International Journal of Engineering Trends and Technology
ISSN: 2231–5381 / https://doi.org/10.14445/22315381/IJETT-V73I5P112

Volume 73 Issue 5, 124-136, May 2025

Original Article

Rethinking the Role of Technology for Development in the AI Era: From AI4D to Smart ICT4D

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Received: 10 December 2024 Revised: 02 April 2025 Accepted: 19 May 2025 Published: 31 May 2025

Abstract - *During the past decade, Artificial Intelligence (AI) has been widely praised for its presumably "immense" potential to support and stimulate development. Several acronyms and related initiatives and/or research networks have emerged, consequently, to accompany this hype, such as AI for Good, AI for the Poor and AI for Development (AI4D). This enthusiasm for AI assumes that AI complies with the distinctive features of projects developed in the context of Information and Communication Technology for Development (ICT4D). Moreover, it is implicitly assumed that AI has a particular added value for development that is not found in the other technologies used in ICT4D. As shown in this paper, it is neither relevant nor sound to use acronyms that, a priori, exhibit the specific type of technology (AI) as THE means to support and/or stimulate development. This is misleading and against the fundamentals of Technology for Development. It is shown, as well, that most defining features of current AI are not compatible with the Development context, and that AI may even compromise the development goals and perspectives of developing countries. As an alternative, we propose a new vision, called Smart-ICT4D, which allows for to fully benefit of AI within the vision and mission of ICT4D. By ricochet, the goal of this paper is to help policy and decision makers, especially in developing countries, to ponder all factors related to the use of AI, and to embrace a wider perspective in elaborating and sustaining the national digital transformation strategies of their respective countries.*

Keywords - *Development, Technology for development, ICT4D, Sustainable Development Goals, Artificial Intelligence, AI4D.*

1. Introduction

Information and Communication Technologies for Development (ICT4D) refers to the application of computer-mediated technologies toward social, economic and political development, with a particular emphasis on fighting the digital divide, helping poor and marginalized people and communities. The ICT4D theory is grounded in the notions of 'development, growth and progress' (Heeks 2009) (Zheng et al. 2018).

It is often interpreted as the use of technology to streamline and stimulate the process of development in developing countries and less developed countries (DLDCs). With the current hype of Artificial Intelligence (AI), new acronyms such as AI for Development (*AI4D*), *AI4Poor*, *AI4Africa*, and *AI4Good* have emerged during the past decade to highlight the presumable high potential of this technology to contribute to development. These acronyms do not have precise definitions and/or any formal theoretical basis, but they all share and exhibit several implicit and questionable assumptions, including:

- AI does not belong to the range of ICT4D enabling technologies.
- AI is much better and more effective to use for development than other enabling technologies.
- AI design and architecture's features are a better fit for development compared to the other 'traditional' technologies.

As none of these assumptions have yet been proven, the relation between AI4D and ICT4D becomes increasingly unclear. Hence, it is useful and timely to address this relation, to clarify it, and to draw informed conclusions. In this paper, three different but complementary goals are pursued:

- To show that the acronym AI4D (and the like) does not stand, is misleading and harmful to use;
- To question the nature of the added value of AI to Development and to raise an objective skepticism about it;
- To suggest a new acronym, Smart-ICT4D (instead of AI4D and the like) to better reflect and highlight, at its fair value, the role of technology as a tool, in supporting/streamlining the global vision and specific objectives/milestones of the Development process, while considering all technology enablers, AI included.

This study adopts a *literature-based conceptual development* methodology, a recognized qualitative research approach that facilitates the construction and refinement of theoretical frameworks by systematically synthesizing existing literature (Jabareen, 2009; Torraco, 2005). Rather than relying on primary empirical data, this methodology enables researchers to generate conceptual insights by examining, organizing and integrating diverse scholarly contributions. It is particularly suited for emerging and interdisciplinary fields, such as Artificial Intelligence in the context of development, where theoretical foundations are still evolving.

An important step of this study was a structured review of the multidisciplinary literature found in research journals, review papers, books and white papers, as well as in policy recommendations from international organizations. The selection of papers from these multidisciplinary sources focused on themes at the intersection of AI and digital transformation, sustainable development, fairness and ethics. It emphasized relevance, credibility and diversity of perspectives. The adopted methodology supports theory-building in contexts with fragmented empirical evidence and enables the generation of well-grounded propositions (MacInnis, 2011; Webster and Watson, 2002). The results of the work reported in this paper should provide a foundation for future empirical work and policy innovation aimed at ensuring that AI contributes equitably to Development goals.

The paper is organized as follows. Section II presents a quick historical review of *ICT4D* and its recent evolution as a vision and an approach, emphasizing the important aspects of using technology for development, while mitigating fundamental problems such as the digital and knowledge divides. To ground the discussion about ICT4D and AI4D, Section III presents the main elements of the UN 2030 Agenda and the Sustainable Development Goals that occupy a prominent place in current international reflections and actions towards sustainable development. Section IV introduces a quick synopsis of the AI history and how it led to the currently used techniques.

The aim is to provide readers with some background knowledge to examine and understand the issues raised in this paper about the possible impacts of AI technology on development. Section V aims at defining and positioning the so-called 'AI for Development' domain. In section VI, it is shown that the added value and appropriateness of AI for Development (as implicitly suggested by the acronym AI4D) have not yet been demonstrated. Consequently, it is argued that there is no objective justification to treat the AI technology differently from any other computer-based technologies, such as Databases, the Internet and Cloud Computing, that are fully considered as ICT4D enabling technologies. In Section VII, the main findings of this paper are discussed, and broader issues are raised about the relation between AI and Development. In Section VII, a new acronym, *Smart ICT4D*, is proposed as a way to better reflect and highlight the role of technology, as a tool, to support/streamline the global vision and the specific objectives/milestones of the Development process, while considering all technology enablers, AI included and concludes the paper and presents future work.

1.1. Digital Technologies, ICT4D

Ineluctably, *Digital Technologies* (DT) have a huge impact on the way people do business, learn, communicate and work. A huge number of software services and products are available. They are integrated in platforms and systems, connected through tentacular and powerful telecommunication infrastructures that allow for the transmission of terabytes of data, from any place in the world to any other one, quasi-instantly. Globally, what is referred to as DT today was called, some years ago, *Information and Communication Technology* (ICT). ICTs flourished thanks to the immense automation needs of our societies. Wealth has been increasingly generated through flows of information, data and knowledge, in a 'global world', and ICTs' continuous advances, expansion and adoption led to important structural transformations in the economy landscape. ICTs can be viewed as institutional enablers for governance, accountability, and civil society. They are also enablers for service production and economic activities, as well as for access to global markets and resources (Thompson and Walsham 2010).

However, inequalities also widened between individuals, communities, and countries, leading to what is known as the *Digital Divide*. Simply put, the digital divide is the continuously growing gap between countries with effective access to and usage of digital technology and countries with very limited or even no access/usage at all. In a recent UN Secretary-General's *Report on Science, Technology and Innovation for Sustainable Development* (UN General Assembly 2023), it is stated that the digital divide and the associated inequalities in technology diffusion affect people's access to the benefits of technologies and risk further exacerbating social divides.

The utmost importance of elaborating ways and strategies to fight the digital divide triggered the emergence of the ICT4D field in the 1990s and represents one of its defining features. Unlike mainstream ICTs, whose main goal is to create software for business purposes, ICT4D is about what should be done to support human and socio-economic development, and how to do it, especially in the context of DLDCs. Many authors contributed to the shaping of what ICT4D is today, and most of them addressed, directly or indirectly, the specific and inherent features and orientations that ICT4D projects and technologies need to fulfil. For example, in the framework of ICT4D proposed by Unwin (Unwin 2009), it was suggested that the prime goal in creating

ICT systems is to empower poor and marginalized communities, through the applications of ICTs in sectors with high social impact (such as health, education and justice), while involving all beneficiaries, and considering the specificities of their local knowledge and traditions.

In another framework proposed to orient ICT4D projects' international funding, Hanna (Hanna 2008) emphasized that ICT4D requires subordinating the technology to more fundamental development objectives, through a holistic framework linking the ICT potential to local development problems, at a national level. This holistic framework was driven by the need for poverty reduction, community empowerment and social development. Hanna (Hanna 2008) claimed that ICT4D is not only a technology enabler, but also an essential way to stimulate and promote development, through technology localization and appropriation, capacity building, learning and local knowledge enhancement, as well as through the strong involvement of local actors.

In evolving definitions of ICT4D-1.0 (Heeks 1999), ICT4D-2.0 (Heeks 2009) and ICT4D-3.0 (Heeks 2017), Heeks considered that poverty alleviation is the *raison d'être* of ICT4D, regardless of the specific applications and platforms that are used. In the different contextualized views of ICT4D that Heeks offered for two decades to accommodate the continuing technology advances and shifts, he systematically reiterated that ICT4D's main goal is to empower the poor.

One should also be aware of the progressive and disruptive potential of ICT-enabled developments (Avgerou 2010). The *progressive perspective* considers ICT as an enabler of developmental transformations in multiple societal domains, considering that these transformations need to be achieved within the existing international and local social order. In contrast, Avgerou (2010) suggested that 'the *disruptive perspective* is premised on a highly political and controversial nature of development, both as a concept and as an area of policy for international and local action'. The author emphasized that such a perspective reveals 'conflicts of interest and struggles of power as a necessary part of ICT innovation in developing countries'. *In this paper, it will be argued that ICT4D fits well with the progressive perspective, while the AI4D hype falls within the disruptive perspective.*

In Walsham 2017 an interesting summary of 30 years of history of ICT4D research and development is presented, with a wealth of useful references. Interestingly, the author mentions that 'the new ICT-enabled models can transform the processes and structures of development'. The author also identified a number of challenges that reflect well the current situation of DLDCs. He mentioned a number of 'major societal issues' that need to be addressed in an ICT4D context: economic well-being, systemic poverty, gender equality, global health, the dark side of ICTs, the environment and climate change, humanitarian crises, as well as wars and terrorism. In the past, many ICT4D initiatives have been *technocentric*: they only focused on deploying ICTs in DLDCs and on granting access to them, expecting that development would happen if access to technology is provided. In most cases, such initiatives led to, at least, partial failure (Gunawong and Gao 2017) because an important aspect was missing: the political, economic and social situation of the DLDCs. Marais (2015) mentioned that the top-down technocentric approach is based on the assumption that 'technology is an autonomous force that causes desirable developmental changes in the lives of people'. Notably, Heeks (2008) advocated for a *per-poor* innovation approach to achieve development goals. In such a view, sustainable Development results from the collaboration between external development actors and local communities, as well as from the dialogue between people having different worldviews, developmental aims and strategies.

To conclude, such 'technology for Development' approaches totally ignore the perspective related to a 'socially-led strategy': they are not *sociocentric*. They are mostly 'top down' (enforced by the authorities) and, in practice, disregard the actual needs of people (Chigona, Pollock and Roode 2009). *It will be shown, later in this paper, that this trend to put the technology first applies as well to current AI4D initiatives.*

Marais (2015) rightfully mentioned that the role of ICT4D promoted by different agencies largely depends on the perspective on development that is adopted. If the emphasis is put on economic growth, then the focus will be on *market-led ICT4D*. If participation and empowerment (human development) are put forward, then the focus will be on *socially-led ICT4D*, seeking equality of access (Unwin 2009). This distinction still applies to the promotion of AI by international development agencies when using acronyms such as AI4D. It is relevant to question the underlying motivation of such a promotion: is it market and industry-led, or is it oriented toward socially-led action plans?

2. ICT4D and the SDGs

In 2015, at the *United Nations (UN) Sustainable Development Summit* held in New York, a new agenda for sustainable development was adopted. This agenda's ambitious aim was to achieve sustainable development between 2015 and 2030 worldwide. It includes 17 *Sustainable Development Goals* (SDGs) and 169 targets. Officially, the emphasis was put on 'People, Prosperity, Partnership, Peace and Planet'. Wu and colleagues (2018) carried out an extensive multidisciplinary literature review on the SDGs literature and provided an interesting study about the potential correlations between the SDGs and ICTs. The 17 SDGs can be regrouped in three broad categories: *economic SDGs* (nbs. 1, 2 and 3 that are related to life considerations; and nbs. 8 and 9 related to economic and technological considerations);

social SDGs (nbs. 4, 5 and 10 related to equity considerations; and nbs. 11, 16 and 17 related to social development considerations); and *environmental SDGs* (nbs. 6, 7, 12 and 14 related to resources considerations; and nbs. 13 and 15 related to environmental considerations). Interestingly, these authors found out that SDGs 5 (gender equality), 10 (reduced inequalities) and 16 (peace, justice and strong institutions) were not well addressed in the extensive literature on SDGs.

Le Blanc (2015) proposed to represent the SDGs in a network schema that displays their complexity, their relationships, their overlaps and gaps. Observing that the links between the goals were made by the *political process that created the SDGs*, Le Blanc stated: 'The resulting network and mapping, which reflect the results of negotiations in an intergovernmental context, can be thought of as a "political mapping" of the sustainable development universe' (Le Blanc 2015).

For the international community and institutions tasked with the monitoring and reviewing of the 2030 international development agenda, the SDGs and associated targets provide a common framework that is convenient to assess projects and programs and to monitor their progress. However, it can be observed that the SDGs and their targets are too complex to be practically used by decision and policy makers in DLDCs, drawing away their attention from fundamental development goals.

India is one of the few countries in the world that has elaborated and adopted a proper policy framework with central and state-level institutions to implement the SDGs. Notably, the *SDG India Index, Baseline 2018*, was created. An interesting document (Dias 2021) reports about the progress made in 3 years and emphasizes the importance of the uneven development of the different Indian states, which can act as a main deterrent in achieving the SDGs. Dias (2021) identified the disparity of states as a main problem: all states do not have the same resources, economic growth rates and level of poverty.

Fulfilling the SDGs in the poorer states (akin to DLDCs) would be a monumental task. Dias (2021) identified other problems such as: 1) long term development goals (such as the SDGs) are often sacrificed for short term infrastructural goals which drain the limited resources available at a local level; 2) the lack of inclusivity in innovations and techniques at a local level; 3) a significant number of states are not prepared with their plans to implement the SDGs; 4) the lack of sufficient capacity building programmes and sensitizations; 5) achieving SDGs requires huge funding and constant checks of progress; which are simply not available in most states; 6) the lack of foreign and international aid. All these problems equally apply to DLDCs, especially in the context of using the most fundamental ICTs for Development. Hence, *it can be surmised that trying to implement AI technologies in such unfavorable contexts will face identical, if not even worse, problems.* The 2030 Agenda and the SDGs have also been largely criticised, especially when it comes to the application to DLDCs (Arora-Jonsson 2023). Analyzing key policy documents produced by the UN from 1971 to 2021 to investigate the support measures taken by the UN and other international organizations for addressing development challenges faced by DLDCs, Regmi (2023) found out that 'while some attempts were made for integrating DLDCs into global trade and economy, international organisations could not translate their policy rhetoric into reality'. Therefore, DLDCs have fallen behind in several developmental sectors such as economy, education and health. Regmi (2023) explains this situation by the fact that they are caused by a 'colonialist approach' which created prosperity in some parts of the world at the cost of deficits in DLDCs (Jaffee 1998) (Regmi 2018).

Moreover, the applicability of the SDGs to DLDCs has been questioned for a long time. Dahlman and Mealy (2016) mentioned that these countries face a set of interconnected global challenges (economic, technological, demographic, environmental, security and governance-wise) that will prevent them to achieve the SDGs, especially when considering a difficult socio-economic context characterized by income inequality, the threat of automation on traditional jobs, jobless growth, demographic imbalances, instability and security threats and weakened domestic governance.

All these elements should be pondered when considering how the promotion and the deployment of the AI technology may impact DLDCs, especially when considering the way it is presented by the AI4D proponents.

3. A Quick Synopsis of Artificial Intelligence

The field of Artificial Intelligence (AI) is not new. It was founded more than 70 years ago as a sub-field of Computer Science, with the aim of building 'intelligent' computer programs to emulate tasks that were deemed to reflect human intelligence (McCarthy et al. 1955), such as understanding, reasoning, search, vision and speech. To perform such tasks, the programs, later called agents or (ro)bots, need to have some knowledge about the world in which they are evolving and about how they can interact with it to perform useful tasks. For a long time, such knowledge-based activities were considered to be exclusively associated with humans, as kinds of cognitive capabilities demonstrating the 'superiority of humans over machines'.

Emblematically, Alan Turin, considered as one of the 'fathers of AI', devised the now-famous *Turing Test* in the 1950s (Turing 1950). The aim was to provide a protocol to determine if a machine was able to exhibit a so-called 'intelligent behaviour'. The test aimed at determining if a program could mimic 'human intelligent behaviour' using natural language in a way that the machine communication would be indistinguishable from a human intervention when

assessed by a human observer. The Turing test was meant to be generic and did not commit to the nature and structure of the reasoning process performed by the AI program.

AI research and development went through a series of up and downs, due to cyclic highs and lows in governmental funding in developed countries, as well as a consequence of the regularly deceived hopes of creating the 'ultimate intelligent technology' (Russell and Norvig 2021). However, during the past decade, the AI research and commercialization have managed to take advantage of different technological advances, which explains the AI hype that is at the forefront worldwide.

This time, significant progress has been achieved thanks to the development of increasingly powerful techniques based on *Machine Learning* (ML), *Deep Learning* (DL) and *Large Language Models* (LLM). These AI techniques benefited, in turn, from the considerable improvements in hardware configurations and the increase in the CPU and GPU performance. They also increased the *learning capabilities* of computers, tablets and smartphones, while taking advantage of the huge data sets ('big data' systems) made available through business records, individuals' profiles and social media.

Consequently, the use of AI has significantly accelerated, especially in areas such as image recognition, text and speech recognition, natural language translation, navigation systems, advertising and product suggestions, predictive maintenance, client support, natural language interactions, process optimization and fraud detection.

Indeed, there is no intuition or common sense involved in these computer programs, and there is no simple way of explaining to human actors the results provided by these AI applications. It can be conjectured that true explanations may be elusive for many years to come, since, by design, ML and DL do not have any reasoning and explanation built-in capability.

In technologically advanced countries, the AI race has raged for decades. Wealthy countries, where the leading AI companies are located, make huge investments in AI infrastructures, as well as in research and development, not to mention the intense training of specialized workforces.

DLDCs will never be able to catch up with such investments in AI, when most of them are still behind for the most pressing investments and policies required by the installation of fundamental ICT infrastructures and the deployment of services required for effective ICT4D, not to mention the education and training of skilled personnel to use and support the ICT applications. AI success stories are widely publicized, but another area of concern is related to the failures of the AI technology. Examples of failures are often related to uses or misuses of AI, including algorithmic discrimination (i.e. 'bias'), abusive surveillance, algorithmic profiling of citizens and flawed automated decisions. There is ample literature on this subject, and there exist comprehensive classifications of AI failures (Zhan et al. 2023) (Kempeneer et al. 2024) and of their consequences (Scott and Yampolskiy 2019). An *AI Incident database* is available in the US (McGregor 2021; Paeth et al. 2025). One also finds interesting discussions about how failures can be mitigated by associating humans and AI systems in the decision-making process (Teodorescu et al. 2021), considering the difficulty of formally defining the notion of fairness.

It is worth noting that all these failures and incidents have been reported in developed countries where AI applications have been implemented for a long time. It is difficult to find reports of AI failures in DLDCs, which is not a surprise, given the brief history of AI use in these countries. One can hope that such a large body of knowledge on AI failures will be helpful to responsible people and organizations when they plan and perform AI implementations in DLDCs.

Moreover, in his official address at the opening of the *Economic and Social Council's* special meeting on *Harnessing Artificial Intelligence for the Sustainable Development Goals (SDGs)*, in New York, the UN Deputy Secretary-General said, speaking of AI:'… Yet these technologies also pose grave risks. They can displace jobs, exploit gaps in global governance, and exacerbate bias, discrimination and misinformation.

Moreover, they can do so on a monumental scale. Our task is to harness this powerful technology to accelerate sustainable development while mitigating its harms. This means accountability for those who create AI systems and for those who use them. These concerns fall into the domain of *Responsible AI* (Dignum 2019), which has been at the forefront of AI debates in developing countries for more than a decade.

Responsible AI addresses some important issues such as the accountability and transparency of AI systems, the ethical implications of AI on privacy and security, the potential for AI to perpetuate existing biases and discrimination, and the responsibility of developers and users to ensure that AI is employed ethically and responsibly (Radanliev et al. 2024).

It is worth noting that most of these debates and the resulting products (scientific papers, books, white papers, guidelines and recommendations) have been produced by researchers and practitioners of developed countries, considering the potential harms and ethical issues of the AI development and deployment in their cultural context. Fortunately, this topic has been recently addressed in the African context (Wakunuma et al. 2022) (Eke et al. 2023), which can be applied to other DLDCs.

4. Artificial Intelligence for Development

It is not easy to find in the open literature a clear and formal definition of AI for Development. Social impact and non-profit are often claimed to be the most significant aspects of AI4D (Shi et al. 2020). It has been suggested that one can get a better and deeper understanding of AI4D through the contemplation of AI's possible applications in societal domains, or simply, by referring to societal challenges, which have not yet received significant attention by the AI Community (Shi et al. 2020).

However, as stated in (USAID 2018), the deployment of AI4D still lags far behind other domains in which AI is deployed. For most AI4D projects, real-world usage is not well established, since most applications are only tested through experiments on datasets. Few projects feature complete pilot studies, and even fewer have been deployed in organizations' operations.

The *United States Agency for International Development* (USAID) was amongst the first to advocate for the use of *AI for Development* (USAID 2018). Loosely equating ML with AI, the agency claimed: 'ML and AI have a tremendous potential for helping to achieve sustainable development objectives globally. They can improve efficiency by automating labour-intensive tasks or offer new insights by finding patterns in large, complex datasets. *In these few lines, the technocentric approach (Maltais 2015) can be easily recognized.*

The *International Telecommunication Unit* (ITU) defines AI for development (*AI4Dev*) as a challenge that aims 'to identify great ideas in Artificial Intelligence and to utilize its impact on SDGs', in DLDCs. It can be observed that such a definition is particularly vague, and it may be inferred that AI4Dev is mainly seeking good opportunities to use AI in DLDCs to promote the SDGs.

One can go a step further and infer that the goal is more technological and commercial than seeking ways to empower poor and marginalized communities, which is the main goal of ICT4D. *This again resonates with the market-led and technocentric approach (Maltais 2015)* mentioned earlier. Moreover, the ITU developed an action-oriented, global and inclusive UN platform, *AI for Good*, with the goal of identifying practical applications of AI to advance the United Nations' Sustainable Development Goals (United Nations 2015) and to scale those solutions for more global impact.

In a highly quoted paper on the role of AI to achieve the SDGs, Vinuesa and colleagues (Vinuesa et al. 2020) presented and discussed how AI can either enable or inhibit the delivery of the 17 goals (SDGs) and 169 targets defined in the UN 2030 Agenda. This study resulted from a consensus-based expert elicitation process, informed by previous studies aimed at mapping SDGs interlinkages. It highlighted that AI was found to have a beneficial impact on 79% of the SDG targets and inhibited 35% of the targets. The *Centre for Long-Term Artificial Intelligence* (CLTAI) also developed an online open service that provides a global repository and an analytic engine of AI projects and proposals that impact the SDGs, both positively and negatively.

The goal of this repository is to promote the positive use of AI for sustainable development and to investigate the negative impacts of AI on sustainable development. A detailed evaluation of each project is provided based on a rating scheme developed by CLTAI. For the interested reader, such repositories and information resources provide a wealth of information and lessons learned to be tapped into in order to better grasp the advantages and limits of AI initiatives.

Interestingly, the *United Nations Development Program* (UNDP) considers that AI for development is fundamentally about people. 'Applications of AI for development need to be led by lives and livelihoods, not just data points and digital'. Putting people at the center of AI thinking, piloting, and scaling is a crucial foundation of the AI4D approach at UNDP.

Moreover, the concept of sustainable development itself has been criticized (Divrik 2022). It appears that the SDGs of the developed countries and the DLDCs are different from each other. Divrik stated: 'This situation has revealed an understanding of sustainable development created for the interests of developed countries in the long run' (Divrik 2022).

Hence, justifying AI4D to help attain the SDGs and their targets may only reflect the view of developed countries on the use of AI technology, and be far from the real development needs of DLDCs. *This resonates with the criticism of the UN 2030 Agenda as being driven by Western models of Development* (Arora-Jonsson 2023; Regmi 2023).

In this perspective, it would have been more relevant to use the acronym *AI4SDGs* instead of AI for Development. Indeed, AI technologies can be effectively used to better monitor the achievement of the SDGs and be helpful to agencies and institutions funding international development. However, the usefulness of the AI4SDG approach can be legitimately questioned when it comes to its practical use for true development, which is the mission of ICT4D.

5. The Acronym "AI4D" is Not Grounded

As stated in the introduction of this paper, there are at least three main implicit assumptions that underlie the use of acronyms such as AI4D, AI4Good and AI4Africa. The following sub-sections specifically address each of these assumptions, separately, and show how these acronyms are wrong or biased. The goal is to demonstrate that the acronym AI4D (and the like) is inaccurate, ungrounded, and may be misleading.

5.1. (Assumption 1). AI Does Not Belong to the Range of ICT4D Enabling Technologies

The acronym AI4D is generally used to refer to systems that partially or integrally use AI technology to support development. The need for this new acronym to replace and eventually override the formal existing acronym ICT4D suggests that ICT4D does not, and cannot, include AI as a technology enabler. However, ICT4D is not technology-bounded and does not depend on any particular technology. One of the main principles of the ICT4D approach is to consider technology as an enabler, not as an end in itself (Unwin 2009; Zheng et al. 2018).

ICT4D encompasses all technologies mediated by computers that are used in projects whose main goal is to contribute to and streamline development. Artificial Intelligence is also a computer-mediated technology, and there is no objective argument to treat it differently from other computer-based technologies such as databases, the internet, programming languages, operating systems and cloud computing, to name a few. So, why single out AI when using acronyms such as AI4D and the like? Otherwise, we would need to accept a mushrooming of acronyms related to each of the specific subfields of computer-based technologies, to denote their possible usage in the context of development as for example, DB4D (Databases for Development), I4D (Internet for Development), CC4D (Cloud Computing for Development), and so forth!

5.2. (Assumption 2). AI is much Better to Use in a Development Context Compared to the Other Technologies

This would mean that using AI applications has a better impact on development compared to traditional technologies, and, consequently, it would be legitimate to emphasize the 'AI' in the acronym AI4D. This assumption specifically addresses the impact of AI applications on development, which is presumably higher/better compared to traditional technologies. However, nobody has yet formally shown that the outcome of the AI technology is better than classical technologies in a Development context. In most cases, the potential of the AI technology praised by the vendors (and, sometimes, by important international development agencies) is taken for granted. Many technological proposals for Development projects, described in the open literature, are framed and specified on the basis of the hypothetical potential of the AI technology, which has never been demonstrated or proven.

For example, the USAID (USAID 2018) presented several exemplary ML/AI applications which may have an important social impact such as image analysis (used for example in medical diagnostics, the prediction of crop yields and the identification of zones of deforestation), Chatbots (used for example to support mental health assistance and reproductive health education), e-Government (to support some tasks such as tax evasion detection, quantifying women's participation and tracking media reports of violence against women). It is worth observing that the application cases provided as examples of the successful use of ML/AI fit well with the pattern matching capabilities of ML (and DL) while exploiting large data sets. But, taking a step back, one realises that these cases are only niche applications when considering the wide spectrum of applications needed to build a solid and reliable ICT4D infrastructure and to provide citizen-oriented services in DLDCs.

As well, Vinuesa and colleagues (Vinuesa et al. 2020) showed that AI could have a beneficial impact on 79% of the SDG targets and inhibit 35% of the targets. It is worth noting that the authors did not address the issue of development per se and only focused on the achievement of the SDGs. Moreover, when considering carefully the approach and results of (Vinuesa et al. 2020), it can be observed that :

- No benchmarking or even a simple comparison with traditional technologies was made to demonstrate that AI is better than other ICTs for Development purposes;
- Very few explanations were provided to justify the specific use of AI rather than other technologies in the suggested applications.
- The formal conclusions were 'mild' in the sense that most affirmations on the possible positive impact of AI on Development were preceded by the term 'could';
- The term 'inhibit' is rather vague and has no sense in the formal theory of software engineering.
- As stated in the paper, 'environmental targets attract the most positive contributions and social targets benefit the least of AI, while economic targets require further investigation in terms of potential positive effects of AI'.

When considering the relation of AI, the SDGs and Development, the statement 'social targets benefit the least of AI' is the most telling one. Indeed, it is important to distinguish between the SDGs and Development because they do not have the same purpose. On the one hand, the SDGs are specific goals identified by the United Nations to 'make the world better'. They apply to all countries with no distinction. Development, on the other hand, has a more specific scope (focusing on the progress of DLDCs) and goals (development process, context and outcomes). Therefore, many AI4D projects that were proposed under the umbrella of the SDGs do not really fit with the Development context and goals. *Hence, again, the misalignment between AI4D and Development.*

5.3. (Assumption 3) The features of AI Design and Architecture are a better fit for development compared to 'traditional' technologies

This means that AI, as a technology, is so different in the way it automates tasks and solves problems that it is necessary to replace 'ICT' by 'AI' in the acronym; hence the acronym 'AI4D' instead of 'ICT4D'. However, suppose one carefully

looks at the most important and inherent design features of the AI technology today. In that case, one quickly realizes that these are neither compatible with a Development context nor are they compliant with the foundations of the ICT4D theory as presented earlier in this paper. The main arguments include:

5.3.1. AI Systems are Essentially Data-Driven

AI applications need to be trained with huge amounts of data which have to be accumulated in gigantesque data stores, through a considerable effort of digitalization, analysis, structuring, standardization and normalization of real-world 'things' and 'situations'. For example, *Financial data sets* include how banks processed their clients' loan requests over the past decades, and what the corresponding decisions were (to grant a loan or not, according to the client's profile and financial history). Moreover, these data sets also need to record if these decisions were fit or unfit with respect to what actually happened to every single client and every single loan request (was the loan reimbursed, was there any difficulty, etc.).

As another example, Justice data sets need to include how judges and tribunals have processed past cases, what the verdicts were and whether these verdicts were fit or unfit. By analogy, we can use these two examples to imagine the type, nature and volume of data that is needed to run AI applications in highly social sectors such as Education, Health and Culture. The data that AI applications require would need decades of hardship to be elaborated and readied in DLDCs. Indeed, there is some data out there that could apply to any country (meteorological data sets, for example), but this kind of data is very limited in its applicability and added value for social sectors (education, health, governance, etc.).

5.3.2. The Lack of Explainability

As previously stated, AI systems are not able, by design, to explain their decisions to end-users, with justifications that one legitimately might need to better understand, accept, and trust the system's proposals. For instance, an AI application used for credit scoring should be able to explain why it rejected or approved the client's application, justifying the decision using data about the client's credit history, unpaid dues and income level.

The only explanation that such an AI-Bot would provide is something like: 'In situations similar to your case, Dear Client, the decision that our Bank made is such-and-such". But, if the client asks: 'Why?', the AI-Bot would only be able to answer something like: 'It is so, according to our practice during the past years'. An answer that is not really satisfying!

5.3.3. The Inability to Explain Decisions can be thought of as a Lack of Transparency

From this perspective, using such AI systems at the level of countries would increase the risk of empowering autocratic and authoritarian governance systems and of weakening citizens' participation, involvement and trust. This is indeed against the fundamentals of Development and ICT4D.

5.3.4. The Lack of Generalization and Adaptability Outside the Specific Set of Tasks/Domains to which AI is Applied.

When considering the potential use of AI applications for development, decision makers are limited to the specific categories of tasks to which AI is applied today, such as chatbots, profiling, image processing, search and human assistance. Suppose the DLDCs' decision and policymakers do not well understand these limits. In that case, there is a risk that they would alter the current digital transformation agenda of their respective countries to prioritize AI applications, putting at risk the overall Development efforts. This is indeed counterproductive in the context of International Development.

5.3.5. AI Platforms and Solutions are Mainly Cloud-Based and Controled by a Few Giant AI Companies Outside the DLDCs.

This means that most of the hardware, software and data that form the AI infrastructure, and that is needed to run it, are located somewhere in the world that the local user does not know and does not control. Since data and information are at the heart of any management and governance system, having these located remotely, with the associated risks (corruptibility, loss, disruption, etc.), is simply against the principle of sovereignty of countries and their regalian attributions.

5.3.6. AI Applications are Inherently 'Black-Box Systems'.

This means that when using such AI systems, one cannot know how they are internally organized, structured, and programmed. DL and LLM training models do not explain how and why they get their results, and very few experts around the world would know how they function. You can use AI Systems, as they are delivered, but you will never own them, master them, and be able to (re)produce them. In the ICT4D context, where countries are highly encouraged to develop their local capacities, to master technology and to contribute to the society of knowledge, the adoption of the AI technology, as currently promoted, seems to be unfit and even dangerous for the future of these countries.

6. Discussion

After demonstrating that assumptions (a1), (a2), and (a3) are wrong, it is relevant to go back to the main goals of this paper:

- To prove that acronyms such as AI4D and the like do not stand and are not grounded;
- To raise a reasonable doubt concerning the capacity of AI to provide added value for Development in DLDCs, while considering the current pressure to adopt AI, no matter the cost and consequences.

This demonstration naturally led the authors of this paper to suggest a new acronym, Smart-ICT4D, instead of AI4D, to better reflect and highlight the role of technology, as a tool, to support and streamline the global vision and specific objectives of development, while considering all technology enablers, AI included.

In this paper, it is contended that the use and promotion of ungrounded and imprecise acronyms related to technologies for Development (AI included) is neither relevant nor useful for the international community, in general, and for decision makers, in particular:

- This is not good for the community (i.e. scientists, academics, practitioners) because there are no theoretical foundations (context, models, methodology, values, etc.) related to AI4D to ground, frame, define and support AI4D projects and initiatives. To some extent, the mushrooming of such acronyms would simply lead to the 'cannibalization' (and death) of the ICT4D field.
- This is not good for decision makers because it creates an unavoidable confusion between the technology itself and the Development objectives, while it seems to suggest that AI is superior to other technologies and that it is THE technology to use for development.

Moreover, DLDCs' policy and decision makers may become confused and possibly destabilized by all this agitation around AI technologies and their potential impacts and threats, which adds up to the pressure put by AI vendors. This discussion aims to help them step back and contemplate a bigger picture of AI within the context of ICT4D.

There is no doubt that AI has a huge impact on the industrial and commercial sectors. Significant examples abound, such as the creation of robotized auto manufacturing plants and the deployment of robotized warehouses and commercial systems supporting the automatic treatment and delivery of customers' orders. However, ICT4D is mainly about delivering social services (such as Health, Education and Justice) to citizens (Hamel 2010), and as shown in this paper, these services do not fit well with the tasks in which current AI technologies based on ML and DL excel. Hence, it is important to understand that AI is not there to replace ICT4D. To take full advantage of AI in a Development context, it seems appropriate to consider it as another technological advance that can complement and enhance the fundamental and essential infrastructures (hardware, software, communications, services) that already constitute ICT4D.

Moreover, it would be wise not to forget the principles of good governance that should inform and orient the decision-making process and the development of e-Government systems that sustain ICT4D (Kettani and Moulin 2014). Although *Good Governance* (GG) is quite dependent on the context in which it is assessed, some of its general characteristics can be devised as proposed by the UNDP: 1) Participation; 2) Rule of Law; 3) Transparency; 4) Responsiveness; 5) Consensus orientation; 6) Equity; 7) Effectiveness and efficiency; 6) Decentralized management; 8) Accountability; and 9) Strategic vision (UNDP 1997). Indeed, GG should apply to AI projects in the same way that it applies to traditional ICT4D projects. When looking at the risks and vulnerabilities of AI projects listed by the *UN AI Advisory Body* (2023), it seems obvious that these projects do not comply with many of these GG characteristics. This should raise a red flag for policy and decision makers in DLDCs.

A long time ago, several authors emphasized that e-Government requires much more than technical wizardry to develop and operate successful online services (Marais 2015). Strategic approaches need to be developed to organize and assemble tangible resources such as computers and networks, and intangible resources such as employee skills, knowledge and organizational processes (Kettani and Moulin 2014). Consequently, government organizations need to address two main issues to achieve success in e-Governance: 1) They must have a significant population of citizens willing and capable to adopt and to use online services; 2) They need to develop the managerial and technical capabilities to implement e-government applications to meet the citizens' needs (Hanna 2010). Obviously, this should also apply to AI applications developed and deployed in DLDCs, considering the context of ICT4D. Such issues have also been recently raised by authors advocating the implementation of a 'Responsible Artificial Intelligence in Africa' (Okaibedi et al. 2023).

In this context, it is interesting to list here the recent guiding principles proposed by the UN for the governance of AI (UN AI Advisory Body 2023): 'AI should be governed inclusively, by and for the benefit of all; 2) AI must be governed in the public interest; 3) AI governance should be built in step with data governance and the promotion of data commons; 4) AI governance must be universal, networked and rooted in adaptive multi-stakeholder collaboration; 5) AI governance should be anchored in the UN Charter, International Human Rights Law, and other agreed international commitments such as the Sustainable Development Goals'.

These guiding principles are completely aligned with most of the principles of Good Governance and the development of e-Government systems that were advocated ten years ago in (Kettani and Moulin 2014). This is most encouraging! Moreover, it is interesting to note that, twenty years ago, it was observed that a large number of e-government systems deployed in developing countries failed to enhance governance (Heeks 2001). A number of reasons have been invoked such as: 1) The application of inappropriate technologies; 2) A field-level disconnection between multilateral banks, donors, other project sponsors and the

client governments they serve; 3) An excessive reliance on top-down government approaches which did not account for users' needs and citizens' demands; 4) Lack of transparency and citizen involvement; 5) Resistance by entrenched bureaucracy; 6) Corruption; 7) Regressive policy and regulatory environments; and 8) Unskilled human resources (Guida and Crow 2008)

When looking carefully at these causes of failure, one can observe that they still apply today to ICT4D in many DLDCs. *It is highly plausible to anticipate the same potential failures for AI projects if they are not carefully planned, developed and deployed in a Development context*.

Considering the ICT4D context in which countries are highly encouraged to develop their own local capacities, to master technology and to contribute to the society of knowledge, *it is claimed in this paper that the adoption of AI must be subordinated to the ICT4D agenda, and not the other way around*.

To support this renewed vision of ICT4D, the authors of this paper propose the new acronym: *Smart ICT4D*. The term 'Smart' stands for:

- Smartly developing policies to sustain ICT4D and smartly complying with international directives and standards;
- smartly choosing, planning and prioritizing the services and applications that are needed for the development of the country;
- smartly using digital technology (including AI) in ICT4D projects;
- smartly sensitizing, involving and educating all the stakeholders, including professionals, civil employees and decision makers, in the transformation process toward sustainable development;
- smartly sensitizing, listening to and educating citizens (students, adults and seniors) and communities;
- smartly selecting and involving (local, national and foreign) companies in the development, deployment and maintenance of Smart ICT4D projects.

The term 'Smart' refers to the intelligence and sensibility of people (policy and decision makers, educators, technology implementers and users) using wisely any technology, including AI, to support and sustain development. Indeed, this view of Smart ICT4D emphasizes the organizational, social and participatory aspects of an approach to ICT4D that:

- Uses the appropriate technologies for the appropriate services for carefully targeted communities;
- Can truly sustain development; and
- Are adapted to the conditions that hold in a particular DLDC.

It is suggested that such a vision is closer to the challenges, constraints and expectations that the policy and decision makers experiment and need to manage day by day on the ground.

Moreover, developing and deploying AI applications while managing AI risks in a responsible way (i.e. Responsible AI) is an important topic that has been raised in Section 4. It is worth noting that good/best practices (Jones 2009), as well as ethics (Alidoosti et al. 2022), have been proposed and practiced in the software engineering domain for a long time, long before it became an issue for AI applications. Software engineering good practices and ethics were developed and applied in developed countries, and were used and applied in DLDCs as well, in the ICT4D context. Indeed, they still apply in the context of Smart ICT4D. Moreover, when AI components need to be considered in a Smart ICT4D project, regulators, developers, and all the involved stakeholders will take advantage of the guidelines, regulations and best practices of responsible AI.

7. Conclusion

In this paper, serious questions were raised about the use of acronyms such as AI4D, AI4Poor, AI4Africa and AI4Good. It has been shown that the emphasis put on AI in relation to development may convey the false idea that AI is the unique solution to all the problems that the DLDCs are tackling. AI technologies have not been developed with any concern for the Development matters. On the contrary, it has been shown that current AI technologies present risks related to threats and vulnerabilities to some categories of individuals (bias, unfair treatment, prejudice), to some groups and marginalized communities (marginalization, unfair treatment), to cultural diversity, to name a few (UN AI Advisory Body 2023). These risks have been identified when observing the consequences of the deployment of AI technologies in developed countries. They become an even bigger threat if great caution is not exerted when trying to apply AI technologies in DLDCs.

The obvious conclusion is that a wiser and safer approach for DLDCs is to contemplate the adoption of AI technologies as subordinated to the country's ICT4D agenda, and not the other way around. Moreover, this adoption should be carried out 'smartly' by the decision and policymakers of DLDCs, taking into account the state of development (economic, societal, industrial, technological) of their countries. In this context, the vision of Smart ICT4D was proposed, emphasizing the organizational, social and participatory aspects of an approach of ICT4D that includes AI technologies. DLDCs may be at very different developmental stages in terms of ICTs, and some may still not have the basic infrastructure to sustain reliable communications and internet services. Hence, it would be insane to 'put the cart before the horse' and to promote the adoption of AI technologies when the communication infrastructures, the computing power, the

knowledge skills, the adequate policies are not there! That is the reason why this paper advocates for a return to the foundations of ICT4D and to the smart usage of the appropriate technologies (ICTs, including AI) to deliver the appropriate services to carefully targeted communities in order to sustain development, taking-into-account the situation of a particular DLDC, as well as its Development plan and goals. This is the vision of Smart ICT4D that emphasizes that any new technology proposed for Development purposes needs to be considered in an ICT4D agenda/framework that is smartly/wisely adjusted in consideration of the needs and specificities of a particular developing country or organization. The next phase of this research work aims at developing a systematic evaluation approach to assess the characteristics of any AI project proposed to a country or an organization for Development purposes. The envisioned approach has two main stages: 1) the assessment of the project characteristics in relation to Development requirements; 2) the assessment of the country/organization's readiness to successfully implement the proposed project. This approach will help decision-makers and policymakers to assess the appropriateness and interest in engaging in AI projects while considering the development goals/priorities of their country/organization.

References

[1] Razieh Alidoosti et al., "*Ethics in Software Engineering: A Systematic Literature Review*," Vrije Universiteit Amsterdam data, 2022. [Google Scholar] [Publisher Link]

[2] Seema Arora-Jonsson, "The sustainable Development Goals: A Universalist Promise for the Future," *Futures*, vol. 146, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[3] Chrisanthi Avgerou, "Discourses on ICT and Development," *Information Technologies & International Development*, vol. 6, no. 3, pp. 1-18, 2010. [Google Scholar] [Publisher Link]

[4] W. Chigonaa, M. Pollocka, and J.D. Roode, "South Africa's Socio-Techno Divide: A Critical Discourse Analysis of Government Speeches," *South African Computer Journal*, vol. 2009, no. 44, pp. 3-20, 2009. [CrossRef] [Google Scholar] [Publisher Link]

[5] Carl Dahlman, and Sam Mealy, "Obstacles to achieving the Sustainable Development Goals: Emerging global challenges and the performance of the Least Developed Countries," *Commonwealth, Achieving the Istanbul Programme of Action by 2020, United Kingdom*, pp. 40-54, 2020. [Google Scholar] [Publisher Link]

[6] Mona Nabil Demaidi, "Artificial Intelligence National Strategy in a Developing Country," *AI & SOCIETY*, vol. 40, no. 2, pp. 423-435, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[7] Fiona Dias, "The Politics of Sustainable Development Goals," *Gap Bodhi Taru, A Global Journal of Humanities*, vol. 4, no. 4, pp. 37-40, 2021. [Google Scholar] [Publisher Link]

[8] Virginia Dignum, *Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way*, Springer, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[9] Burkay Divrik, "Critical Approaches to the Concept of Sustainable Development," *International Journal of Rural Development, Environment and Health Research (IJREH)*, vol. 6, no. 3, pp. 26-29, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[10] Damian Okaibedi Eke, Kutoma Wakunuma, Simisola Akintoye, *Responsible AI in Africa: Challenges and Opportunities*, Palgrave Macmillan Cham, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[11] James Guida, and Martin Crow, *E-Government and E-Governance*, ICT4D: Information and Communication Technology for Development, pp. 283-320, 2009. [Google Scholar]

[12] David Jaffee, *Levels of Socio-economic Development Theory*, Bloomsbury Publishing, 1998. [Google Scholar] [Publisher Link]

[13] Panom Gunawong, and Ping Gao, "Understanding E-Government Failure in the Developing Country Context: A Process-Oriented Study," *Information Technology for Development*, vol. 23, no. 1, pp. 153-178, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[14] Jean-Yves Hamel, "*ICT4D and the Human Development and Capabilities Approach: The Potentials of Information and Communication Technology*," United Nations Development, Program Human Development Reports, 2010. [Google Scholar] [Publisher Link]

[15] Nagy K. Hanna, "*Transforming Government and Empowering Communities: The Sri Lankan Experience with e-Development*," World Bank Publications, 2008. [Google Scholar] [Publisher Link]

[16] Nagy K. Hanna, *Transforming Government and Building the Information Society: Challenges and Opportunities for the Developing World*, Springer New York, 2011. [CrossRef] [Google Scholar] [Publisher Link]

[17] Richard Heeks, "Information and Communication Technologies, Poverty and Development," *SSRN Electronic Journal*, 1999. [CrossRef] [Google Scholar] [Publisher Link]

[18] Richard Heeks, "Understanding E-Governance for Development," *SSRN Electronic Journal*, 2001. [CrossRef] [Google Scholar] [Publisher Link]

[19] Richard Heeks, "ICT4D 2.0: The Next Phase of Applying ICT for International Development," *Computer*, vol. 41, no. 6, pp. 26-33, 2008. [CrossRef] [Google Scholar] [Publisher Link]

[20] Richard Heeks, "The ICT4D 2.0 Manifesto: Where Next for ICTs and International Development?," *SSRN Electronic Journal*, 2009. [CrossRef] [Google Scholar] [Publisher Link]

[21] Richard Heeks, *Information and Communication Technology for Development (ICT4D)*, Routledge, 2017. [CrossRef] [Google Scholar] [Publisher Link]
[22] Yosef Jabareen, "Building a Conceptual Framework: Philosophy, Definitions, and Procedure," *International Journal of Qualitative Methods*, vol. 8, no. 4, pp. 49-62, 2009. [CrossRef] [Google Scholar] [Publisher Link]
[23] Capers Jones, *Software Engineering Best Practices*, McGraw Hill, 2009. [Google Scholar] [Publisher Link]
[24] Shirley Kempeneer, Sofia Ranchordas, and Simone van de Wetering, "AI Failure, AI Success, And AI Power Dynamics in the Public Sector," *SSRN Electronic Journal*, 2024. [CrossRef] [Google Scholar] [Publisher Link]
[25] David Le Blanc, "Towards Integration at Last? The Sustainable Development Goals as a Network of Targets," *Sustainable Development*, vol. 23, no. 3, pp. 176-187, 2015. [CrossRef] [Google Scholar] [Publisher Link]
[26] Deborah J. MacInnis, "A Framework for Conceptual Contributions in Marketing," *Journal of Marketing*, vol. 75, no. 4, pp. 136-154, 2011. [CrossRef] [Google Scholar] [Publisher Link]
[27] Mario A. Marais, "ICT4D and Sustainability," *The International Encyclopedia of Digital Communication and Society*, pp. 1-9, 2015. [CrossRef] [Google Scholar] [Publisher Link]
[28] Warmhold Jan Thomas Mollemaorcid, "Decolonial AI as Disenclosure," *Open Journal of Social Sciences*, vol. 12, no. 2, pp. 574-603, 2024. [CrossRef] [Google Scholar] [Publisher Link]
[29] John McCarthy et al., "A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence," *AI Magazine*, vol. 27, no. 4, pp. 12-14, 2006. [CrossRef] [Google Scholar] [Publisher Link]
[30] Sean McGregor, "Preventing Repeated Real World AI Failures by Cataloging Incidents: The AI Incident Database," *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 35, no. 17, pp. 15458-15463, 2021. [CrossRef] [Google Scholar] [Publisher Link]
[31] Damian Okaibedi Eke, Kutoma Wakunuma, and Simisola Akintoye, *Responsible AI in Africa: Challenges and Opportunities*, Palgrave Macmillan Cham, 2023. [CrossRef] [Google Scholar] [Publisher Link]
[32] Kevin Paeth et al., "Lessons for Editors of AI Incidents from the AI Incident Database," *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 39, no. 28, pp. 28946-28953, 2025. [CrossRef] [Google Scholar] [Publisher Link]
[33] Petar Radanliev et al., "Ethics and Responsible AI Deployment," *Frontiers in Artificial Intelligence*, vol. 7, pp. 1-17, 2024. [CrossRef] [Google Scholar] [Publisher Link]
[34] Kapil Dev Regmi, "Foundational Models of Development, Underlying Assumptions and Critiques," *Social Change*, vol. 48, no. 3, pp. 1-20, 2018. [CrossRef] [Google Scholar] [Publisher Link]
[35] Kapil Dev Regmi, "Five Decades of Neoliberal Developmentalism in "Least Developed Countries": A Decolonial Critique," *Journal of International Development*, vol. 37, no. 1, pp. 68-86, 2025. [CrossRef] [Google Scholar] [Publisher Link]
[36] Stuart Russell, and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th ed., Pearson, 2021. [Google Scholar] [Publisher Link]
[37] Peter J. Scott, and Roman V. Yampolskiy, "Classification Schemas for Artificial Intelligence Failures," *Delphi Interdisciplinary Review of Emerging Technologies*, vol. 2, no. 4, pp. 186-199, 2019. [CrossRef] [Google Scholar] [Publisher Link]
[38] Zheyuan Ryan Shi, Claire Wang, and Fei Fang, "Artificial Intelligence for Social Good: A Survey," *arXiv Preprint*, 2020. [CrossRef] [Google Scholar] [Publisher Link]
[39] Mike H.M. Teodorescu et al., "Failures of Fairness in Automation Require a Deeper Understanding of Human-ML Augmentation," *MIS Quarterly*, vol. 45, no. 3b, pp. 1483-1499, 2021. [CrossRef] [Google Scholar] [Publisher Link]
[40] Richard J. Torraco, "Writing Integrative Literature Reviews: Guidelines and Examples," *Human Resource Development Review*, vol. 4, no. 3, pp. 356-367, 2005. [CrossRef] [Google Scholar] [Publisher Link]
[41] A.M. Turing, "Computing Machinery and Intelligence," *Mind*, vol. 59, no. 236, pp. 433-460, 1950. [Google Scholar] [Publisher Link]
[42] UNDP, "*Governance for Sustainable Human Development: A UNDP Policy Document*," United Nations Digital Library, 1997. [Google Scholar] [Publisher Link]
[43] USAID, "*Reflecting the Past, Shaping the Future: Making AI Work for International Development*," 2018. [Google Scholar] [Publisher Link]
[44] United Nations, *Governing AI for Humanity*, UN-iLibrary, 2024. [CrossRef] [Publisher Link]
[45] UN. Secretary-General: UNCTAD, "*Science, Technology and Innovation for Sustainable Development: Report of the Secretary-General*," United Nations Digital Library, 2017. [Google Scholar] [Publisher Link]
[46] United Nations, Transforming our World: The 2030 Agenda for Sustainable Development, A/RES/70/1, 2015. [Online]. Available: https://sdgs.un.org/2030agenda
[47] Tim Unwin, *ICT4D Information and Communication Technologies for Development*, Cambridge University Press, 2009. [Google Scholar]
[48] Ricardo Vinuesa et al., "The Role of Artificial Intelligence in Achieving the Sustainable Development Goals," *Nature Communications*, vol. 11, no. 1, pp. 1-10, 2020. [CrossRef] [Google Scholar] [Publisher Link]
[49] Kutoma Wakunuma et al., "Responsible AI, SDGs, and AI Governance in Africa," *2022 IST-Africa Conference (IST-Africa)*, Ireland, pp. 1-13, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[50] Geoff Walsham, "ICT4D Research: Reflections on History and Future Agenda," *Information Technology for Development*, vol. 23, no. 1, pp. 18-41, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[51] Jane Webster, and Richard T. Watson, "Analyzing the Past to Prepare for the Future: Writing a Literature Review," *MIS Quarterly*, vol. 26, no. 2, pp. 13-23, 2002. [Google Scholar] [Publisher Link]

[52] Jinsong Wu et al., "Information and Communications Technologies for Sustainable Development Goals: State-of-the-Art, Needs and Perspectives," *IEEE Communications Surveys & Tutorials*, vol. 20, no. 3, pp. 2389-2406, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[53] Xinhui Zhan, Heshan Sun, and Shaila M. Miranda, "How Does AI Fail Us? A Typological Theorization of AI Failures," *ICIS 2023 Proceedings, 25*, 2023. [Google Scholar] [Publisher Link]

[54] Yingqin Zheng et al., "Conceptualizing Development in Information and Communication Technology for Development (ICT4D)," *Information Technology for Development*, vol. 24, no. 1, pp. 1-14, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[55] UN Secretary-General Launches Advisory Board to Support AI Governance, IISD, 2023. [Online]. Available: https://sdg.iisd.org/news/un-secretary-general-launches-advisory-board-to-support-ai-governance/

[56] AI4Dev 2020 Challenge, AI4DEV, 2020, [Online]. Available: https://ai4dev2020.com/#about

[57] XPRIZE and ITU: A Partnership with a Unique Mission, 2019. [Online]. Available: https://www.xprize.org/articles/xprize-itu

[58] AI for Sustainable Development Goals (AI4SDGs) Think Tank. [Online]. Available: https://ai-for-sdgs.academy/

[59] Artificial Intelligence: AI for Sustainable Development. [Online]. Available: https://www.undp.org/digital/ai