

Ten simple rules for successful and sustainable African research collaboration

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Introduction

Collaborative research is the assemblage of researchers from diverse backgrounds, who are pursuing mutually interesting and beneficial research to achieve a common purpose via the coordination of activities and the sharing of knowledge, competencies, resources, and information, resulting in the production of new scientific knowledge [1]. Hence, research collaboration could involve a continuum of organizational levels ranging from individual researchers to institutions, organizations, or even communities from different disciplines and geographical locations [1,2,3]. Furthermore, the quick expansion in international collaboration frameworks is largely fostered by the tremendous benefits it brings, and has enhanced access to funding, data sources and methodological expertise, as well as opportunities that increase both the global impact and integrity of research findings [2,4]. Research outcomes from international cooperations contribute effectively to global stability, security and prosperity. It also fosters equal opportunities by ensuring that communities are represented in global policies particularly those related to health and sustainable development [5]. African countries continue to witness a significant surge in national and international collaborations [6] due to the unique research potential of the continent. For global research to benefit from the unique opportunities present in Africa and for the impact of African researchers and their research to be rightly felt within the scientific community, there is a need to elaborate key steps that will guide such partnerships for the benefit of all [7,8]. It is for this reason that we have proposed solutions that will scale meaningful collaboration with African researchers.

Rule 1: Understanding Africa

Firstly, Africa is not a country; it is a continent with the largest number of countries in the world. Africa has 54 countries fully recognized by the United Nations, two independent states gaining recognition (Western Sahara and Somaliland), and several territories. Africa is a diverse continent made up of these distinct countries, each with its own unique cultural, social, political, and economic characteristics. While culturally diverse, research teams have shown the need to be creative [9], an understanding of cultural diversity and how it is managed is an important factor in enhancing the teams' success [10]. A difference in culture can affect the way research is conducted, analyzed, interpreted and communicated, and can pose challenges to effective collaboration with African researchers. Furthermore, an awareness of cultural norms, beliefs, and practices of African communities and linguistic differences can help researchers from other parts of the world to effectively collaborate with African researchers.

The political and economic systems in most African countries are often unpredictable and can significantly impact the way research is conducted, funded, and regulated. Also, resources and

infrastructure for research can vary widely across different African countries, with some countries having more advanced facilities and equipment than others. Countries across the world have been affected by the COVID-19 pandemic coupled with the effects of the Russia-Ukraine war; however the effect on Africa has been intensified due to its fragile economy. Therefore, a better understanding of the African continent and the impact of the economy and the cultural norms of the collaborators can help to promote respect for local knowledge, potential barriers and the expertise to ensure that research is conducted in a way that is sensitive to local interests, needs and priorities. This will promote sustainable development and ensure that research is conducted in an ethical and equitable manner.

Rule 2: Taking advantage of virtual reality

Because of the pandemic and the lockdowns that ensued, online meetings quickly became the main way to work and communicate across the globe. The use of technological tools that enable virtual meetings offers an opportunity to bridge the physical distance and facilitate collaboration in an engaging and cost effective way. Working virtually allows researchers to meet using technology in a shared space, regardless of their physical or geographical location. It also allows for frequent and efficient communication, as well as providing the opportunity to share ideas, data, and research findings rapidly in real-time [11]. Virtual technology provides easy access to workshops, conferences, and other collaborative events, allowing researchers to overcome barriers such as visa complications and childcare demands to work together in a more inclusive, engaging and interactive way. In areas where physical access to research materials or subjects is difficult or almost impossible, virtual technology can be used to facilitate environmental explorations, conduct surveys, and collect data. By enabling virtual meetings, visualizing data, and supporting fieldwork, virtual technology can help break down geographic and cultural barriers and enable researchers to work together in a more immersive and engaging way. Importantly, recent studies indicate that virtual teams when managed effectively are efficient, reliable and tend to achieve productivity benefits, have less acrimony, and foster social integration [12]. As virtual technology continues to evolve, it has a huge potential of facilitating collaboration with African researchers by bridging geographical distances. Despite the advantages of using virtual networks, the technology still requires a high speed internet and computer skills and so collaborators need to be understanding of this and discuss these points when planning the collaboration.

Rule 3: Investigators' in-person meetings in Africa

With the growing need for global collaboration for several reasons including research, the need for in-person meetings could span from building trust between partners or collaborators, to mentoring, auditing, and program-to-project dissemination meetings which have been tested and proven to be important at one stay during the process of implementing a project/program [13]. Whatever the reason for physically convening with collaborators, most interactions require visas or invitations for the process to be effective which might be difficult because of visa denial issues, limited time and low financial resources. Every day, scientists are being denied entry to countries where they have been invited to attend conferences, events, meetings, to teach and present, to share knowledge and advance science and research. Agencies such as the International Labour Organization and the African migration policy are trying to address these issues, as the benefits of improvements to global research community travel are clear to both the researchers' and host nations [14]. Visa issues create serious challenges or delays to the work that researchers do, resulting in research waste from the dissemination of findings necessary crucial to discovery, drug development and treatments, to personal career development and job opportunities in the in-person networking events in conferences, as well as the investment in scientific development of the country or continent due to a lack of international collaborators traveling between the countries [15]. To address this, it is very important to discuss the issue of visas and long wait times with your collaborating organizations and conferences so they can ensure you are given invites and dates as early as possible, for you to remain organized with your personal and scientific records, and to start the visa application processes as early as you can to ensure you can gain all documentation needed and preempt often long wait times in processing. If possible, researchers could also aim to cultivate good working relationships with government ministries and agencies to try to gain local knowledge that can help to reduce bureaucracy and research permits denial.

Rule 4: Trade by barter

The disparity in resources between different regions of the globe is a major barrier hindering research collaborations aiming to tackle global challenges. African researchers often face significant challenges due to limited or absent funding, infrastructure, access to advanced research materials and tools, and lack of databases and open data or software. This can make it difficult for them to conduct research and contribute to global scientific progress [16]. One solution to this challenge is the exchange of valuable materials and tools between researchers from different parts of the world enabling African researchers to access resources that may not be readily available in their home countries. Researchers in Africa can then exchange these state-of-the-art resources and technologies

with their unique insights, research data, and information that is only obtainable in Africa. The sharing of this knowledge that is unique to the African continent is valuable for human discovery and global research initiatives, such as those related to climate change, infectious diseases, or natural resource management. For instance, most infectious diseases are still endemic in Africa and knowledge of the nature and dynamics of these infectious agents is necessary to develop solutions for re-emerging infectious agents in other parts of the world [17]. This approach will entrench ethical and equitable collaborations with African researchers being full partners while also protecting the rights and interest of other partners in the research projects and initiatives. Collaborations should also be focused on promoting sustainable development and addressing local needs and priorities, rather than solely serving the interests of researchers from more developed regions. In addition to the exchange of materials and tools, collaboration between African researchers and those from other parts of the world should involve joint research projects, mentorship programs, and training initiatives. These types of initiatives can help African researchers build skills and expertise, while also contributing to research projects of global importance. It is worth noting that in most cases, research projects with investigators outside of the continent are held in high esteem and are published in higher-ranked or respected journals. This can help African research collaborations to improve existing initiatives and research capacities to publish globally, access research funding and continue to build their research teams.

Rule 5: Collaboration between projects within Africa

Unfortunately, collaboration between African countries is scarce and it lags behind collaboration between African countries with and researchers from regions such as Europe, Asia and America. Collaboration between projects is an important aspect that has not yet been explored. This type of collaboration could help collaborators share the experience of different or similar projects and experiences thus providing maximum benefits for all. Such collaboration could lead to sustainable relationships beneficial to the projects, collaborating individuals, and organizations. Any improvements to training and upgrading of technology in research institutes across Africa would ensure the attraction to research between peers and networks across Africa becomes easier. Organizations could collaborate if they had similar projects thus leading to efficient use of scarce resources such as financial resources. Structured collaboration projects across African countries would also strengthen the development of individuals with the soft skills necessary for effective collaborations, and the expansion of other research activities thus establishing a consortium for more gains, and promoting common goals important to the continent of Africa, similar to the

Institute for Healthcare Improvement (IHI Institute) [18]. To ensure that initiatives like this work, there is a need for more government involvement, as well as universities and research communities uniting efforts to establish, manage and maintain the initiative through dedicated project management, training and funding.

The growth of research collaboration is growing quickly globally, and although across Africa it may lag behind other global countries, it is also rapidly increasing. To understand what motivates collaboration in research, it is important to have a proper understanding of the underlying reasons. One significant reason is the rising cost of conducting scientific research. In many fields, the cost of scientific research exceeds what an individual, institution, or organization can afford, causing academic institutions and scientific organizations to combine human and capital resources to finance research projects.

Moreover, some research projects require the use of innovative technologies that are not yet available in certain countries. This leaves researchers with no choice but to collaborate with colleagues who possess the necessary technology to undertake the project successfully. Additionally, the progress and development of scientific research and discoveries are largely dependent on collaborative research efforts. Consequently, research institutions often launch projects that require the expertise of professionals from different fields to carry out the research effectively. The interdisciplinary approach to research is becoming more important as it brings together experts from different fields and increases the likelihood of scientific breakthroughs.

Another important factor that motivates research collaboration is the increasing need for specialization within certain scientific fields, especially those where the research required is very complex. A good example is vaccine research, which is a complex and multifaceted field that draws upon expertise from a wide range of disciplines. It involves the study of infectious diseases, immunology, microbiology, epidemiology, virology, genetics, and many other areas. As such, it is truly an interdisciplinary field that requires collaboration and cooperation between researchers from different backgrounds and specializations. It would be very hard to find a single scientist or researcher that is qualified in all these disciplines to handle all aspects of research and development, which is why research collaboration among experts from different fields is inevitable.

At present, the African Union (AU) and the Africa Centers for Disease Control and Prevention (Africa CDC) are jointly advocating for a novel Public Health Order, aimed at safeguarding both the health and economic stability of the continent, while simultaneously striving towards achieving

the aspirations set forth by Agenda 2063 [19]. A fundamental element of this initiative involves bolstering the local production of vaccines, diagnostics, and therapeutics, given that currently, less than one percent of vaccines being administered in Africa are locally manufactured [19]. For this to succeed, collaborations between research institutions in Africa cannot be neglected, especially if Africa is truly interested in the manufacture of its own vaccines. This shows why we need continuous research collaborations within African countries. Collaborations between African researchers and research institutions are particularly important in vaccine research. This is because many infectious diseases that disproportionately affect African populations have been historically neglected in terms of research and development of vaccines. For example, malaria, tuberculosis, and HIV/AIDS are major health concerns in Africa, but there are still no highly effective vaccines for these diseases. By collaborating with African researchers and research institutions, scientists from other parts of the world can gain a better understanding of the unique challenges and complexities of these diseases in the African context. African researchers can also bring their own expertise and perspectives to the table, which can help inform and improve the design and implementation of vaccine research studies. In addition, collaborations with African researchers and institutions can help ensure that the benefits of vaccine research are more equitably distributed. This is important because historically, vaccines have often been developed and distributed primarily to wealthy countries, leaving many African countries behind and vulnerable in emergency epidemics and pandemics such as the COVID-19 pandemic, where millions of Africans lost their lives [20]. Through research collaborations between African researchers and research institutions, we can gain a better understanding of the unique challenges and complexities of diseases like COVID-19 in the African context, which will thoroughly reshape the research capabilities of African institutions. This will in turn allow African researchers to bring their own expertise and perspectives to the table, and help inform and improve the design and implementation of global vaccine research studies to ensure that vaccines are developed and distributed in a way that is fair and just.

Finally, collaborations between African researchers and institutions can help build local capacity and expertise not only in vaccine research but other research areas as well. This can help ensure that African countries are better equipped to tackle future health challenges and reduce the dependence on foreign expertise and resources.

Rule 6: Promoting Fairness and Diversity in Collaborative Research in Africa

Collaborative research plays a pivotal role in tackling complex issues, particularly in Africa, where researchers combine their expertise and resources to generate knowledge that informs policy and

practice. However, the success of such collaborations is contingent upon inclusion and equity, as collaborators may have varying research capacity, access, resources, and experience (CARE). Therefore, it is crucial to explore the concept of inclusion and equity in research collaboration and how it can be promoted to enhance research outcomes and impact.

Inclusion and equity in research collaboration refer to the extent to which all collaborators, regardless of their background and experience, are given equal opportunities to contribute to the research process and share in the outcomes. Inclusion involves creating an environment that values the input of all collaborators, irrespective of their race, gender, ethnicity, social status, or disability. Equity requires ensuring that all collaborators have access to the same opportunities, resources, and benefits. While there are accomplished researchers with extensive research capacity, access, resources, and experience (CARE-Researchers), it is critical to focus on how to include and be fair to those who are not in the CARE category, as they can bring fresh ideas based on their exposure level, resulting in truly impactful research. In research collaboration, inclusion and equity are crucial as they promote diversity of ideas and perspectives, leading to innovative solutions to complex problems. Inclusion and equity also encourage collaborators to contribute their best ideas and expertise, leading to better research outcomes and impact. Furthermore, promoting social justice through inclusion and equity in research collaboration is vital for creating a more equitable society.

The Cape Town Statement on Fostering Research Integrity through Fairness and Equity is a call for ethical conduct at every stage of research, from conception to implementation. It comprises 20 recommendations that target all stakeholders involved in the research process [21]. In particular, the statement highlights the importance of fairness and equity in research integrity and aims to promote recognition of these values as a fundamental aspect of research [21]. The recommendations are grounded in values such as diversity, inclusivity, mutual respect, shared accountability, indigenous knowledge recognition, and epistemic justice, which were identified as key considerations in discussion groups at the 7th WCRI [21]. The impetus behind these recommendations is clear: high-income countries and institutions tend to benefit more from global research collaborations than their low- and middle-income counterparts, whether in terms of authorship, career progression, publication output, research priorities, or ownership of data and samples [22]. For instance, Naidoo et al. (2021) found that out of the papers related to COVID-19 and Africa published in the top 10 medical and global health journals during the first nine months of 2020, 66% of the authors were not from Africa. This underscores the need for authoritative journals to actively seek local

representation in papers that describe health systems in regions outside their own, thereby promoting fairness and equity in research in African countries [23]. The Cape Town Statement emphasizes the crucial role of fairness and equity in research integrity, and provides a comprehensive framework for promoting these values across all aspects of research practice. By implementing these recommendations, stakeholders can contribute to a more just and inclusive research landscape, where all researchers can thrive and make meaningful contributions to knowledge generation.

Regrettably, a number of obstacles impede the advancement of inclusion and equity in research collaboration throughout Africa. A major obstacle is the unequal distribution of resources, as certain areas have greater access to funding, infrastructure, and equipment, resulting in uneven participation in research collaboration. Furthermore, the governments of low- and middle-income countries (LMICs) must appreciate the importance of funding research, both to address local priorities and to decrease their nations' reliance on funders from high-income countries [19]. It is imperative that African governments prioritize research funding to foster fairness and inclusion in research, as research institutions' reliance on foreign funders has been shown to have numerous repercussions for the integrity of research.

Furthermore, cultural disparities can further impede inclusivity and equity in research collaboration, as collaborators hailing from distinct regions may hold divergent beliefs, values, and working styles. Cultural differences can be a major barrier to achieving inclusion and equity in research collaboration in Africa. These differences can manifest in a variety of ways and impact various aspects of research collaboration, including communication, power dynamics, and values. One way in which cultural differences can impede inclusion and equity in research collaboration is through language barriers. The issue of language barriers, particularly in African nations with numerous languages, can pose significant constraints on the participation of potential collaborators, thereby hindering the attainment of diversity in research collaboration. Africa is home to over 2,000 languages, and researchers from different parts of the continent may have different linguistic backgrounds, making communication difficult. This can lead to misunderstandings, miscommunications, and a lack of clarity, which can ultimately affect the quality of research outcomes. It has been widely acknowledged that differences in language can give rise to dysfunctional group formations, social fragmentation, and reduced rhetorical capacities among individuals in diverse settings [24].

Power dynamics can also be influenced by cultural differences. In some African cultures, respect for elders and authority figures is highly valued, which can result in younger researchers, women or those from lower social classes being reluctant to challenge or question senior or more established colleagues. This can lead to a lack of diversity in ideas and perspectives, which can hinder the development of innovative research. Values and beliefs can also differ across different African cultures, which can impact the way research is conducted and interpreted. For example, in some cultures, privacy is highly valued, which can lead to reluctance to share personal information, while in other cultures, openness and sharing are more highly prized. These differences can impact the design and implementation of research studies, as well as the interpretation of findings. Addressing cultural differences in research collaboration is essential for achieving inclusion and equity in Africa. This can be done through the development of culturally sensitive research methods, communication strategies, and training programs that promote cultural awareness and understanding among researchers. By doing so, research collaboration in Africa can become more inclusive, diverse, and equitable, leading to more meaningful and impactful research outcomes.

To promote inclusion and equity in research collaboration in Africa, strategies such as building partnerships based on shared values, fostering diversity and inclusion, investing in capacity building, promoting effective communication, and addressing power imbalances are crucial.

Building partnerships based on shared values, such as mutual respect, trust, and a commitment to social justice, can create a culture of inclusivity and equity, where all collaborators are valued and encouraged to contribute their ideas and expertise. Fostering diversity and inclusion by actively seeking out collaborators from diverse backgrounds and regions can also promote diversity of ideas and perspectives, leading to better research outcomes. Capacity building should be a priority to ensure that all collaborators have equal opportunities to contribute to the research process. This includes providing training, mentorship, and resources to less experienced collaborators to build their skills and knowledge. Effective communication is essential for promoting inclusion and equity in research collaborations. Creating an open and transparent communication culture, where all collaborators are encouraged to share their ideas and concerns, can help build trust and create an environment that values the input of all collaborators. Addressing power imbalances is also crucial in promoting inclusion and equity in research collaboration. This involves ensuring that all collaborators have an equal say in decision-making and are given equal opportunities to contribute to the research process.

In conclusion, inclusion and equity in research collaboration are essential for promoting diversity of ideas and perspectives, leading to innovative solutions to complex problems. While several challenges hinder the implementation of inclusion and equity in research collaboration in Africa, employing strategies such as building partnerships based on shared values, fostering diversity and inclusion, investing in capacity building, promoting effective communication, and addressing power imbalances can promote inclusion and equity in research collaboration.

Rule 7: Building the capacity of research collaborators

Staff exchange can be a very effective way to improve the capacity of African researchers and an effective way of promoting meaningful collaboration [25]. This can be achieved through different forms, such as short-term research visits to other institutions or long-term placements, and can be a valuable way to transfer knowledge and expertise between different regions. Partnership between universities creates sustainable and scalable structures for this to occur. International research companies and institutes can invest in the future of African research through establishing research branches in Africa. Staff and knowledge exchange can help to build personal relationships between researchers from different regions, which can facilitate sustainable collaboration and knowledge-sharing. Staff exchange can help build the capacity, re-orient researchers and shape their cultural dimensions which are valuable for a successful collaboration. Investing in the development of local research capacity supports long-term sustainability that is mutually beneficial. Since resources are limited, funding required to support the knowledge exchange should be captured in research grants. This will help in ensuring that the exchange is mutually beneficial and prioritizing the transfer of skills and knowledge that are relevant for future collaborations.

Rule 8: Publication guidelines

Clear and transparent guidelines for the publication of collaborative research are important for fostering meaningful collaboration with African researchers. Such guidelines can help ensure that all researchers are aware of their roles and responsibilities, and can help to promote fair and equitable authorship. Before starting collaboration, researchers should develop a publication policy that outlines the criteria for authorship, the order of authors, and the responsibilities of each author. The publication policy should be communicated to all researchers involved in the collaboration, including students, post-docs, and other trainees. It should be clear that all researchers follow the policy and violations are not tolerated. Throughout the collaboration, all researchers should communicate openly and transparently about their research findings, data generated, and analyses. Any disagreements or concerns should be addressed early to avoid conflicts later in the process. A

proper data management plan should be in place that will allow the recording of all research activities, data collection, analysis, and interpretation. These records should be maintained in a secure and accessible open source location for future reference. The publication policy should be unambiguous, developed early, reflect the level of contribution of the collaborators, and should be agreed upon by all parties. This will ensure that publications resulting from such collaborations give credit to all contributors in a fair, equitable, and respectful way.

As collaborators continue to collaborate across different spectrums within Africa, it is vital to think about the set of strategic policies and regulations of each organization, nation, group, or country to promote responsible collaboration among and between parties involved. This also involves discussing with collaborators, the objectives, responsibilities, and values of the collaboration at an early stage. Doing this could promote sustainability that only happens when parties have proven to be accountable during initial collaboration defined by elements such as trust and mutual respect within their partnerships. Effectively collaborating with partners within the African continent will pave the path for sustainable partnerships that could positively address the issue of underrepresentation of researchers from developing countries in scientific publications [26]. This accountability is also expected to extend to study participants in the study setting by treating them fairly and providing them with all the details of the study and also truthful information that they need to know at all stages of working with them and in their community [27].

Rule 9: Data sharing and management

Data sharing and management are crucial elements in any research collaboration, and this is especially true when working with African researchers. When data is shared openly and transparently, it helps to build trust between collaborators. This is particularly important when working across different cultures and regions, where there may be differences in research practices and ethical standards. Sharing data can help to improve the quality of research by allowing for greater scrutiny and validation of results. This is especially important when conducting research on complex and interdisciplinary topics, where multiple datasets and methods may be involved. However, a data sharing and use agreement should be written and agreed upon by all collaborators. An effective data management plan with clear guidelines and protocols for data sharing, and data ownership is key to ensuring that research findings are protected, easily retrieved, and shared over the long term. When research findings are published, sharing data with other researchers is recommended. To ensure effective data management and sharing in collaboration, it is important to consider the Findable, Accessible, Interoperable, Reusable (FAIR) principle [28]. This involves

developing a data management plan that outlines the types of data that will be shared, the methods of data sharing, and the roles and responsibilities of each collaborator in managing the data. It is also important to ensure that the data is shared securely and ethically, in compliance with relevant data protection regulations and ethical standards. It also highlights the use of appropriate data-sharing platforms and tools, such as data repositories or secure data-sharing platforms, to ensure that the data is shared in a safe and secure manner. Universities and funders need to promote and encourage Open Data access and sharing privileges for African researchers to remove the red tape and closed access to data. This is needed to give equal rights and opportunities to promote accountable and sustainable research for every researcher.

Rule 10: Ethical approvals

Africa for decades has served as a place for research and discovery for the world, helping to improve research and practice across the continent. However, some collaborators have misused this opportunity, leading to a great call for concern and ethical research practices between African collaborators with an aim to enhance sound ethical practices in research. In the search for responsible research practices in the continent, ethical standards towards research practice have been put in place to guide researchers. These guidelines are expected to be followed keenly by all including African researchers. The purpose of these ethical procedures is to ethically appraise authors' work and minimize conflict of interest, protect the interest of study participants or subjects by critically appraising tools such as study consent or assent and study protocol particularly to evaluate the risks, benefits, voluntary participation, learning process for Research Ethics Committee (REC) members, and limit the risk of exploitation among others [29,30].

- Timely submission of research protocols and tools including consent or assent as the groups permit. This is done to allow the REC members to review the protocol and related tools before the meeting. Protocols not submitted before the stated deadline otherwise, they will not be considered for that sitting. This submission is accompanied by an application letter to the review board. Submitting Principal Investigators (PI) should always expect to receive a notification often by email in advance inviting them to the meeting together with all REC members to be present that day. Both parties are encouraged to be physically present. After the meeting, feedback is sent after an agreed number of days [31].
- Translation of tools to local languages. As Africa is diverse in different aspects including language, so are its people [32]. It is important during the planning process of one's research to consider translating study tools into the local language. This is encouraged to ensure that

both the investigators and the participants have the same understanding. Most ethical review boards in Africa will look keenly into this aspect to ensure that citizens are protected from any form of exploitation [31].

- Submit a list of principal investigators including a local principal investigator in the country where the study is being conducted. The local investigator(s) should also be included in the reporting or publication of whatever becomes the outcome of the study or product. The act of involving local investigators creates ownership, builds local capacity, and promotes a respectful scientific atmosphere thus limiting scientific malpractices such as helicopter or parachute publications as well as increasing African impact in the scientific space among others [31]. A clear example of this can be seen in a review of articles conducted in Sub-Saharan Africa related to cardiovascular research: only 10% of the native publishers are from this area of Africa, the rest are from other parts of the world including Europe and North America, and South Africa [33].
- It is not without noting that social and economic stability, that enables access to funding and resources, as well as good life-work balance and support, are the land that researchers need for research to flourish and so government and policy must be forward-thinking on these topics in respect to the scientific enterprise.

Conclusion

Collaborations are a major tool in increasing the continent's scientific capabilities by supporting African countries in overcoming the weaknesses of their national scientific systems and the lack of resources and infrastructure [6]. As for non-African countries, Africa has unique opportunities that could be harnessed [7]. For instance, Africa carries the largest global burden of communicable infections and with the nature of modern mobility across continents; infections are no longer confined to Africa but are becoming a global threat to public health [34]. Furthermore, Africa is also witnessing a considerable increase in the prevalence of non-communicable diseases which are common among non-African societies but are driven by similar risk factors in both African and non-African populations. Africa is privileged to have the oldest and most diverse genome in the world [35], mining this genome through collaborative research would provide valuable insights into complex disease patterns and aid in delivering breakthroughs in the implementation of precision medicine globally [34,35]. Therefore, an investment in quality cooperative research in Africa will in parallel be an investment in policies of disease prevention and treatment everywhere in the world [7]. Apart from the wide range of potential benefits to global health systems,

collaborative research in Africa could also provide huge global socioeconomic merits. This is because the African population is the youngest and fastest growing globally with sub-Saharan African countries estimated to account for more than half of the world's population growth rate between 2019 and 2050. As a result, making an intellectual investment in this growing demographic is important in harnessing and growing talent that will lead the generations of the future [7]. Furthermore, as Africa continues to offer a critical mass of future consumership, it is important that developed products and technologies are adapted to suit their needs and culture, and this can only be achieved via collaborative research [7]. These ten principles are key proposals to consider for the blueprint and roadmap for African research collaboration within Africa and alongside the global academic community.

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