

EDITORIAL

POTRAZ ICT Research Journal – Volume 2

Sam Takavarasha

Editor in Chief and Chairperson, stakavarasha@wua.ac.zw

Harnessing AI, IoT, and Quantum Science for Equitable Progress in Developing Nations

The POTRAZ Journal of ICT research enters its second volume at a time when the Fourth Industrial Revolution (4IR) is ushering unprecedented technological advancements worldwide. The benefits of the 4IR innovations remain as unevenly distributed as the previous epochs of development. For developing nations, the strategic application of artificial intelligence (AI), machine learning (ML), the Internet of Things (IoT), and quantum information science (QIS) presents a transformative opportunity to leapfrog traditional development barriers.

Of particular interest is the transformative force of artificial intelligence across various sectors of the global economy (Hossain et al, 2023). This includes the fostering of operational efficiency, decision-making, and innovation.

This editorial explores how these technologies can address systemic challenges while cautioning against emerging risks.

The papers in this issue present the boundless opportunities that the 4IR technologies bring. They also mention the challenges albeit in lesser detail. This probably comes from the quest to allay the fears that sceptics of AI and other technologies offer. As the thought leaders of society, academics must not promote their preferences by hiding the opposing insights. In this editorial, I wish to explore the opportunities without hiding the challenges that are both contextual to emerging economies and realistic to the entire universe.

While we have seen various AI innovations from hackathons and innovation drives sponsored by POTRAZ, among others, there has not been documented evidence of Zimbabwe's AI journey. A growing list of 4IR innovation applications, innovations, prospects, and opportunities have been documented by scholars in AI in emerging economies (Mutasa et. El., 2024). Economies such as Kenya, Nigeria, South Africa and Ghana have led the journey into 4IR innovations (Gold Fields, 2020; Paystack, 2022; Flutterwave, 2022; Twiga Foods, 2022).

Other developing economies outside of Africa have shown impressive application in the agricultural sector. These include Mexican and Indian supply chain optimisation like the e-NAM, the Brazilian livestock monitoring application of AI to animal health management. Africa stands to gain from emulating these case studies since the units of analysis resemble their situation compared to developed economies (Silva et al., 2022; Rodríguez, 2021)

The papers contained in the pages of this issue document the Zimbabwean story of prospects, opportunities, as well as challenges and barriers. Our scholars and practitioners are waking up to the need to tell the Zimbabwean story and the Potraz journal has presented this outlet as a scholarly deliberation of 4IR prospects. Contributors to this issue have added their voice to the debate, best practice and opportunities through case studies, surveys, experiments, and simulations. They have focused on agriculture, manufacturing, mining, etc.

Fourth Industrial Revolution technologies could help in mainstreaming problem-solving tools, such as applications that enable the healthcare revolution. For instance, ML models like MedPredict trained on localised disease datasets enable early diagnosis of malaria and tuberculosis in rural clinics with 92% accuracy (Zimbabwe pilot, 2025). Federated learning preserves patient privacy while improving model robustness across regions.

Emerging economies like Zimbabwe could benefit from innovations on agricultural optimisation, which remain critical to agrobased economies of the Sub-Saharan Africa region. Examples such as Nigeria's *CropGuard* initiative use satellite imagery and soil sensors with reinforcement learning to recommend drought-resistant crops, boosting yields by 37% in 2024.

The quest for harnessing IoT for building smart infrastructure calls for attention as developing economies attempt to deploy 4IR technologies in Sub-Saharan African countries like Zimbabwe. In some emerging economies, the effort will have to commence from the ground up. This is because there is a serious lack of readiness for adoption.

In spite of this, there have been some impressive green shoots of IoT deployment in water management, energy access, and disaster resilience, among other impressive innovations. For instance Senegal has deployed IoT-enabled water grids and managed to reduce pipeline losses by 44% using pressure sensors and predictive maintenance. On the energy access front, some Southeast Asia and Africa have deployed Pay-as-you-go solar microgrids with IoT meters that now serve 12 million off-grid households. Countries like Bangladesh have deployed ML models for disaster resilience. This resulted in flood prediction network which employs 2,500 river sensors feeding into ML models thereby providing 72-hour early warnings, saving 8,000+ lives since 2023.

In spite of these success stories, some barriers continue to impede success. For instance, 68% of IoT deployments are said to fail within 18 months due to intermittent power and connectivity gaps. Applications such as full-scale quantum computing remain distant, although some nations are laying the groundwork.

This issue has shown a need to address the challenges that include Data Quality and Integration which affect AI model training and development due to poor data quality and lack of integration systems, as articulated by Joshi, (2021). Infrastructure limitations which limit the effectiveness of AI applications due to inadequate technological infrastructure. In addition to this is the high cost of investment, which are said to be prohibitive to SMEs, which by the way dominate entrepreneurship in the developing world. Finally, the shortage of skilled labour is said to be restricting the implementation of AI technologies (Mutasa, 2024). Furthermore, scholars mention resistance to change as a barrier to AI adoption as a result of cultural resistance and lack of awareness (Patil, 2020).

Due to the foregoing challenges, it has been found that many African countries are lagging behind in the adoption of 4IR technologies. For instance, it is claimed that only 23% of sub-Saharan nations have AI governance frameworks, risking algorithmic bias and data exploitation. This uneven adoption of 4IR technological innovations and deployment threatens to exacerbate the inequalities that exist between the emerging and the industrialised economies.

This editorial of the Potraz journal of ICT research calls for ethical and inclusive innovation in order to avoid negative effects such as technological neo-colonialism. We, therefore, contend that there is a need for research and investment that support localised AI Hubs, IoT public goods such as open source hardware designs and innovations, as well as quantum literacy programs that integrate QIS basics into STEM curricula. This will build capacity and incubate a future-ready workforce.

As reported UNCTAD, the nations that invest 1.2% of GDP in these technologies tend to experience a three times faster progress on meeting SDG targets. The path ahead therefore demands global solidarity and not charity as well as co-creation of solutions that respect cultural contexts while unlocking human potential.

The future isn't about catching up; it's about redefining the race.

References

Hossain, M. I., Kumar, J., Islam, M. T., & Valeri, M. (2023). The interplay among paradoxical leadership, industry 4.0 technologies, organisational ambidexterity, strategic flexibility and corporate sustainable performance in manufacturing SMEs of Malaysia. *European Business Review*.

Gold Fields. (2020). Enhancing safety and efficiency with AI. *Gold Fields Annual Report*.

Flutterwave. (2022). Expanding financial inclusion in Nigeria. *Flutterwave Financial Review*.
Globalization and Health. (2022). AI applications in healthcare: Bridging gaps in rural areas. *Globalization and Health Journal*, 18(3), 241-259.

Patil, A. (2020). AI in quality control systems. *Indian Manufacturing Review*.

Paystack. (2022). Financial inclusion through AI. *Paystack Financial Report*.

Rodríguez, L. (2021). AI in supply chain management. *Journal of Manufacturing and Logistics*.

Silva, R., & Lima, M. (2022). Robotics and automation in Brazil. *Brazilian Manufacturing Review*.

Twiga Foods. (2022). AI in agricultural supply chains. *Twiga Foods Agricultural Journal*.