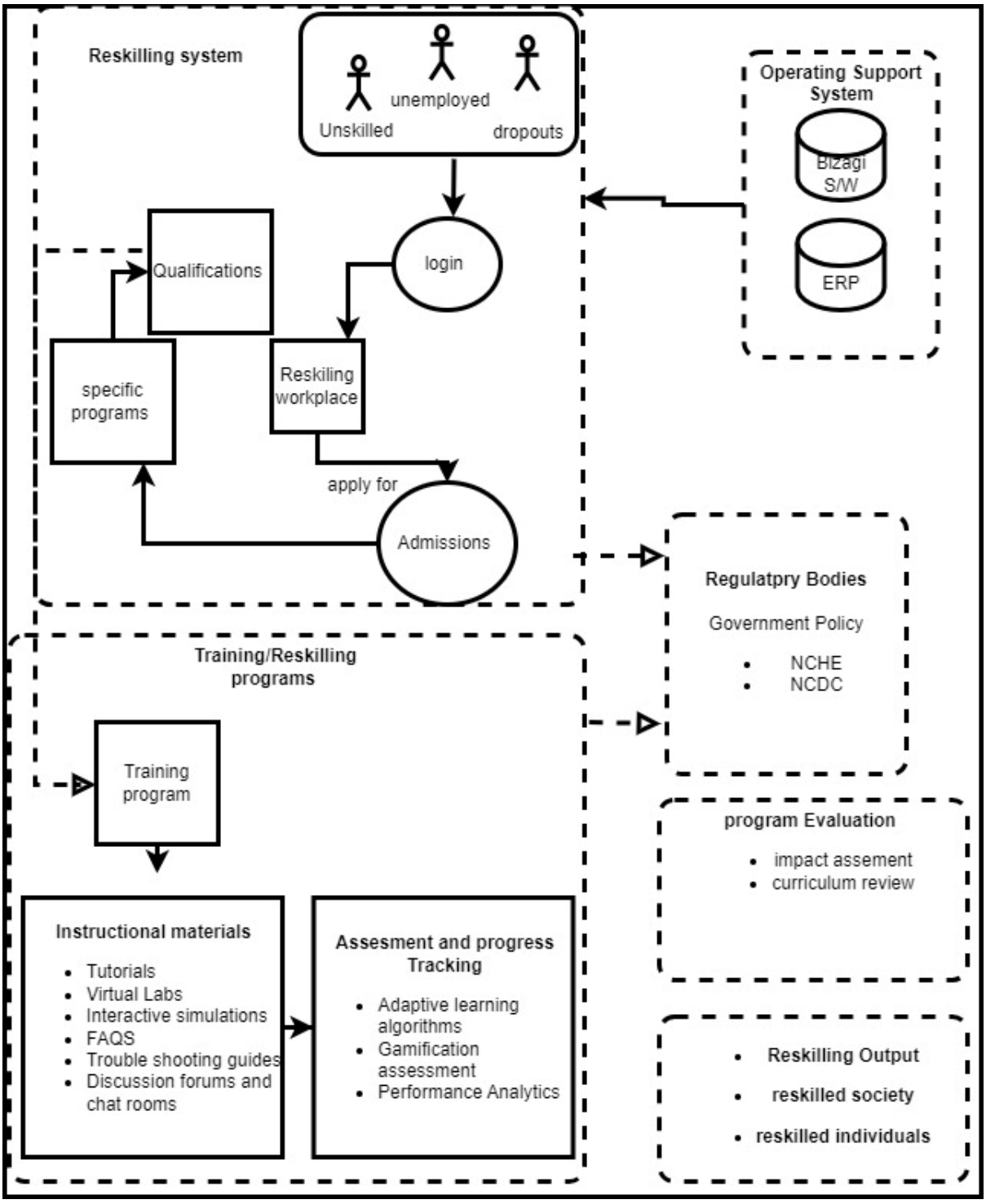


Figure 3: Objects required for developing Reskilling/Upskilling program development

Results

Education forms fundamental right for all people worldwide. Unfortunately, not everyone who goes through educational systems achieves their goals and aspirations, leading to gaps that may require reskilling to bridge. This study highlights that ICT reskilling solutions are highly likely to provide a pathway for societal reskilling and upskilling, particularly for those who have faced challenges in obtaining formal education or missed acquiring certain skill sets. Such access creates a more versatile and adaptable workforce, reduces unemployment, and opens opportunities in growing sectors like healthcare and technology. Additionally, it

promotes personal fulfilment through continuous learning, intellectual stimulation, and the attainment of new competencies, which boost confidence. This is consistent with findings in [30]–[32]

The study outlines six stages necessary for enabling stakeholders to create opportunities for disadvantaged members of society through reskilling. These stages include gap analysis, strategic planning, mentorship, funding, and governing policies. These steps are crucial for developing a program tailored to individuals lacking specific skill sets. Skills deficiency arises for many reasons, such as changing the workplace environment due to adopting technology, management styles, and a dynamic workforce. These findings align with those of [33], [34], whose studies highlight the importance of these stages in effective reskilling initiatives. Additionally, it has been noted that skills in labour 4.0 across vast dimensions of jobs, e.g., agriculture, innovative city applications, and eHealth, form essential components of the skill set required in the knowledge society. These skills are in addition to the formal educational paths and processes at various exit levels.

The expert interviews revealed aspects of lifelong learning, including professional development and career transition strategies. In the professional development aspect, training is required in imparting transferable skills that include Programming and Coding, Data Analytics, AI and internet of things. In addition, business skills such as Project Management, Financial Literacy are key drivers' management from house hold level to startup management. Digital literacy skills such as word processing emails management, social media intelligence, Digital Tool, Cybersecurity Awareness form the core of using 21st century skills; Technical soft skills like Communication and Adaptability cannot be left out; lastly, Active learning (Hands-On Practice, Project-Based Learning, Interactive Tutorials) and Customized industry training (Certification Programs, Certification Programs, Corporate Training Initiatives) form the core of lifelong learning. All the above views are supported in studies [23], [35]–[37]

Business Benefits

The framework developed in this study offers a novel approach to rethinking the education system by providing equal access to knowledge, thereby contributing to society's development without necessarily focusing solely on employment opportunities. It also prompts a re-evaluation of curriculum restructuring and educational pathways recalibration, considering a holistic view of society.

Conclusions

This study reveals critical links between skills assessment, planning to address skill gaps, mentorship for applying gained skills, training to acquire necessary skills, and funding. These elements are essential in creating a business process that facilitates reskilling, ultimately leading to the development of an ICT system that supports this process. The ICT system, in this context, serves as a tool to enhance and facilitate the learning process, not as a replacement for traditional education methods. If well implemented, the ICT-based model will enable individuals committed to lifelong learning and development to transform both themselves and their society. Therefore, carefully analysing individual skill gaps, planning to address these gaps, training in required skills, providing mentorship, and creating policies for reskilling programs not only enhance the human resources of society but also bridge gaps left by traditional and formal education systems.

ICT reskilling is crucial for empowering Uganda's knowledge society. As the Uganda seeks to build a skilled workforce capable of driving economic growth and innovation, mobile technologies has become increasingly popular, this trend has facilitated access to vast amounts of content which could act as bedrock of reskilling opportunities. In addition, digital

infrastructure expansion, especially in rural areas, is vital to ensure equitable access to reskilling programs throughout the country. As Uganda continues to digitize its government services, there is a growing demand for skilled workers to support and maintain these systems. Developing local content and culturally relevant educational resources can enhance the effectiveness of reskilling initiatives.

In the future, studies may focus on assessing the impact of ICT reskilling on employment and economic mobility, as well as examining how reskilling programs can help address gender disparities in education and the workforce. Research into effective strategies for reskilling rural populations, evaluating different delivery methods (online, in-person, hybrid), and exploring how government policies and cross-sectoral collaborations can support ICT reskilling will be crucial to foster a vibrant digital economy and knowledge society in Uganda.

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