LUSH PRIZE

SUPPORTING ANIMAL-FREE TESTING

The use of animals and alternative approaches in research, testing and education in Africa

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Lush Prize

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Contents

1 Introduction

1.1 Animal-based research and testing

Globally, an estimated 192 million non-human animals (hereafter referred to as animals) are used in laboratory research, testing and education (Taylor and Rego Alvarez, 2019).

For over one hundred years attention has been drawn to the ethical objections to the use of animals in scientific research due to the suffering inflicted on them. Anna Kingsford, the first English woman to receive a degree in medicine (in 1880) was an outspoken opponent of vivisection (experimentation on live animals); in 1875 another social reformer, Frances Power Cobbe, founded the world's first anti-vivisection organisation (Cruelty Free International, 2023).

In addition, numerous studies have questioned the scientific validity of using animals as proxies for humans, particularly given the major problem of biological differences between species, the difficulties of extrapolating results from non-human animals to humans and the huge failure rates of drugs and chemicals passed as safe during research on animals but later found to be harmful to humans (Pound, 2020; Ram, 2019).

The rapid advancement of New Approach Methodologies (NAMs), such as computational toxicology and organ-on-chip research, provides a more biologically-relevant approach to science that avoids the use of animals (Schmeisser, et al., 2023; Ram, Gadaleta and Allen, 2022).

Whilst both the critique of animal use in research, testing and education, and the promotion of NAMs is highly developed in the Global North, there have been fewer studies about the awareness of these across the continent of Africa. Where such discussion has taken place, it tends to be done by a few organisations and individuals directly connected to the use and promotion of animals in research and focusing on welfare rather than replacement of animals.

1.2 Lush Prize

The Lush Prize is a global prize fund supporting scientists and campaigners working to end and replace the use of animals in research, particularly in toxicology. It is a collaboration between Lush Cosmetics and Ethical Consumer Research Association.

Since the inception of the Prize in 2012, almost £3 million of funding (in addition to several non-financial prizes) has been provided to 156 projects in 30 countries.

Only one project in an African country has been awarded a prize during those twelve years (Africa Network for Animal Welfare won a Training Prize in 2014), plus one other being shortlisted, and only five nominations in total were received from organisations or scientists across the whole continent.

This research paper was originally designed to assist the Lush Prize Team to better understand several issues:

- The level of animal use in research, testing and education across the continent of Africa - including identifying countries where most animal research takes place, the number and species of animals used and the types of research conducted
- Identify scientists or organisations who are working on non-animal research methods and/or promoting such methods within the scientific community
- Identify any animal welfare (or other) organisations highlighting the issue of animal experimentation and working to end it, either through legislative changes, promotion of non-animal methods, or by other means

The results of this study are intended to help us identify projects that could be supported through the Lush Prize or other projects and organisations, as well as strategies to improve our outreach across the continent, including which countries to focus on.

Given the large number of countries on the continent and the difficulties in obtaining information, this report is not designed to be exhaustive but to provide a preliminary overview of the issues mentioned above and provide foundation for potential further work.

1.3 Terminology

There are a few terms contained in this report that some readers may not be familiar with.

Animal research is a broad term that refers to a wide range of practices that may be conducted on living non-human animals. In relation to this paper, we use it to refer to the use of animals in research (such as biomedical research), testing (for example, testing drugs and chemicals on animals for efficacy and safety), education and training (for knowledge and skills acquisition).

Other terms include:

In-vivo - studies conducted in living beings (in this context, usually refers to experiments on living animals)

In-vitro - a term given to a range of studies not conducted in living beings

In-silico - research performed using computer simulations and modelling

3Rs - The concept of Replacement, Refinement and Reduction of animal use in scientific research, developed by in 1959 (Russell, and Burch, 1959; republished in1992).

2 Africa is not a country

In this paper we make assessments at both a national- and at a continent-level approach. It is inevitable, when assessing any issue from a continent-wide perspective, that some generalisations will be made. Wherever we have made generalisations (and we avoid these as much as possible), we do so with the following words in mind, from Dipo Faloyin's 2023 book *Africa is Not a Country: Breaking stereotypes of modern Africa* (Faloyin, 2023, pp6-7):

"Few entities have been forced through this field of distorted reality as many times as Africa - a continent of fifty-four countries, more than two thousand languages, and 1.4 billion people. A region that is treated and spoken of as if it were a single country, devoid of nuance and cursed to be forever plagued by deprivation.
[…] In reality, Africa is a rich mosaic of experience, of diverse communities and histories, and not a singular monolith of predetermined destinies."

3 African economy

We address some of these generalisations first.

There are 54 independent states in Africa (Africa.com, 2022) [see Appendix 2]. It is the second largest and economically fastest-growing continent in the world, with countries including Niger, Uganda, DRC, Angola, Chad, Mali and Somalia each growing at a rate greater than 3% per year (Haddad, 2023).

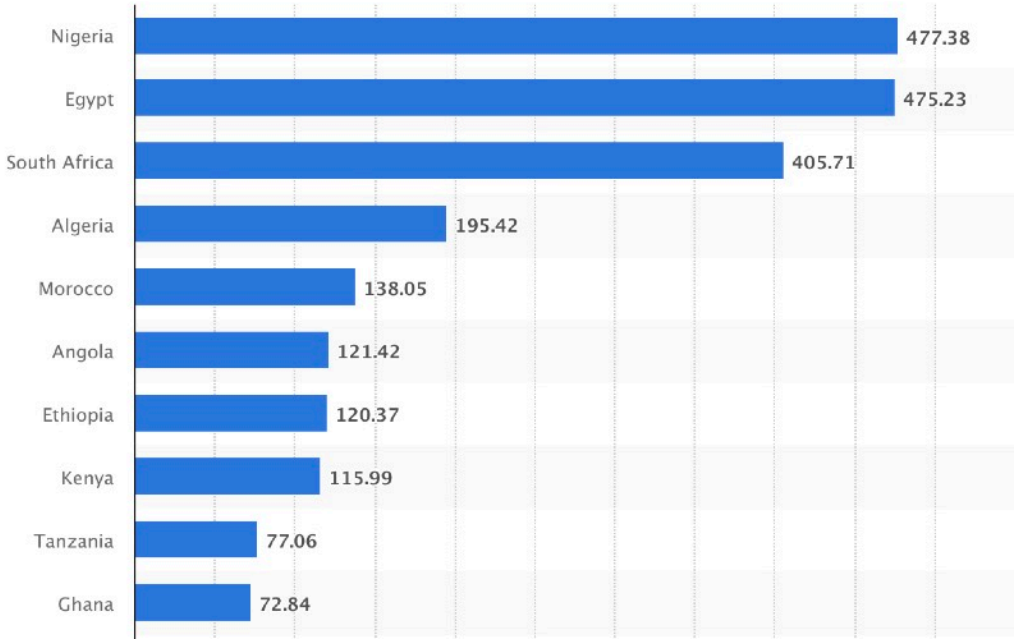
The continent's population in 2024 was 1.49 billion (World Population Review, 2024) and 70% of Africans are under the age of 30 (Rédaction Africanews, 2023).

Around 18.7% of the world's population live in Africa (World Population Review, 2024), but the continent only accounts for about 3% of global GDP. It is the world's youngest and fastest-urbanising continent. Between 2015 and 2045 it will have, on average, 24 million more people living in its cities – more than India and China combined (World Economic Forum, 2020).

According to the World Bank, Sub-Saharan Africa (SSA) "is composed of low, lower-middle, upper-middle, and high-income countries, 22 of which are fragile or conflict-affected. Africa also has 13 small states, characterised by a small population, limited human capital, and a confined land area. […] economic growth in SSA is not uniform across subregions and countries" (World Bank, 2023).

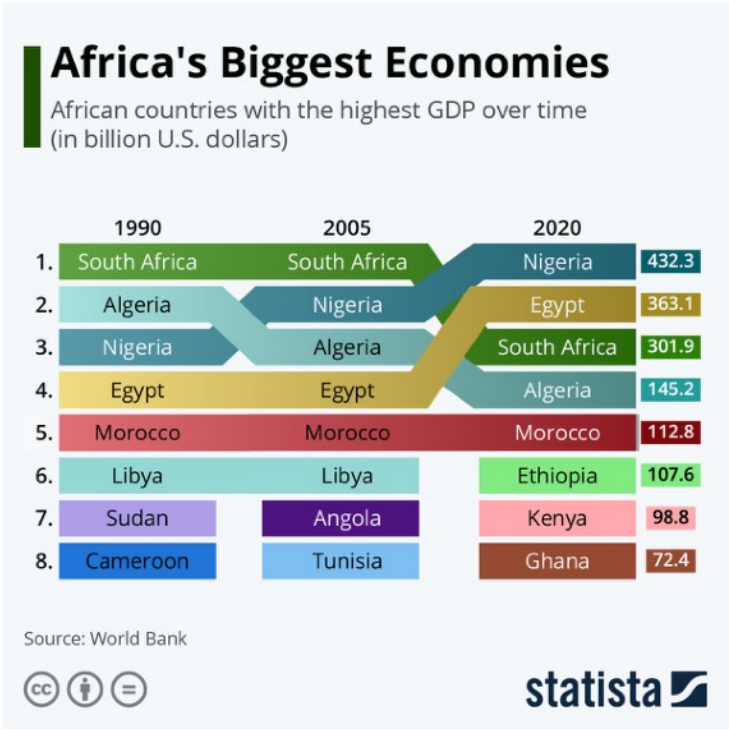
Nigeria is the biggest economy on the African continent, with a rapidly expanding financial sector and it is one of the world's largest petroleum exporters. The capital, Lagos, is also a growing tech hub. Despite it's large total GDP, Nigeria has a comparably low GDP per capita because of the stark divide between rich and poor (Statista, 2021).

Chart 1: African countries with the highest Gross Domestic Product (GDP) in 2022 (in billion US dollars)
Source: https://www.statista.com/statistics/1120999/gdp-of-african-countries-by-country/



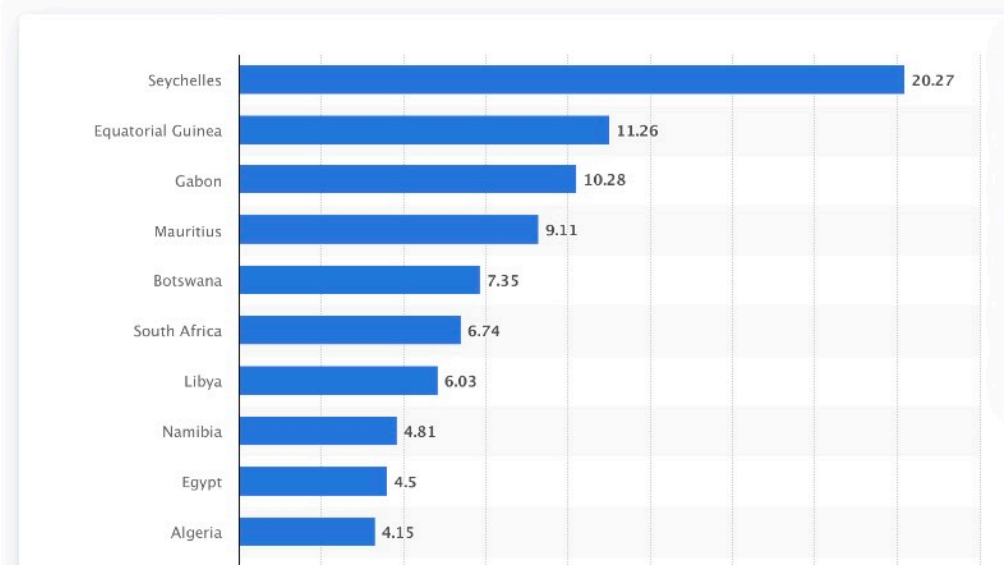
There is often fluctuation in the economies of African countries, as the following image shows.

Chart 2: Africa's biggest economies, 1990-2020
Source: https://www.statista.com/chart/26371/african-countries-with-the-highest-gdp-over-time/



Looking at GDP per capita gives a different outlook. GDP per capita is calculated by dividing a country's GDP by its population, meaning that some of the largest economies are not ranked within the leading ten (Statista, 2023).

Chart 3: African countries with the highest Gross Domestic Product (GDP) per capita in 2022 (in 1,000 US dollars)
Source: https://www.statista.com/statistics/1121014/gdp-per-capita-of-african-countries/



It should be noted that measuring the 'success' of a nation by its monetary value is full of flaws, as Allin, Coyle and Jackson (2022) point out:
"There are numerous aspects of our lives that simply go missing from this conventional account [GDP]. The inequality in our societies. The contributions from unpaid work. The labour of those who care for the young and the elderly at home or in the community. The depletion of natural resources or biodiversity. And the value of data and many digital services."

4 Research and universities in Africa

Globally, a great deal of research on live animals (in-vivo) is conducted within academic institutions. For example, 54% of animal experiments conducted in the UK in 2020 were carried out in universities and medical schools; those establishments held 81% of the project licences required to conduct animal research (Home Office, 2021).

Higher education in Africa has expanded considerably in recent decades. When many countries on the continent were gaining independence in the 1960s there were only around 30 higher education institutions (HEIs). This had increased to over 600 by the 2000s and most African countries are now home to several diverse HEIs (Casimiro Zavale and Schneijderberg, 2022).

According to Cloete, Bunting and Van Schalkwyk (2018, p4), higher education across Africa "has been shaped, limited and skewed by colonial legacies, internal political wrangling, and the influence of international donor agencies' agendas and aid.

"Colonial rule left few universities behind. Most African countries lacked even a single university at independence. The development of higher education institutions remained limited until after the Second World War because the colonial authorities were generally suspicious of, and opposed to, the creation of a substantial modern, educated African elite and wished to suppress their nationalist demands for equality and freedom. As a result, Africans seeking higher education were often forced to go abroad, including to the imperial metropoles themselves. Furthermore, the existing universities were elitist and based on European models."

These newly independent states faced challenges making universities more relevant to Africa's socio-cultural contexts but the growth was rapid, from an estimated 120,000 students in 1960 to 782,503 in 1975, and to 3.4 million by 1995. Enrolments doubled after 2000 from 6 million to more than 12 million by 2015 (Cloete, Bunting and Van Schalkwyk, 2018, p5).

El-Aal (2014, p17) reported an "increase in scientific research being conducted by local African scientists. From 1996 to 2012, the number of research papers published in scientific journals with at least one African author more than quadrupled (from about 12,500 to over 52,000). During the same time, the share of the world's articles with African authors almost doubled from 1.2% to around 2.3%."

From the responses to our questionnaire (see section 9), it would appear that universities collectively are major users of animals in various countries in Africa.

5 Colonialism and its ongoing impacts

Measuring post-colonial countries with a Western-based focus on economics obviously creates problems. Parashar and Schulz (2021) comment: “to be recognised as a worthy member of the international society of states, a post-colonial state is obliged to achieve the global (actually Eurocentric) yardsticks of modernisation, development and socio-economic parameters.”

They continue:
“It has been our endeavour to challenge the dominant ideas that colonialism is old history in Africa and that the states and societies of Africa have had opportunities to find their own path and chart their own destinies. The contemporary problems of Africa, including the ongoing conflicts, governance challenges and entrenched inequalities, can be traced to colonial practices and legacies that have been sustained through neo-liberal, neo-colonial networks and global institutions dominated by the Global North and through the local elites who are supported by Western powers.”

The colonisation of Africa by European powers between 1890 and 1914 is referred to as the ‘scramble for Africa’. No country on the continent really escaped colonisation. To some extent Ethiopia and Liberia avoided outright colonisation, although “they were forced to give up territory” and “agree to differing degrees of European economic control” (Thoughtco, 2020a).

Independence mostly came during the 1950s - 1970s (Thoughtco, 2020b), although Morocco has been occupying Western Sahara since 1975 (RULAC, 2023).

All of this is relevant because the impacts of colonisation are still prominent throughout the continent today. It was the colonial powers who drew the boundaries of countries and set the scene for ongoing conflicts long after they left.

These borders “bear no relation to the topography, culture or languages of the land they apportion” states Faloyin (2023, p48), noting that most territorial disputes considered at the International Court of Justice relate to Africa (Faloyin, 2023, p46). “Countries with unnatural borders and divided communities tend to have greater economic problems and political violence (Faloyin, 2023, p64).

Alesina, Easterly and Matuszeski (2006) have referred to countries “in which political borders do not coincide with a division of nationalities desired by the people on the ground” as “artificial states”. Their research leads them to claim that the 80% of African borders that follow “artificial (unnatural) borders [and] which create ethnically fragmented countries or, conversely, separate into bordering countries the same people, are at the roots of Africa’s economic tragedy”. These borders were drawn during the colonial period and few borders changed after decolonisation.

The social and political problems impact everything, including the welfare of the people and animals who live in those countries, and economic stability.

Ethical Consumer Research Association compiles a list of countries “governed by oppressive regimes” as part of its ethical ratings of companies. Twenty eight countries are on its latest compilation (Denyer, 2023) and twelve of these are in Africa, five of which were added in the most recent update:
Algeria, Libya, Egypt, Mali, Sudan, South Sudan, Nigeria, CAR, Ethiopia, Somalia, DRC, Uganda.

Yemen is only excluded from the list because it is classed “as being in the most acute state of humanitarian crisis” (Denyer, 2023).

No one would expect animal welfare, or even scientific research, to be high on the list of priorities for people living under such oppression. In the Global South, “poverty, resource scarcity, and education all factor into the way that animals are regarded and treated” (Fakoya, 2012). However, where people in such difficult conditions do work to protect the welfare of other animals they deserve our respect and support.

6 Lush Prize nominations from countries in Africa

Although there are 54 independent states in Africa, since the Lush Prize began in 2012 it has only received four nominations from organisations and one from an individual based on the continent.

One of these was a submission to the Training category from an individual scientist in Egypt, one Training nomination from Kenya and another from Tanzania, and two submissions from South Africa (one for Training and one for Public Awareness).

This low number could be the result of a lack of outreach to countries across the continent (or lack of appropriate outreach such as language- or culture-specific communications), a lack of work in the field of replacing the use of animals in research, or of a lack of campaigns against animal research and testing, or any combination of all of these.

Of these five submissions, four were shortlisted and one won a prize.

Africa Network for Animal Welfare, based in Kenya, was joint winner of the Training Prize in 2014. ANAW had organised a conference introducing stakeholders (including educational institutions, government representatives and professional associations) to alternatives to animal testing.

7 Animal protection organisations and animal welfare work in Africa

In order to assess which organisations are working on the issue of animal research and testing we first searched for animal protection organisations on the continent and checked their websites or social media (where they existed) for any mention of the issue.

7.1 Sources

Source 1: Animal Advocacy Africa released a report in 2021, assessing the "animal advocacy landscape" (Animal Advocacy Africa, 2021). For the report, AAA surveyed 22 animal advocacy organisations, 20 of which "work on behalf of a wide range of animal populations (most commonly farmed, wild, working and companion animals)".

In personal correspondence with AAA, they informed us that, according to their database, there are four organisations that mention working on the issue of animal research.

Source 2: The World Federation of Animals hosts a Directory of animal protection organisations around the world (https://wfa.org/appdev/directory/search-wan-directory). This can be searched by topic. Searching all African countries for organisations that include 'Experimentation' as one of their areas of work produced a total of 321 organisations (not including local branches of national organisations; this was accurate at the time of our search but will obviously change over time). Most of these list 'experimentation' amongst many other issues, although the vast majority appear to focus on other topics, in particular companion, farmed, 'working' and wild animal welfare (which was also found by the Animal Advocacy Africa report). Of these, 103 are based in South Africa.

Source 3: Dr Dennis Makau from the University of Minnesota, USA, (formerly of Africa Network for Animal Welfare) kindly connected us with three other individuals / organisations in two countries.

Source 4: Animal law organisations such as the Global Animal Law website (https://www.globalanimallaw.org/). We are aware of three animal protection law organisations (based in Kenya, South Africa and Nigeria) and three individual lawyers (in Zimbabwe, Sudan and South Africa).

Source 5: During our general research for this report we came across other animal protection organisations (e.g. named in academic papers or elsewhere).

Source 6: Some respondents to our Research Questionnaire (see section 9) referred to other organisations working on this issue. We then reached out to those contacts directly.

Combining the data from all these sources, we compiled details of 351 animal protection organisations and individuals in Africa.

Further analysis of these organisations, primarily by searching their websites and social media, revealed that the vast majority had no obvious projects relating to animal research and testing.

Based on all of these contacts, we compiled a database of 45 contacts (29 organisations and 16 individuals) across 16 countries in Africa who appear to work on this topic:

South Africa: 11 contacts
Kenya: 7 contacts
Zimbabwe: 5 contacts
Nigeria: 4 contacts
Tanzania: 4 contacts
Egypt: 3 contacts
One each in: Cameroon, Gambia, Ghana, Liberia, Mali, Mauritius, Rwanda, Sudan, Tunisia, Uganda (and one 'across Africa')

All of these contacts were sent the Preliminary Research Questionnaire (see section 9) to help us build an overview of campaigns, science and legislation relating to animal research in Africa. Of these 45 contacts, 19 responded to the questionnaire, a response rate of 42%, higher than we expected.

8 Scientists in Africa relevant to this study

For the purpose of the Preliminary Research Questionnaire (see section 9) we compiled a database of scientists with knowledge on this topic. Sources for these contacts were Dr Dennis Makau (see section above), contacts provided by others working in this field, as well as named authors of relevant published papers.

For this current report we did not contact any scientists who we knew to be primarily using animals in their research. Neither did we reach out directly to academic, government or commercial institutions that may use animals. However, these contacts would be made during any future work.

9 Preliminary Research Questionnaire

To help us build an overview of campaigns, science and legislation relating to animal research and testing in Africa a questionnaire was sent to all contacts.

Questions included:

- What work does the organisation / individual do on the issue of animal research?
- Request for information on the types of animal research, including statistics on animal use and the types of research.
- The type of establishment where most animal research and testing takes place? E.g. universities, government institutions, contract research laboratories.
- Whether animal research is covered by a specific law.
- Information on any scientists working on replacing animal research or on other areas of non-animal research.

- Information on other organisations working to create awareness around animal research or campaign for changes in the law.

Table 1: Responses to Preliminary Research Questionnaire

The questionnaire was sent to a total of 45 contacts in 16 countries:

Organisation category	Individual category	Country	Region	Replied to questionnaire?
Animal welfare		Cameroon	Mid-Africa	Yes
Animal welfare		Egypt	North Africa	No
Animal welfare		Egypt	North Africa	No
	Scientist	Egypt	North Africa	No
Animal welfare		Gambia	West Africa	No
Animal welfare		Ghana	West Africa	Yes
Animal welfare		Kenya	East Africa	No
Animal welfare		Kenya	East Africa	Yes
Law		Kenya	East Africa	Yes
	Scientist	Kenya	East Africa	Yes
	Scientist	Kenya	East Africa	No
	Scientist	Kenya	East Africa	No
	Scientist	Kenya	East Africa	No
Animal welfare		Liberia	West Africa	No
Animal welfare		Mali	West Africa	Responded to email but didn't have capacity to complete questionnaire due to current situation of repression in the country
Animal welfare		Mauritius	East Africa	No
Animal welfare		Nigeria	West Africa	Yes
	Animal Welfare Lawyer	Nigeria	West Africa	No
	Scientist	Nigeria	West Africa	No
	Scientist	Nigeria/UK	West Africa	No
	Veterinarian	Rwanda	East Africa	Yes
Animal welfare		South Africa	Southern Africa	Yes

Organisation category	Individual category	Country	Region	Replied to questionnaire?
Animal welfare		South Africa	Southern Africa	Yes
Animal welfare		South Africa	Southern Africa	Yes
Animal welfare		South Africa	Southern Africa	Yes
Animal welfare		South Africa	Southern Africa	No
Animal welfare		South Africa	Southern Africa	No
Law		South Africa	Southern Africa	Yes
	Animal Welfare Lawyer	South Africa	Southern Africa	No
	Scientist	South Africa	Southern Africa	No
	Scientist	South Africa	Southern Africa	No
	Scientist	South Africa	Southern Africa	No
	Veterinarian/ NGO	Sudan	North Africa	Yes
Animal welfare		Tanzania	East Africa	Yes
Animal welfare		Tanzania	East Africa	Yes
Animal welfare		Tanzania	East Africa	No
	Scientist	Tanzania	East Africa	No
	Scientist	Tunisia/USA	North Africa	No
Animal welfare		Uganda	East Africa	Yes
Animal welfare		Zimbabwe	East Africa	Yes
Animal welfare		Zimbabwe	East Africa	Yes
Animal welfare		Zimbabwe	East Africa	Yes
Animal welfare		Zimbabwe “and Africa at large”	East Africa	No
	Veterinarian	Zimbabwe	East Africa	No
Animal welfare		Across Africa	Africa	No

Notes:
Some contacts cover more than one category type - we have selected the most suitable main category for the purpose of these table
Some organisations work across multiple countries. The country in which they are based is listed in the table above
Animal welfare lawyer - these are individual lawyers listed on databases of lawyers with a professional interest in animal welfare; they do not work solely in this field

10 Animal protection in African countries

Animal protection organisations exist in virtually all African countries. The World Federation of Animals database is the most comprehensive database of such NGOs. According to this database, only 13 out of 54 countries in Africa did not have an animal welfare organisation listed (World Federation of Animals, 2023. Search conducted 05.06.23), although there may be unknown organisations there and organisations listed in other countries may no longer be active.

Despite this, all sources consulted for this report suggest that there is a lack of public awareness or understanding of animal welfare amongst the public as well as a lack of legislation and enforcement (e.g. Animal Advocacy Africa, 2021; Qekwana, et al., 2019; Hau, et al., 2018; OIE, 2011; Masiga and Munyua, 2005).

In its *Animal Welfare Strategy for Africa*, the African Union Commission states (African Union, 2017):
"Most African countries are at different levels with regard to animal welfare laws, legislation policies, and regulatory frameworks such as the OIE [World Animal Health] standards. Policies, standards and legislation are observed to be either lacking, inadequate, outdated or inadequately enforced. Similarly, despite all countries being signatories to the OIE standards, there is often limited understanding and subsequent minimal compliance with the standards primarily due to the lack of implementation capacity and the need for elaboration into country and context specific measures."

This appears to be reflected in the level of scientific publications on the topic. Marchant, et al. (2023) report:
"A cursory Web of Science Core Collection search of the term 'animal welfare' yields just under 25,000 papers. Of these, around 1,800 have authors based in Latin America, 1,400 have authors based in Asia (excluding Japan) and 500 have authors based in Africa, illustrating the relative strengths of animal welfare science in the regions."

They add:
"For papers specifically addressing animal welfare within these regions, under 10% of papers concerning Latin America and Asia have no authors from those regions, but this increases to nearly 25% for animal welfare within Africa—i.e., a quarter have no local expertise input."

As a vast continent of around 1.5 billion people, it is no surprise that perceptions of animal welfare in Africa differ by region, culture and customs. Qekwana et al. (2019) note that "addressing animal welfare issues is a challenge due to differences in traditional customs and beliefs. In addition, the welfare of humans in the majority of African countries takes priority over animal welfare".

Speaking about the Global South more broadly, Fakoya (2012) adds that "animal welfare issues cannot be viewed in isolation from culture, values, and economic conditions – all of which affect how animals are perceived and treated."

A 2011 report by the World Organisation for Animal Health (OIE) found that levels of public awareness on animal welfare are generally low in most of the African countries. An exception is South Africa, where awareness is high in some sectors of the society (OIE, 2011). Zimbabwe is another country which has been highlighted as having made "significant progress in educating their citizen[s] on animal welfare" (Qekwana, et al., 2019).

It is important to not see low levels of awareness in isolation - it is not just countries in Africa, or the Global South more broadly, that have this problem. Animal welfare is low on the list of priorities in many parts of the world where people face challenges relating to conflicts, poverty and other socio-economic factors.

Mohr, et al. (2016), discussing Africa and the Middle East, write that "until fairly recently […] the dominant view has been that animals are there for humans to use. Therefore, there have been relatively few ethical limits to animal use. This philosophy, *similarly handed down colonially*, has continued until today with no formal guidelines or regulations being followed by most researchers or teachers, which perpetuates a lack of attention to animal welfare" [our emphasis].

Hau, et al. (2018) state:
“Levels of public awareness on animal welfare [in Africa] are generally low, and although awareness has risen over the years, humane education on animal welfare is lacking at most institutions of higher learning. This is unacceptable by international standards, considering how commonly animals are used in academic research in Africa.”

They continue (Hau, et al., 2018) with a crucial point that appears lacking in most discussions about animal welfare on the continent:
“However, it is of paramount importance to honour the sovereignty of African nations and to ensure that each country remains able to maintain a system of oversight that reflects its own cultures, traditions, and religions. Harmonisation of principles, with incorporation of full stakeholder engagement - rather than a case of generic simple standardisation - should thus be the ultimate goal for sustainable positive change.”

In 2017 the African Union Commission set out its strategic objectives and plan for animal welfare (African Union, 2017). It’s list of ‘key animal welfare issues faced in Africa’ include:
- Inadequate stakeholder’s engagement and involvement;
- Lack of home-grown science and research;
- Inadequate Policy framework, guidelines strategies, and action plans as depicted by lack of laws or outdated laws, inappropriate regulations and standards and weak or no implementation and enforcement;
- Lack of financial, technical, technological, social capital and resourcing for animal welfare.

It’s ‘Vision’ statement includes “an Africa where animals are treated as sentient beings” and the ‘Guiding Principles’ includes the following (African Union, 2017):
"A system approach will imply also addressing the full range of animal welfare challenges including farm animals, working animals, experimental and laboratory animals, […] and deploying a variety of interventions; and convening partners from across countries, the continent and the world.”

An interesting paper by Coetser (2022) addresses animal research in South Africa from the perspective of an African model of ethics. She considers some of the variants in African moral theories and states “while it is clear […] that not all theorists accord moral standing to animals from an African perspective, there are many who do.”

Coetser concludes: “there are convincing moral reasons, from within an African framework, to significantly reduce, and even abolish, the use of animals in research, and that it should be enacted in legal regulations”.

We do not intend to delve deeper into these philosophical issues here, only to state that Coetser’s paper helps reaffirm the idea that region, country and community considerations need to be taken into account when discussing animal protection issues across the continent.[1]

A report on charitable funding of animal welfare in Africa, published by Animal Advocacy Africa in 2024 (Stumpe and Kamratowski, 2024), estimated that the funders they analysed granted a total of 25 to 35 million US dollars to animal-related causes in Africa in 2020, noting “these grants had substantially increased from 2018 to 2020”. They found that most of this - 72.9% of all grant amounts in 2020 - was for wild animal and conservation work. Projects relating to the welfare of ‘working animals’ such as donkeys received 19.3% of the funding, followed by companion/stray and farmed animals with 3.8% and 1.7% respectively. The authors found that the issue of animal use in laboratories “did not seem to attract any funding”.

[1] Coetser writes: “I am following Metz in meaning a broadly ‘Sub-Saharan’ view, excluding many communities in countries in Northern Africa, like Egypt, Libya, Tunisia and Morocco. These countries have a strong Muslim influence, and so do not necessarily encapsulate the same values as communities in Sub-Saharan Africa.”

10.1 CASE STUDIES

CASE STUDY 1: Africa Animal Welfare Conference (AAWC)

The Africa Animal Welfare Conference is an annual conference co-hosted by Africa Network for Animal Welfare (ANAW - a Lush Prize winner for Training in 2014), in collaboration with the United Nations Environment Programme (UNEP), African Union InterAfrican Bureau for Animal Resources (AU-IBAR) and the government of the country in which the conference is held. It offers a platform to discuss and promote animal welfare concepts among a number of stakeholders across the continent (Africa Animal Welfare Conference, 2023).

The AAWC grew out of ANAW's Animal Welfare Workshop and related pan-African conferences held from 2009 onwards. InterNICHE (the International Network for Humane Education) and ANAW co-organised the '1st Pan-African Seminar on Alternatives to Animal Experiments in Education and Training', a two-day event held subsequent to the Animal Welfare Workshop in 2009. The seminar was the first and largest event on the topic in Africa, and produced a resolution with a call for 100% replacement.

Presentations about alternatives in education have been held by InterNICHE at most AAWC conferences since - in some cases supported by exhibitions of alternatives and distribution of software. And the topic of animal use in research and testing has also been part of the discussions in a number of the events. For example:

2017:

Panel session 'Animals used in education, research and training; animals used in cosmetic research'. Prof. Fawzy Elnady of Cairo University discussed tissue preservation for basic anatomy and clinical skills; Jack McQuibban from Cruelty Free International spoke on the European Union ban on animal testing of cosmetics; and Dr Mwenda Mbaka of Kenya Veterinary board and Dr Maina Ngotho of Mount Kenya University discussed Animal Care and Use Committees (Africa Animal Welfare Conference, 2017a).

The Conference Policy Brief included the following recommendation:
"Use of animals for testing and research is no longer necessary with existing technology. Animals used for various purposes such as cosmetic testing, education and training and pharmaceutical testing have since been proven inaccurate compared to other technology such as; human tissue cultures and computer simulated modules" (Africa Animal Welfare Conference, 2017b).

Photo 1: Africa Animal Welfare Conference, 2017

2019:

Nick Jukes of InterNICHE informed us of a presentation and workshop he held on alternatives in education at the AAWC in Ethiopia in 2019. Nick organised hands-on demonstrations and showed software alternatives, as well as videos of other humane innovations. Participants were teachers, animal protection campaigners, and a veterinary animal welfare trainer, amongst others.

Photo 2: Africa Animal Welfare Conference, 2019 (Credit: Nick Jukes / InterNICHE)

2022:

Dr Josiah Kantiyok of the Johan Vet Network gave a presentation that defended the use of animals in scientific, biomedical and veterinary research and confirmed that there was a lack of legislation and guidelines across the continent to protect animals. He went on to highlight the establishment of PAN-LASE (Pan-African Network for Laboratory Animal Science and Ethics) to promote “good practice in laboratory animal science, animal welfare and ethics” (Africa Animal Welfare Conference, 2022).

There is a regular theme at the AAWC that addresses replacement alternatives in education, and occasional coverage of replacement in research and testing by other international partners. However, despite the example of the conference brief above, it is clear from many of the conference sessions that the focus is more about implementing basic welfare measures rather than discussing in detail the unreliability and animal welfare problems associated with animal research or promoting the use of non-animal methods more widely.

CASE STUDY 2: Tanzania Animal Welfare Society

Tanzania Animal Welfare Society (TAWESO) has a formal arrangement with colleges and students are trained in their classrooms with replacements to animal use in research.

Computer software has been used to replace the use of dogs, cows and frogs, especially in physiology and anatomy. These are the species most commonly used in these fields.

TAWESO reported a good response: “students have been very happy and said they never thought of a good and simple learning method like this where they can work without fear of killing an animal for the purpose of learning. The tutors have been wishing to see if this can be part of the curriculum as it becomes easier to teach.”

[personal correspondence, 2023]
The organisation was shortlisted for the Training Prize during Lush Prize 2024.

Photo 2: TAWESO workshop with students

CASE STUDY 3: InterNICHE

In 2012, InterNICHE organised a week of events on replacement alternatives in education, research and testing across South Africa with the National Council of SPCAs (personal correspondence with InterNICHE, 2023).

Workshops and training provided access to nearly one hundred learning tools from across the disciplines, including software mannekins and simulators as well as a live demonstration of laparoscopic surgery, illustrating the potential of advanced training tools for superior surgical skills acquisition and the replacement of animal experiments.

Photo 3: InterNICHE seminar in Bloemfontein

Photo 4: Exploring the range of software alternatives in the Multimedia Room

There appears to be no organisation across the whole of Africa that works solely on the issue of animal experimentation, although Beauty Without Cruelty South Africa does have this topic as its main focus, in particular a ban on cosmetics testing on animals (see section 17.1).

NGOs that responded to our questionnaire that noted any work they do on this issue were:

Ghana: “We do awareness creation and advocacy on it at vet colleges and universities”. No further information was provided.

Kenya: Previous Lush Prize winner for Training conducted workshops with different stakeholders in 2015 and the issue was addressed in conferences it co-ordinated in 2019 and 2021.

Kenya: An animal welfare law organisation commented: “We work with policy makers to come up with policies that provide great animal welfare standards for animals involved in testing.”

Kenya: A scientist informed us that they were involved in training veterinarians in replacing animal testing. No further information was provided.

South Africa: One NGO commented that it monitors the export of primates for vivisection. Another referred to its work to ban cosmetics animal testing and the production of a guide to cruelty-free cosmetics.

South Africa: An animal welfare law organisation worked on the bill to have cosmetic testing on animals banned in South Africa.

Tanzania: One NGO commented that they “run a project on the use of animal alternatives in training animal health training colleges.” (See case study above for more information).

Zimbabwe: One NGO commented that they “are working with the local university in ending the use of animals in lab testing.” No further information was provided.

The questionnaire did spark some interest in potentially starting some work on the issue in South Africa, Nigeria and Tanzania.

A Cameroon NGO responding to our questionnaire commented:
“Most of the organisations working to protect animals in Cameroon are foreign organisations” and focus on wild animals and other species. “Very few Cameroon-based organisations work for the welfare of animals and none of them is advocating against animal testing.”

11 Scientific literature search on animal research and use of alternative methods across Africa

11.1 Methodology for scientific literature search strategy

Our aim in this section was to gain further insight into animal research and the use of alternative methods across the continent of Africa.

Therefore, as an initial but comprehensive scoping review, a literature search was made of scientific publications across the 54 nations of Africa, to gain an initial overview of the level of animal research carried out, as well as awareness and use of alternative methods.

To achieve this, electronic searches were made for science-based publications (e.g. research papers, as well as commentaries, reviews, editorials and others) involving either of the following:

i) use of animals or animal-based methods; e.g. in biomedical research or toxicity tests. These are represented in Table 2;

ii) use of ‘alternative’ (non-animal) methods or publications on animal welfare in research, e.g. direct research articles using non-animal methods (in-silico, in-vitro or human-based studies), awareness of animal welfare, ethics in science (including awareness of the ‘3Rs concept – replacement, reduction, refinement). These are represented in Table 3.

Some specific filters and keywords were used to extract examples of animal research and non-animal methods (see Tables 2 and 3 respectively). Results were sorted by most recent first (from 2023 to 2020) and selected examples are included in Tables 2 and 3. Occasionally, if no relevant publications could be found within the publication year range of 2020-2023, the range was expanded e.g. to 2019 or 2018. Also, if a publication title was particularly technical, the next listing down was included in the table which provided more reader friendly, non-scientific terminology for a wider audience.

Searches for animal research publications included a wide variety of species as well as the general term ‘in-vivo' to capture animal studies (however, it is noted that this would result in some human ‘in-vivo' studies being counted, as well as in-vitro or in-silico studies, as studies of all types are often carried out in parallel).

Our searches were made using the PubMed database, the primary freely-available database of biomedical research references. It is acknowledged that PubMed is just one platform of many to search and that future research could expand this literature search further. As noted by Maina, et al. (2021), many African journals are not PubMed indexed, so in their own analysis of neuroscience publications affiliated with African institutions, as in ours, such publications are excluded from the analysis.

Due to time constraints, the searches used were by no means exhaustive, but sufficient to capture a wide range of publications. Also, as the same searches were used consistently across all countries, we are content that they allow a reasonable comparison of results as a starting point or inceptive search. Additionally, with further time, at least one other publications database (e.g. Web of Science, Google Scholar, ResearchGate) could be used as a comparison of results. Further specific and customised searches are highly recommended to filter results further, refine accuracy (e.g. by use of more keywords or search fields) and could perhaps be the focus of future sub-projects. Similarly, country names matched other words in the results on occasion (e.g. authors’ names or scientific terms in the abstract). Where this was the case and if appropriate, searches

were further filtered (e.g. to exclude author names of ‘Chad’ or studies on ‘Aspergillus Niger’). Others, e.g. ‘Republic of Congo’, also resulted in listings for ‘Republic of China’. Further filtering and revised searches would address this; however, as this was intended as a general ‘scene setting’ exercise, extra searches would be too time consuming. Therefore, further studies would be recommended (e.g. of sub-themes or specific countries, groups or search ‘tags’) to refine and investigate further. This is also discussed later.

Furthermore, we recognise that relying on English language scientific publications will not capture all of the relevant published research, and actually that it is possible that not all such research will even be submitted or accepted for publication. Publication fees are language differences may be barriers for some scientists.

The search queries used were as follows;

- PubMed Search query for animal-based (in-vivo) publications (Table 2);

(COUNTRY NAME) AND ((Animals, Genetically Modified[MeSH Terms]) OR (Animal Experimentation[MeSH Terms]) OR (Models, Animal[MeSH Terms]) OR (Animals [MeSH Terms])) AND (animal[Filter]) AND (2020:2023[pdat])
Note: It was considered worthwhile to use the additional PubMed filter of ‘Other Animals’ and select publications within the year range of 2020-2023.

- PubMed Search query for alternative approaches (e.g. in-vitro, in-silico) or animal welfare based publications (Table 3);

(COUNTRY NAME) AND ((animal welfare) OR (3Rs) OR (vitro) OR (silico) OR (new approach methodologies) OR (NAMs))
Note: for the above search for Table 3, originally the terms ‘replacement reduction refinement’ and ‘alternatives’ were also included, but removed due to too many irrelevant results.

11.2 Results

Table 2: PubMed search by country of publications involving animal research
(*Number of results are correct at time of search)
Further examples can be provided on request.

Country	**Number of results***	**Comments**	**Descriptions and examples of latest publications (Generally 2020-2023)**
Algeria	558		Many in-vivo studies e.g. anti-cancer tests of various mushroom extracts in mice (Abdellaoui, et al., 2023); effect of green tea and nicotine on albino rats (Nacera, et al., 2023). In-vivo vaccine studies for uterine infection in dairy cows (Boudelal, et al., 2022).
Angola	110		Few studies directly in Angola. Mainly co-authored with UK/ China e.g. Evaluation of okadaic acid toxicity in human retinal cells and zebrafish retinas (Tchivelekete, et al., 2022).

Benin	378	It is noted here that some results were captured not only for the nation of Benin, but also Benin City, Nigeria	Anti-cancer testing of plant extracts in mice (Lehmane, et al., 2023) Many studies on meat for human consumption, antibiotic resistance e.g. poultry etc or deliberate infection and force feeding of rabbits to test anti-parasite treatments for rabbit farms (Konmy, et al., 2023). Mung bean testing in rats given diabetes, co-authored between Benin and Burkina Faso (Kabré, J.A.W., Dah-Nouvlessounon, D., Hama-Ba, F., Agonkoun, A., Guinin, F., Sina, H., Kohonou, A.N., Tchogou, P., Senou, M., Savadogo, A., Baba-Moussa, L.). Veterinary studies, e.g. investigation and treatment of dog ticks, collection of ticks and examination of dogs across six areas of Benin.
Botswana	159		Papaya extract force fed to diabetic rats (Matsuane, et al., 2023). Veterinary case study reports e.g. genome analysis of pet dog with COVID-19 (Choga, et al., 2023).
Burkina Faso	314		Raspberry extract force fed to alcoholic mice - co-authored with China/Egypt (Zogona, et al., 2023). Deliberate infection of pigs with Tryapnosomasis (Ilboudo, et al., 2022).
Burundi	33		Large scale multi-national foot and mouth vaccination of ‘food’ animals /‘livestock’ (Hammond, Maulidi and Henning, 2021). Genotyping of pork samples for African Swine Fever outbreaks – Burundi and Malawi – carried out in Tanzania (Hakizimana, et al., 2021).
Cameroon	690		Custard apple/soursop extract testing in rats given breast cancer (Silihe, et al., 2023). Fruit and tree mixed extracts tested on rats given diabetes and suffering decreased mobility (Djientcheu Tientcheu, et al., 2023).
Cape Verde	74		Largely environmental and island habitat studies given Cape Verde location and archipelago structure, some farming/ agriculture, insecticide studies, marine observation or ecology studies (e.g. sea turtles)

Central African Republic	148	Some more detailed searching performed to account for common keywords in country name, meaning results are inflated by irrelevant entries e.g. results include 'republic' of China and others and would benefit from a more refined search	Mainly co-authored international studies, e.g. veterinary study (co-authored with France) to genetically analyse samples of pneumonia virus from cattle (Ngounda, Manso-Silván and Thiaucourt 2021). Numerous other studies (human population, disease prevention and genetic sequencing of previously obtained animal data on prominent viruses and diseases, e.g. monkeypox, African swine fever, malaria).
Chad	131	Some 'invalid' results accounted for in the number provided , due to author names of 'Chad', also some references to adenovirus, vaccine terms e.g 'ChAd'	Blood sampling of 443 'livestock' animals across different regions of Chad and genetic analysis for trypanosomiasis (Vourchakbe, et al., 2023); co-authored with Cameroon. Further studies in naturally infected animals (Vourchakbé, et al., 2022); co-authored with Cameroon. Many other studies concerned with prevention of trypanosomiasis (sleeping sickness) e.g. in humans (Antillon, et al., 2023).
Comoros	30		Environmental and habitat studies, new species and virus control research.
Democratic Republic of the Congo (Congo-Kinshasa)	312	As anticipated, many overlapping results with the following country due to name similarity	Head and neck cancer in-vivo and in-vitro studies (co-authored with China) (Zhang, et al., 2023). (Due to search similarity, overlap with next row)
Republic of the Congo (Congo-Brazzaville)	931	As anticipated, many overlapping results with the previous country	Results include anthropological research into sanctuary chimps co-authored by the Jane Goodall Institute based in RoC. Also investigation of Covid infected pets in RoC
Cote D'Ivoire (Ivory Coast)	339		Agricultural (e.g. cattle ticks) and infection (e.g. malaria) studies most prevalent.

Djibouti	31		Plant extracts injected into rats given Chronic Lung Injury (Saghir, et al., 2021); co-authored by the Laboratory of Djibouti Regional livestock Quarantine (tests carried out in Egypt, other co-authors in Saudi Arabia). Others by the same co-author institutes include plant extracts (e.g. ginger) tested on alcoholic rats (Elnagar, et al., 2021).
Egypt	9701		As anticipated, extensive examples of animal testing of many kinds, e.g.: Antidepressant testing in stressed rats including forced swim and tail suspension (Koriem and Tharwat, 2023). Dental experiments on dogs kept alive for a period before being killed and dissected at Cairo University (Metwally, et al., 2023). Spirulina testing in fish (Youssef, et al., 2023). Plant extracts fed to “overwhelmed broiler chickens” to test for decreased infection, increase quality and profits for the poultry industry (Soliman, Hassan and Farid, 2023).
Equatorial Guinea	32		Ecology and conservation studies, epidemiology, including human studies against viral and parasitic infection (e.g. Marburg virus)
Eritrea	14		Very few relevant studies and co-authored
Eswatini	14		Snakebite anti-venom testing in mice (Menzies, et al., 2022). Mainly malaria studies, cattle tick prevention, agriculture, parasites etc.
Ethiopia	1264		A number of cattle studies for the Ethiopian dairy industry (e.g. Almaw, et al., 2022), genetic sampling studies to ‘improve performance’ in chickens for the poultry industry. Studies on chickens fed with coriander and altered temperature conditions to ‘improve performance’ for the poultry industry (Welay, et al., 2023).
Gabon	187		Food reward/psychological testing in non-human primates; co-authored with UK/France/Italy/Germany (Romain, et al., 2021).
Gambia	112		Toxicity studies force feeding coconut oil to rats injected with lead to cause reproductive damage; co-authored with Nigeria, South Africa, Uganda (Olaniyan, et al., 2021a). Similarly, rats force fed vitamin E to test for benefits against injection with cadmium to cause reproductive damage; co-authored with Nigeria, Uganda (Olaniyan, et al., 2021b).
Ghana	765		Acute toxicity studies in mice force-fed plant extracts to check for benefits against deliberately induced arthritis and inflammation (knee and paw swelling) (Antwi-Adjei, et al., 2023).

Guinea	2217		In-vivo studies (mice) alongside in-vitro tests for experimental malaria (Camara, et al., 2019).
Guinea-Bissau	30		Mainly animal and wildlife epidemiology studies, species habitat, forest protection for monkeys, sampling of marine life (e.g. oysters) from rockbeds in GB archipelago
Kenya	1661		Toxicity studies in mice deliberately infected with Trypanosomiasis and treated with VIt B12 to try to predict effects in human infection (Oula, et al., 2023) Diabetic rats force-fed antiretroviral drugs (e.g. used to treat HIV) and already in use for humans (Makamu, Mwangi and Bukachi, 2023).
Lesotho	24		Tick studies on Merino sheep to improve wool industry exports from Lesotho (Roxa, et al., 2023). Also parasite and epidemiology studies (e.g. donkeys to improve working performance) (Nts'aoana, et al., 2023).
Liberia	44		In-vivo studies include Ebola testing in mice and macaques (Marzi, et al., 2018). Other study types include public health studies relating to animals ,e.g. 'living safely with bats' (Martinez, et al., 2022); co-authored with Cameroon/Tanzania/Guinea/Malaysia/ Thailand/Vietnam/USA Human malaria/population studies
Libya	161		Veterinary studies of infection in cats and dogs in Tripoli - healthy and clinical patient animals with owners' consent (Elnageh, et al., 2021). Otodectic and bacterial etiology of feline otitis externa (Hiblu, et al., 2021. Genetic sampling of sheep with gut worm infections for farming industry (Ahbara, et al., 2021). Intestinal studies in mice co-authored with UK/Greece/ Germany/UAE/Spain (Papoutsopoulou, et al., 2022). Antidepressant mirtazapine in mice; co-authored with Canada/Egypt (Almishri, et al., 2021).
Madagascar	512		Ecology/environmental/habitat studies, also National Park funded studies on the live trapping, sampling and release of lemurs to study parasitic infection (Montero, et al., 2021). In-vitro COVID studies using mouse antibodies and Chinese Hamster (CHO) cells (Frumence, et al., 2021).

Malawi	254		Co-authored international studies of experimental lung injury and sepsis in mice alongside human (in vitro) studies (Alsabani, et al., 2022). Genetic study of tick infections in sheep and goats across southern Malawi (Chatanga, et al., 2021). Drug resistance studies in pigs, goats linked to farming industry (Ohene Larbi, et al., 2022; Airs, et al., 2023). Other studies include malaria epidemiology studies in humans.
Mali	241		Farming studies of 'production systems' termed 'traditional' (nomadic, transhumant, sedentary) vs 'commercial' (fattening and dairy production), (Traoré, et al., 2021). Studies of wild caught mice from Mali and transported to the USA for captive breeding for lab use to improve on the lack of data "despite the species being a known reservoir and vector for zoonotic viruses, including the highly pathogenic Lassa virus, as well as other arenaviruses and many species of bacteria"; co-authored with Germany/Canada/USA (Wozniak, et al., 2021).
Mauritania	44		Eco and environmental studies, e.g. plastic pollution, foot and mouth disease epidemiology, slaughterhouse studies of viral disease (camels and cattle). Haemorrhagic fever studies of cattle, goats, camels and sheep across Mauritania - collection of samples for genetic sequencing (Schulz, et al., 2021).
Mauritius	119	Note: many studies are included here which were not carried out in Mauritius, but were captured due to the supply and long distance transport of non-human primates (macaques) from the region	Marine sponge derived drug studies (Ramanjooloo, Andersen and Bhaw-Luximon, 2021). In-vitro studies of Mauritian plant extracts on mouse cancer cell lines (Kauroo, et al., 2021). Co-authored studies in rats (with China) to investigate new injection methods of well known diabetic drugs (Liu, et al., 2021). Studies to investigate skin tissue engineering of seaweed extracts in rats and in-vitro; co-authored with France/ Germany (Madub, et al., 2021).

Morocco	762		Review of health benefits of well known and widely tested fruit and veg extracts/oils (e.g. carrots, raspberries citrus fruits, spices) and recommending animal studies to link to potential use in drugs (Balahbib, et al., 2021); many similar studies on plant extracts. Many further farming studies for industry, meat/dairy production, virus control. 'Veterinary' study (by Multi-Chemical Industry Santé Animale) involving experimental infection and killing of goats with goatpox to prevent 'economic losses' (Hamdi, et al., 2021).
Mozambique	298		Genetic studies in cattle, many environmental studies, 3 month food additive testing studies in cattle including repeat blood sampling before slaughter to increase animal performance and profitability in beef cattle production (Mozambique/Brazil co-authors) (Corrêa, et al., 2021).
Namibia	209		Many co-location studies. Zebra habitat ecological studies (Huang, et al., 2021); virus sample collection studies in pigs and warthogs (Molini, et al., 2021); breeding (observation) studies of white rhino National Park populations
Niger	460		Testing in mice of plant extracts already in wide human use across West Africa to "treat diverse ailments including piles, rheumatism, oedema and wound healing" (Thomas, et al., 2021). Many (co-authored) farming studies in animals.
Nigeria	2686		As expected, one of the leading African nations in science and therefore many animal-based publications. Includes many co-authored studies, e.g. rats force fed turmeric to check for improvement in deliberately induced reproductive defects (Kehinde, et al., 2021), co-authored with South Africa/ Namibia.
Rwanda	211		Farming studies to help production and industry, slaughter, fever and parasitic epidemiological studies, also habitat and environmental studies, e.g. effects of poaching on wildlife. In-vivo (co-authored Rwanda/Nigeria) experiments include caffeine studies on pregnant mice to study brain effects (Owolabi, et al., 2021). Anti-malaria treatments tested in mice *which are already in human use* (Onohuean, et al., 2021a), co-authored Rwanda/ Uganda.
Sao Tome and Principe	12		Malaria, rabies, farming and veterinary studies. Appear to be few/no in-vivo laboratory publications.
Senegal	360		As above. Viral epidemiology studies (e.g. Ebola, Marburg). In-vivo includes studies of COPD and cigarette smoke in mice (Tiendrébéogo, et al., 2023), co-authored with France.
Seychelles	113		Mainly eco and habitat studies of various species; includes some analysis of mercury exposure in fish.

Sierra Leone	85		Many population/epidemiology studies of viruses and environmental/habitat studies. A key study includes the capture and killing of 1755 bats across 4 regions of Sierra Leone to to sample for new strains of Marburg virus (Amman, et al., 2020).
Somalia	55		As above, farming and veterinary studies, viral population studies, some ecology studies. Some vaccination studies (co-authored Somalia/Nigeria) testing Somalian frankincense and myrrh in live and dissected goats/sheep (Mumin, Emikpe and Odeniyi, 2020).
South Africa	6076		As expected, the nation with the highest prevalence of publications in general. A topical recent example explains how animal research facilities acted during the COVID-19 pandemic (Chipangura et al., 2021) and several papers on training in laboratory animal science (e.g. Mohr, et al., 2023b). Other examples include: HIV vaccine testing in rabbits (Douglass, et al., 2021). Testing the anti-seizure effects of plants *already in use for epilepsy in South Africa* in zebrafish bred with epilepsy (Chipiti, et al., 2021). Mouse malaria studies (Mambwe, et al., 2022). And many more.
South Sudan	122		Overlap and cross reference with similarity to Sudan search (below). Examples include 'animal production'/agricultural studies of lambs experimentally infected with gastric parasites to assess impact on growth rates and feed supplements (Atiba, et al., 2021); co-authored with China. Agricultural veterinary studies of goat fertility (Aban, et al., 2019). Other examples include earlier studies of kidney research on rats (Yengkopiong and Lako, 2015).
Sudan	581		Examples include antibiotic tests in mice (Kwon, et al., 2020), co-authored with Korea/Saudi Arabia Also co-authored (Sudan/Egypt/China) bacterial infection testing of curcumin in rats given infected wounds (skin cut and injected with bacteria) (Othman, et al., 2023).
Tanzania	984		Many agricultural (e.g. Swine fever), population and ecology studies.

Togo	202		As above many agricultural, veterinary, virus and parasitic infection (e.g. trypanosomiasis) population studies. Also co-authored (Togo/Senegal) basic anatomy/dissection studies of wild rodents (cane rats - numbers being increased via breeding programmes to be eaten) to provide reference illustrations for veterinary use (Kabkia, Ataba and Agba, 2022). Also native plants tested in diabetic rats (Motto, Lawson-Evi and Eklu-Gadegbeku, 2022).
Tunisia	1109		Examples include: Circumin testing in rats given Alzheimer's (ELBini-Dhouib, et al., 2021). Testing in rats to mimic Parkinson's disease (Masmoudi-Kouki, et al., 2020). Rabbits injected with toxins to mimic osteoarthritis in humans (Rebai, et al., 2020). Tunisian plant extract (widely available for human consumption) used for acute toxicity testing in rats (alongside in-vitro studies) to predict gastric benefits in people (Boujbiha, et al., 2023). Many others and extensive co-authored studies.
Uganda	763		Co-authored Rwanda study on malaria (as above) (Onohuean, et al., 2021a), co-authored with Rwanda/Egypt/Australia/ Austria Diabetic rat studies (Onohuean, et al., 2021b). Acute toxicity studies of Aloe Vera extract on rats (Nalimu, et al., 2022). And many others.
Zambia	332		In-vivo (mice) and in-silico testing of anti-parasitic drugs. Mice deliberately infected (Munsimbwe, et al., 2021). Tests of the effects of clove oil (eugenol) against aluminium poisoning (neurotoxicity) in rats (Mesole, et al., 2020).
Zimbabwe	211		As above, many viral and agricultural studies. Fruit and herb extracts forced fed to diabetes-induced baby rats to check protection against fatty liver disease (Mukonowenzou, et al., 2021).

Table 3: PubMed searches of the use of alternative/non-animal methods (e.g. in-vitro and in-silico models) also incorporating reference to the 3Rs (replacement, refinement, reduction) (*Number of results are correct at time of search).
Further examples can be provided on request.

Country	Number of results*	Comments	Descriptions and examples of latest publications (Generally 2020-2023)
Algeria	805		Drug modelling TK studies (Ahmed, et al., 2023). Computerised (*in silico*) studies of antibiotic drugs to improve performance in humans (however, also intended as preliminary work to animal studies) (Benselama and Benchouk, 2023).
Angola	65		Some in-vitro and in-silico studies, co-authored with other countries (e.g. Valente, et al., 2023; co-authored with Portugal).
Benin	319		In-vitro alongside mice in-vivo studies of senna extract (Towanou, et al., 2023). As in Table 2, results also overlap with Benin University, Nigeria
Botswana	185		In-vitro study using human breast cancer cell lines, also alongside in-vivo studies (co-authored Botswana/Ethiopia/Taiwan) (Alem, et al., 2023). In-silico chemistry studies co-authored Botswana/South Africa/UK (Sejie, et al., 2023).
Burkina Faso	289		In-vitro studies of essential oils on human cancer cell lines (co-authored with France) (Bayala, et al., 2023).
Burundi	45		Human population studies, viral transmission, HIV, anti-malaria studies. In-vitro studies on herb extracts, co-authored with Belgium (Ngezahayo, et al., 2017).
Cameroon	961		In-vitro/in-silico studies on Senna extract (Chimi, et al., 2023).
Cape Verde	23		Co-authored in-vitro (human blood cells) and in-vivo (mouse xenografts) studies (Rodrigues, et al., 2018).
Central African Republic	75		Mainly human-based/population studies, e.g. blood sampling for malaria (Nzoumbou-Boko, et al., 2020). Other parasite studies or conservation/environmental studies.

Chad	135	As above in Table 2, country names cause overlap with technical terms or author names. Accounted for in search	Multinational co-authored studies on new malaria strains (Stokes, et al., 2021); co-authored with USA/NZ/France/ Burkina Faso/CAR/Tanzania/Rwanda/Sierra Leone/Gambia/ DRC/Thailand/UK (As above, country name causes overlap with technical terms or author names)
Comoros	33		Co-authored in-silico drug toxicity studies on COVID (Mohamed, et al., 2022); co-authored with Morocco/Saudi Arabia
Democratic Republic of the Congo (Congo-Kinshasa)	216		In-silico investigations to repurpose anti-cancer drugs, as preliminary studies to in-vitro and in-vivo testing (Matondo, et al., 2022). Generally many human health/population prevention studies, parasitic infection studies
Republic of the Congo (Congo-Brazzaville)	952		Experimental toxicity testing of silver nanoparticles in rats (Olugbodi, et al., 2023); co-authored with Egyot/Nigeria/ Taiwan/USA/Saudi Arabia
Côte D'Ivoire	271		In-silico studies of plant extracts(Sinan, et al., 2023); co-authored with Sudan/Turkey/Spain/Italy.
Djibouti	26		In-silico and in-vitro testing of national plants; co-authored internationally (Mohamed, et al., 2023). Similar in-silico studies alongside mice tests (Elmi, et al., 2021).
Egypt	12294		In-silico and in-vitro COVID studies as preliminary testing to in-vivo (Ibrahim et al., 2023). Also involvement in international NAMs studies (Rai, et al., 2023); co-authored with India/Germany/Nepal/USA/Italy/Czech Republic
Equatorial Guinea	37		Human in-vitro studies for malaria (Guirou, et al., 2020); co-authored with Switzerland/Tanzania/USA.
Eritrea	59		In-vitro studies of plant extracts as cardiovascular drugs (Kiflemariam, et al., 2022).
Eswatini	30		In-vitro snakebite venom studies alongside mice testing (Menzies, et al., 2022); co-authored with UK.

Ethiopia	1137		National in-vitro/in-silico studies on grape vines/crop protection (Dagne, et al., 2023; Adane, et al., 2023)
Gabon	184		In-silico/in-vitro studies of Gabon medicinal plants (Essono Mintsa, et al., 2023); Co-authored with France.
Gambia	246		Stepwise in-vitro testing (prior to in-vivo) for anti-malarial drugs (Mbye, et al., 2023); co-authored with Ghana.
Ghana	869		In-silico studies on Trypanosomiasis (sleeping sickness) (Nketia, et al., 2023).
Guinea	38587	Results inflated by duplicate and irrelevant terms	In-vivo studies (mice) alongside in-vitro tests for experimental malaria (Camara, et al., 2019); co-authored with Mali/France.
Guinea-Bissau	51		In-vitro combined with in-vivo study of anti-fungal property of plant (Moreira, et al., 2023); co-authored with Portugal/Spain. Anti-inflammatory properties of plant (Macedo, et al., 2021); co-authored with Portugal/Spain. Human tissue models to overcome animal model problems in child vaccine development (Sanchez-Schmitz, et al., 2018); co-authored with USA/Denmark.
Kenya	1678		Ex-vivo and in-vitro study of drugs predicted to have antimalarial activities (Ochora, et al., 2023a). Agro-veterinary welfare studies (Sitawa, et al., 2023).
Lesotho	32		In-vitro and ex-vivo drug studies (Kheoane, Enslin and Tarirai, 2021); co-authored with South Africa
Liberia	92		Data analysis of COVID-19 models (Gupta, et al., 2022); co-authored with South Africa/India.
Libya	168		In-vitro and in-silico anti-cancer drug design (Husseiny, et al., 2023); co-authored with Egypt. In-silico and in-vitro testing of Jasmine extract against Covid-19 (Al-Karmalawy, et al., 2023); co-authored with Egypt/ Saudi Arabia/Korea.

Madagascar	268		In-vitro antibacterial studies of local vanilla extract (Lalanne-Tisné, et al., 2023); co-authored with France/Belgium. In-vitro tests of essential oils to treat scabies, based on earlier (and leading to later) animal studies (Andriantsoanirina, et al., 2022); Co-authored with France. UK authored environmental studies for animal welfare e.g.effects on NHP habitat of roads and transport expansion in Madagascar (Galea and Humle, 2022). Madagascar results are inflated by the variety of experiments on national plants (e.g. vanilla) by many other countries.
Malawi	393		Many population/health and societal studies, e.g. malaria, juvenile pregnancy. In-vitro studies of cow cells to improve reproduction rates in agriculture (Chelenga, et al., 2023); co-authored with Japan. Systematic review of in-vitro and in-vivo nanomaterial studies (Utembe, Tlotleng and Kamng'ona, 2022); co-authored South Africa.
Mali	300	Revised search to exclude author names of 'Mali' gave improved results	In-vitro genetic studies for malaria vaccines (Niaré, et al., 2023); co-authored with Africa/UK.
Mauritania	11		In-silico studies of aquatic toxicity due to iron pollution (Aillal, et al., 2023); co-authored with Tunisia/Saudi Arabia. In-silico modelling to assess fish stocks (Sarr, et al., 2021); co-authored with Senegal/Gambia/Morocco/France.
Mauritius	223	Large scale supplier of non-human primates worldwide, yet few studies on welfare	In-silico chemistry studies (Ugwu, et al., 2023); co-authored with South Africa/Nigeria/USA/NZ.
Morocco	1103		In-vitro/in-silico testing of Moroccan essential oils including cinnamon; e.g.: Maache, et al., 2023; co-authored with Ethiopia/Turkey/ Pakistan/Canada/Saudi Arabia Ezzaky, et al., 2023; co-authored with Portugal/Spain In-vitro tests of plant extract alongside acute lethal toxicity (LD50) tests in animals (Lachkar, Lamchouri and Toufik, 2022).

Mozambique	264	Many health economics and population studies	In-vitro/in-silco studies of cinnamon and rosemary extracts against parasitic infections (Leishmaniasis) (Come, et al., 2022); co-authored with China/Italy/Brazil. Pig farm welfare study (Chilundo, et al., 2020); co-authored with South Africa/Denmark.
Namibia	83	Significant number of in-vitro publications relative to overall results	In-vitro (and in-vivo) cancer studies (He, et al. 2023); co-authored with China. Further swine fever control studies in pig farming (Luka, et al., 2022). Other welfare related studies on conservation and cattle farming.
Niger	400	Aspergillus Niger' term accounted for which results in many additional non-relevant listings	In-vitro (rat cell) study of Niger plant extracts (Sevik Kilicaslan, et al., 2023); co-authored with Switzerland.
Nigeria	2865		In-silico modelling for malaria treatments (Evbuomwan, et al., 2023). In-vitro studies for anticancer treatments alongside mice tests (Ukwubile, Ikpefan and Famurewa, 2023). Some papers on animal welfare, including: ACURET study "supporting advancement of lab animal welfare" (Fakoya, 2023). Emergence of animal welfare science and policy (Marchant, et al., 2023); co-authored with Ethiopia/USA/UK/Brazil/Germany/ Australia. Veterinary studies to treat/eliminate rabies in both 'owned' / homed dogs and street dogs (Mshelbwala, et al., 2018).
Rwanda	217		In-vitro studies of medicinal plants (Tuyiringire, et al., 2022); co-authored with Uganda/Belgium. Other in-vitro and in-silico studies.
Sao Tome and Principe	13		Mainly health population studies.

Senegal	388		Human in-vitro cancer cell models (Thiam, et al., 2022); co-authored with France. Welfare studies by Brooke on horse injuries (Seck, Jobling and Brown, 2022).
Seychelles	18		Mainly ecological/island environment studies, some 'invasive species' studies.
Sierra Leone	115		In-vitro cell studies alongside xenografts in mice (Nguyen, et al., 2023); co-authored with Taiwan. Sierra Leone chimp sanctuary welfare study (Anderson, Amarasekaran and Riba, 2021); co-authored with Spain.
Somalia	56		Mainly health population /modelling studies, virus/disease prevention, female population studies
South Africa	8452	Many studies on welfare, also in vitro and in silico publications	Several papers published on animal welfare and ethics related to animal research and testing. E.g.: African ethical perspective on animals in research (Coetser, 2022). 12 Rs Framework guiding animal research ethics (Brink and Lewis, 2023); co-authored with UK. Animal welfare considerations when conducting inhalation and toxicokinetic studies for nanomaterials (Chung, et al., 2022); co-authored with Korea. Education and training in laboratory animal science and ethics (Mohr, et al., 2023b); co-authored with Tunisia/Nigeria/Algeria/Egypt/Kenya/Botswana/Uganda/UK/Switzerland.
South Sudan	82		Agricultural/animal production led in-vitro studies to test quality and performance of animal feed (Zhong, et al., 2021); co-authored with China.
Sudan	846		In-silico and in-vitro study of a traditional plant for hypertension, diabetes and rheumatism (Fawzi Mahomoodally, et al., 2023); co-authored with Mauritius/South Africa/Sudan/India/Turkey/Italy/Saudi Arabia. In-silico and in-vitro study of a traditional plant for anti-oxidant and anti-enzymatic properties (Suroowan, et al., 2023). Donkey welfare studies (Adam, et al., 2022).
Tanzania	727		In-silico models of Parkinson's disease alongside in-vivo (fruit fly) tests (Tibashailwa, et al., 2023).

Togo	159		in vitro, ex vivo and in vivo testing of plant extracts (co-authored with Italy) used as anticancer treatments (Kola, et al., 2022); co-authored with India. In-vitro and multiple in-vivo/archaic organ perfusion tests on Ginseng for cardiac benefits (Komla, et al., 2022); performed in Togo and co-authored with France.
Tunisia	1697		As above, co-authored in-vitro and in-vivo study (Boujbiha, et al., 2023); co-authored with Algeria/Saudi Arabia/Spain/Italy. 3D skin model (Tahri, et al., 2023); co-authored with Malaysia. Co-authored (in 2016) with South Africa/Tunisia/West Indies/ Denmark/USA, 'the governance of animal care and use for scientific purposes in Africa and the Middle East' (Mohr et al., 2016).
Uganda	952		Ex-vivo, in-vivo, in-vitro studies of evergreen plant/shrub extracts against malaria (Ochora, et al., 2023b); co-authored with Kenya/Nairobi/UK.
Zambia	321		In-vitro tests on herb extracts for wound healing (Balachandran, et al., 2023), co-authored with Poland/ Malaysia/Philippines. Cattle and poultry 'production welfare' studies.
Zimbabwe	309		In-silico and in-vitro tests of plant extracts on human breast cancer cells, prior to animal tests (Nyambo, et al., 2023); co-authored with South Africa. In-silico testing of plants for anti-diabetic benefits (Nyathi, et al., 2023).

11.3 Discussion

The aim of the literature searches was to provide a 'first look' and, to some extent, an early *quantitative* analysis of numbers of publications for each country of Africa and in turn, a *qualitative* overview of where and what types of research are carried out.

11.3a General findings

As expected when comparing larger and smaller nations across Africa, several countries showed higher numbers of results than others with regard to both animal research and use of approaches such as in-silico or in-vitro methods, reflecting greater numbers of academic establishments and general scientific infrastructure (e.g. Nigeria, Kenya, Egypt, South Africa).

The number of publications listed in the above tables should be treated with caution. As explained in section 11.1 some of the numbers have been artificially inflated due to country names matching other words (e.g. 'Chad' both as a country and name of a paper's author). In both tables 2 and 3 (publications based on animal research and non-animal research), the highest number of publications were from Nigeria, Egypt and South Africa (also Guinea, but the results were inflated to some extent by duplicate and irrelevant terms):

Table 4: *Countries with highest number of publications based on animal research and non-animal research*

Country	Number of papers based on animal research	Number of papers based on non-animal research
Egypt	9701	12294
South Africa	6076	8452
Nigeria	2686	2865

According to Table 4, in each of these three countries more papers were published of work based on non-animal research. Further analysis of the papers would be required to assess their relevance in order to provide a more accurate figure; however, we can see (Table 3) that in the case of Nigeria, some in-vitro studies were conducted alongside animal tests and the figures for South Africa include papers on ethics and training in addition to NAMs.

We are also careful to use the term ‘alternatives’ rather than ‘non-animal methods’ in general, as while some findings were entirely animal-free, some were not; for example in-vitro studies sometimes involved human models but often animal cells and tissues too. Therefore, these might be more accurately termed ‘live-animal-free’.

Generally, a wide variety of publications on animal studies as well as human health, epidemiology (population) studies on disease prevention, farming and agriculture were found. Key topics of study, as anticipated, included elimination and prevention of malaria, trypanosomiasis (sleeping sickness), many other parasitic infections, snakebite venom studies, agriculture and socio-economic healthcare studies.

Furthermore, in addition to the many animal species commonly used in laboratory research and testing worldwide (e.g. mice, rats, non-human primates, dogs, sheep, pigs and many others), there were found to be widespread publications on animals specific to diseases and agriculture research in African countries. Just a few examples include testing of pesticide sprays for tick infestations in cattle, studies of particularly prominent diseases (e.g. African swine fever, Schistosomiasis or Marburg virus) and research into dramatic rises of pandemics such as Avian Flu (see Table 2).

There are concerning efforts in place to increase specific areas of animal research in Africa where it is considered ‘lacking'. For example, Maina et al. (2021) note what they refer to as a “worrying” lack of transgenic models available for neuroscience research in Africa and how this can be addressed by putting “regulation for the import and use of genetically modifiable animals in place”. It may therefore be argued that situations like this (i.e. where the use of animals are considered challenging for practical or other reasons) present the ideal opportunity to engage with African scientists on the need to transition away from animal use towards alternative approaches (e.g. in-silico or in-vitro methods) and of course prioritising the implementation of entirely animal-free methods. These, once established within the lab, may provide not only accessible solutions, but are more biologically-relevant to humans and eliminate animal suffering.

Veterinary research and ‘animal welfare’ studies across Africa (and indeed worldwide) appears in a wide variety of publications. As it is often accompanied by the claim that it is ‘animal research *for* animals’, it is important from an ethical viewpoint to examine the objectives of veterinary research. Does it, for example, constitute what may be argued as ‘genuine’ research (i.e. to treat animal patients for their benefit and to share knowledge on their care; for example, case reports on treating patients such as gunshot wounded rhinos or other animals)? Or does it lead to suffering of animals to market new commercial products, achieve higher breeding rates or ‘meat quality’ for farmers, breeders or animal (‘livestock’) traders, or deliberate infection of animals with disease with the aim of marketing new products?

The term ‘welfare’ also of course captures many aspects of animal welfare (e.g. Leiberich, et al., 2022). The primary reasons for ‘welfare’ studies for cattle or other species (e.g. chicken, sheep, goats) termed as ‘food animals’ are frequently stated to be to increase revenue for the meat or dairy industries (e.g. new vaccine studies) by eliminating infection to improve yield, and to increase profits especially for export (e.g. Africa to Europe: Delooz, et al., 2021) or to increase ‘egg laying performance’ in factory-farmed hens (Erensoy, et al., 2021). It must be noted that many human welfare related publications were also found in the results too. However, some veterinary welfare studies were noted; e.g. on street and ‘pet’ dogs for rabies treatments and prevention (Nigeria, Table 3) or by comparing healthy animals to veterinary patients with the owners’ consent (Libya, Table 3).

As noted briefly in the methodology, for the above search for Table 3, originally the terms of ‘replacement, reduction, refinement’ and ‘alternatives’ were also included, but removed due to too many irrelevant results. In fact, very few results on the terms ‘3Rs’ and ‘NAMs’ (New Approach Methodologies) were seen in general, showing that these are still relatively rarely used terms across Africa. However, there is some recognition and very notable exceptions, such as the Pan-African Network for Laboratory Animal Science and Ethics (PAN-LASE) which was established “to pioneer a support network for the development of education and training in LAS and ethics across the African continent” (Mohr, et al., 2023b). Another very notable example concerns Rwandan vet Dr. Jean Claude Masengesho who, having lost his job because of the coronavirus pandemic, decided to use his interest in animal welfare to found the Rwanda Animal Welfare Organization (Masengesho, 2021).

Also, generally there was reference to animal welfare in specific publications on in-vitro and in-silico methods. However, these are often carried out along with in-vivo (animal) studies.

With regard to co-authoring across African countries and beyond, it is also noted that some results appearing for several countries were co-authored; e.g. papaya extract tests in rats for Botswana and Kenya (Matsuane, et al., 2023) or experimental infection of pigs with sleeping sickness co-authored by researchers in Burkina Faso and the Ivory Coast (Ilboudo, et al., 2022). Many publications were also co-authored between African and non-African authors.

Also of important note is that a number of publications were captured in searches which were not from institutions based in African countries. For example, some papers appeared in searches due to their focus on African-related diseases (e.g. swine fever) but the research was carried out by authors elsewhere, such as the USA or China. It is beyond the timeframe of this project to eliminate these, but could be addressed in further data extraction projects and, where papers are found citing one or more authors based in Africa, the paper can be reviewed to see how much of the research was carried out by these author(s) and/or if the animal studies were carried out in other countries (see recommendations for further work below - section 11.3b). This may be a particularly important piece of work given concerns (e.g. as highlighted by Nyika, 2009) that procedures on animals continue to be exported to African countries to avoid higher welfare measures and laws elsewhere.

There are ethical and scientific issues with animal research across Africa, similar to the rest of the world. These are just a few observations:

- Duplication of animal experiments widely published elsewhere
- Experiments to test treatments (e.g. well-known essential oils or plant extracts) in animals already available and in wide human use
- Experimental/deliberate infection of animals with disease, where the same disease is widespread in animals and humans and may be studied to the benefit of both animal and human patients more ethically
- A general need for more ethics review bodies to oversee animal studies and assess where other methods (e.g. in-vitro, in-silico or ‘weight of evidence’ based on history of human use) may give equal or better results

- Concern over animal research being exported to African laboratories to avoid stricter laws elsewhere

11.3b Limitations and recommendations for further work

The results provided ‘per country’ inevitably include a number of publications which are not directly relevant to our objectives. This is unavoidable to some extent in an electronic search and can only be rectified by follow up 'hand searching' of titles and reviewing of abstracts at a minimum, which would take far longer than we have for this initial review.

Nevertheless, given that a consistent search strategy was used, we believe the numbers serve as useful ‘like-for-like’ indicators within the context of this initial review, to compare and contrast where most scientific research is carried out, by type and location and to observe some general trends.

As also noted in the Methodology (section 11.1), specific filters and keywords were used to extract examples of animal research and non-animal methods (see Tables 2 and 3 respectively). These, for the reasons listed there, will have captured a wider number of articles than was originally intended.

Therefore, to investigate animal research and alternatives across Africa as comprehensively as possible, further specific and customised searches are highly recommended to filter further, refine accuracy (e.g. by use of further keywords or search fields, sub themes or specific countries, groups or search ‘tags’) and could perhaps be divided into future sub-projects.

11.3c Conclusions

As summarised well by Hau et al. (2018), ”Animal experimentation is common in Africa, despite the fact that legislation in the field is scarce”. Furthermore, concerns have been raised previously that animal research continues to be ‘exported’ to Africa from outside countries to avoid stricter laws and welfare measures elsewhere (Nyika, 2009).

Our searches confirm these conclusions that there is a significant level of animal research conducted across many African countries, but with relatively few legal requirements on reporting animal numbers or implementing welfare measures. Although numbers of animals used in tests (where occasionally quoted) may suggest lower levels than in some countries outside Africa, the fact is that animal research is routinely conducted with little or no oversight, which means we cannot be certain.

The level of animal research varies significantly between nations. However, there is also encouraging use (to a significant extent) of alternative approaches, such as in-silico and in-vitro methods (see section 11.3a), but these methods are often used as preliminary work to animal studies, rather than to replace them. Nevertheless, this demonstrates the great potential for much further training, outreach and education that is required. Important further insights are revealed by some animal research papers, for example the difficulties in obtaining the animals for use (Maina, et al., 2021). This could be argued as a potential opportunity to educate and train on the transition to alternative non-animal methods instead, by building on welfare and ‘3Rs’ awareness, where already in place.

12 Statistics and types of animal use in labs across Africa

The previous section sets the scene for the types of recent animal research in each country across the continent (primarily research published between 2020 and 2023, but where necessary some papers with slightly earlier dates were included).

To try and understand the numbers of animals used we relied on a number of older published studies as well as responses to our questionnaire (see section 9). Some of these papers may be a decade old but this reflects the lack of research into the numbers of animals used across Africa.

All previous research, as well as our discussions with experts for this report, suggest that no country in Africa collates (or at least makes publicly available) official data on the number of animals used in research. Several experts told us that they had requested figures from either government departments responsible for licensing experiments, or from individual institutions that conduct animal research, but that they had not been able to obtain any data.

None of the respondents were aware of any official statistics for animal research in their country. Typical responses included:

- "No statistics are available at the moment." (Kenya)
- "We have tried to get this, but it seems virtually impossible." (South Africa)
- "No accurate and official figures." (South Africa)
- "I have contacted some individuals in these institutions but they didn't provide me with statistics." (Rwanda)

One respondent, from Zimbabwe, said that they did have some statistics but would need permission to share them. It was not clear from their response what these statistics referred to, whether an individual lab or the country as a whole.

Taylor and Rego Alvarez (2019), in their global study of numbers of animals used in labs state: "No statistics were obtainable for African […] countries. Although the following countries had evidence of significant animal research (i.e. more than 200 PubMed publications in 2016 that featured the use of animals), publicly accessible statistics were not available for" Egypt, South Africa, Tunisia, Nigeria and Kenya.

Nyika (2009) claims that "most universities in Africa use animals for teaching purposes in such fields as veterinary medicine, animal science and some biomedical studies."

Where any statistics on animal use in individual countries does exist, it has often been compiled by researchers rather than an official government body. In the majority of these cases, these statistics are now several years old and may not apply to the country as a whole. We reached out to the lead authors of these papers in an attempt obtain more up-to-date statistics, but received no replies.

In an analysis of neuroscience publications affiliated with African institutions between 1996 and 2017, Maina, et al. (2021) revealed that publications have been dominated by a small number of countries. Egypt, South Africa, Nigeria, Morocco and Tunisia "account for more than three in every four neuroscience papers published from the continent." These were followed at a lower rate by the East African nations of Kenya, Ethiopia and Tanzania.

Most of the respondents to our questionnaire had very little or no detailed information on the types of animal research being conducted, the species involved or any indication of the numbers of animals used.

Despite the lack of statistics about animal research across Africa, where figures or estimates do exist, they suggest that the numbers are not as high as in some countries in other continents. In Taylor and Rego Alvarez's (2019) global study of animal research statistics, no African country appeared in the top ten animal-using countries.

However, we re-emphasise that without official statistics a true picture of the level of animal research in Africa is not available, and we must assume significant numbers of animals are

routinely used, even if this is relatively ‘low’ when compared to countries with high rates of scientific research in academia and commercial laboratories.

If we take Taylor and Rego Alvarez’s (2019) estimate for South Africa as the highest national total of 127,549 animals and multiply it by 54 to try to establish a ‘worst case’ total, this is approximately 6.8 million animals across Africa. Yet we know this is likely to be an overestimate as other countries are estimated to use far fewer animals - for example Algeria and Kenya use approximately 38,000 animals and 35,000 animals each, respectively (Section 12.1). Given that many countries are much smaller, their totals are likely to be even less. It is important to avoid either overestimating or underestimating as all figures currently provided, whether by published studies or questionnaires, are estimates. More on estimates for some countries is discussed below.

The lack of official and reliable statistics on the numbers of animals used is not unique to African countries. During their research to “estimate the number of animals used for scientific purposes worldwide", Taylor and Rego Alvarez were only able to obtain official statistics from 37 countries (30 from Europe, three from Asia, two from Oceania and two from North America). They were required to apply a prediction model, based on publication rates, to estimate animal use in a further 142 countries. (Taylor and Rego Alvarez, 2019).

Of the top ten (estimated) largest users of animals compiled by Taylor and Rego Alvarez in 2019, six did not produce accurate statistics: USA, China, Japan, Canada, Brazil and Australia. The other four were EU Member States where detailed data are collected and are publicly available.

With regard to industry, animal research is often conducted in African countries in collaboration with international organisations. Although specific companies are not always publicly disclosed, several sectors, including pharmaceuticals, biotechnology, and cosmetics, are known to commission such research. This is reflected in contract research organisations which promote an international client service for animal testing and also the breeding and supplying of animals, for example the Bioinformatics Institute of Kenya (KIBS, 2024).

12.1 Countries

Algeria

A 2020 paper on animal use in labs in Algeria (Benmouloud, et al., 2020) stated that the use of animals was increasing.

The Pasteur Institute of Algeria (PIA) is the official and major source of animals for all institutions in Algeria. Based on the 2015 PIA annual report, the authors estimated that 37,958 animals were used annually. These were 84% mice, 15% rats, 0.7% rabbits, 0.2% ovines (sheep) and 0.1% horses.

Most animal research in Algeria takes place in academic institutions and government organisations. Animals have been used for biomedical research, animal production research, technical and scientific training and biological production.

The 2015 PIA annual report indicates that 27% of the Algerian institutions used animals in research and/or education. Twenty seven institutions using animals in research and/or education were surveyed:

41% of animals are used in teaching activities, most of whom were small rodents. Only 5% were used for fundamental biological research and breeding purposes. “Animals were also used for quality control (34%) and screening for drugs, in bioassays and for preclinical testing including general and specific toxicity studies. […] Rabbits and horses were also frequently used for therapeutic sera production (19%).”

According to the PIA report, the largest users of animals in Algeria for education and research (by institution) were the University of Sétif (13% of the total number of animals used by the 27 institutions) and the University of Science and Technology Houari Boumediene (11%).

Benmouloud, et al. conducted a PubMed database search for 2013-2017 and found that 62% of the 27 Algerian institutions used animals in research. They estimated that a total of 4,006 animals were used over five years: 38% mice, 36% rats, 8.7% rabbits and 2% hamsters.

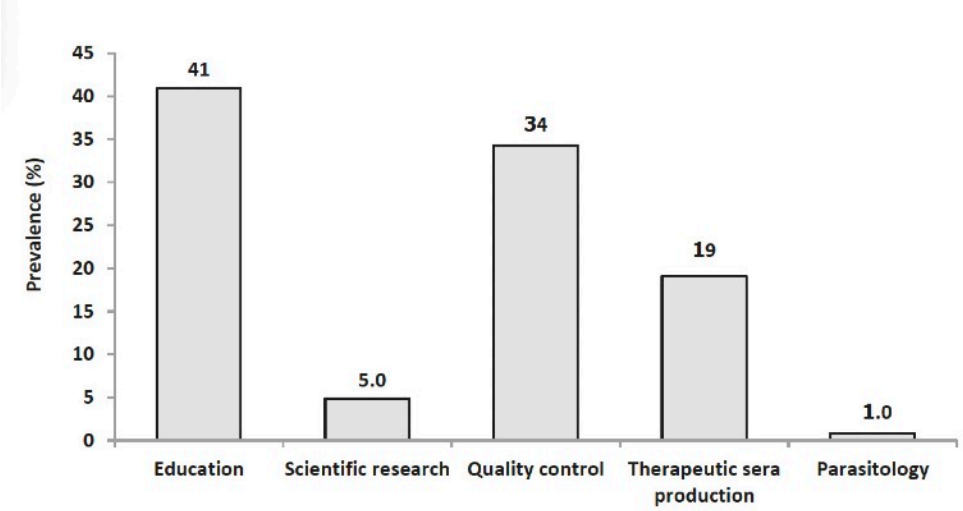
From this PubMed research, the authors identified fifteen institutions using animals in research. 46% were used at the University of Science and Technology University Houari Boumediene and 17% at the University of Annaba.

Most animals used in education and research were provided by the animal breeding programme at the Pasteur Institute of Algeria.

Some animals had been captured from the wild, in particular the desert. Sand Rats accounted for 13% of all animals used, 1.8% Gerbillus [rodent], 0.5% Meriones [rodent] and 0.2% Uromastyx [lizard]. “These animals are mainly used in fundamental research relating to biology and species behaviour, research on animal welfare, nervous system, reproductive system, human related diseases and disorders and the conservation of the species in nature. They account for 18% of all rodent species in this study which is considerably higher than that reported by the EU.”

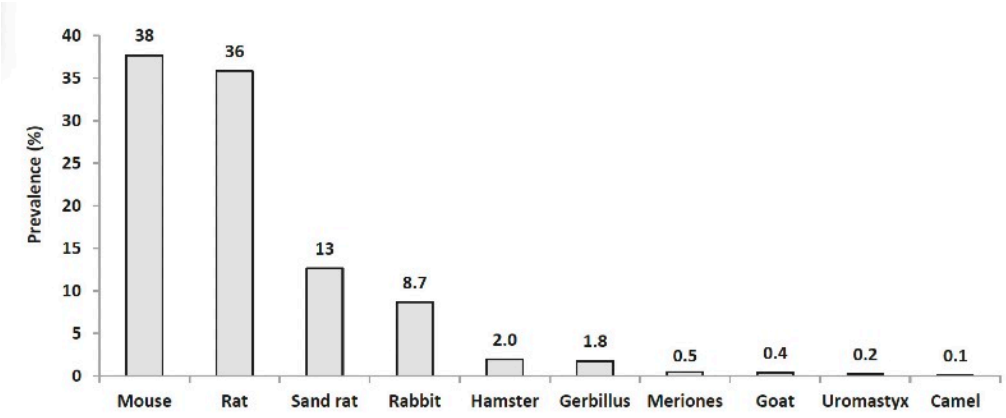
Farmed animals were also used: goats accounted for 0.4% of animals used and camels for 0.1%.

Chart 4: Reasons for animal use in laboratories in Algeria (from Benmouloud, et al., 2020)



Prevalence of laboratory animal use for different purposes in Algeria (PIA report, 2015).

Chart 5: Species of animals use in laboratory research in Algeria (from Benmouloud, et al., 2020)



Prevalence of animal species used specifically for scientific research in Algeria (PubMed 2013-2017).

The retrospective study "showed that the majority of animals [41%] were used for education, with quality control and therapeutic sera production being the next two large areas where animals were used in Algeria."

"Basic research was the minor area for which animals were used, with less than 5% compared to 45% in the EU in 2017."

"This study revealed that a large proportion of the total animals used were for teaching and educational purposes mainly due to a lack of alternative methods. The high animal usage for educational purposes may be related also to the high teaching activity and practical sessions involving animals for undergraduate and graduate biology and veterinary students. Moreover, non-animal alternative methods are still not given serious consideration in most Algerian universities and high schools."

Cameroon

An animal welfare NGO responding to our questionnaire stated that "most of the animals that are used for testing are rabbit, guinea pig, chickens, frog" and that "every year millions of these animals are used in school labs" by students who are writing the Ordinary and Advanced Levels exams.

The NGO added that "most of the animals are used in secondary, high schools and universities, both private and government institutions."

Ethiopia

Hau, et al. (2018) referred to research using vervet monkeys being conducted in Ethiopia.

Ghana

An animal welfare NGO responding to our questionnaire stated that animal research mostly took place in universities and colleges: "most colleges of education and universities use rabbits and guinea pigs to prepare what is called animal skeletons in their laboratories."

Kenya

Research conducted by Kimwele, Matheka and Ferdowsian (2011), gives the only insight we have come across into the numbers of animals used in research in Kenya. This was based on questionnaires "administered at 39 highly ranked academic and research institutions" in Kenya. Of these, 30 were academic institutions and departments, whereas nine were non-academic research institutions. The data collected refers to the year 2009, so is now 15 years old. The authors do not state how many institutes in the country are likely to use animals, but it is presumed that this was a representative sample at the time it was conducted.

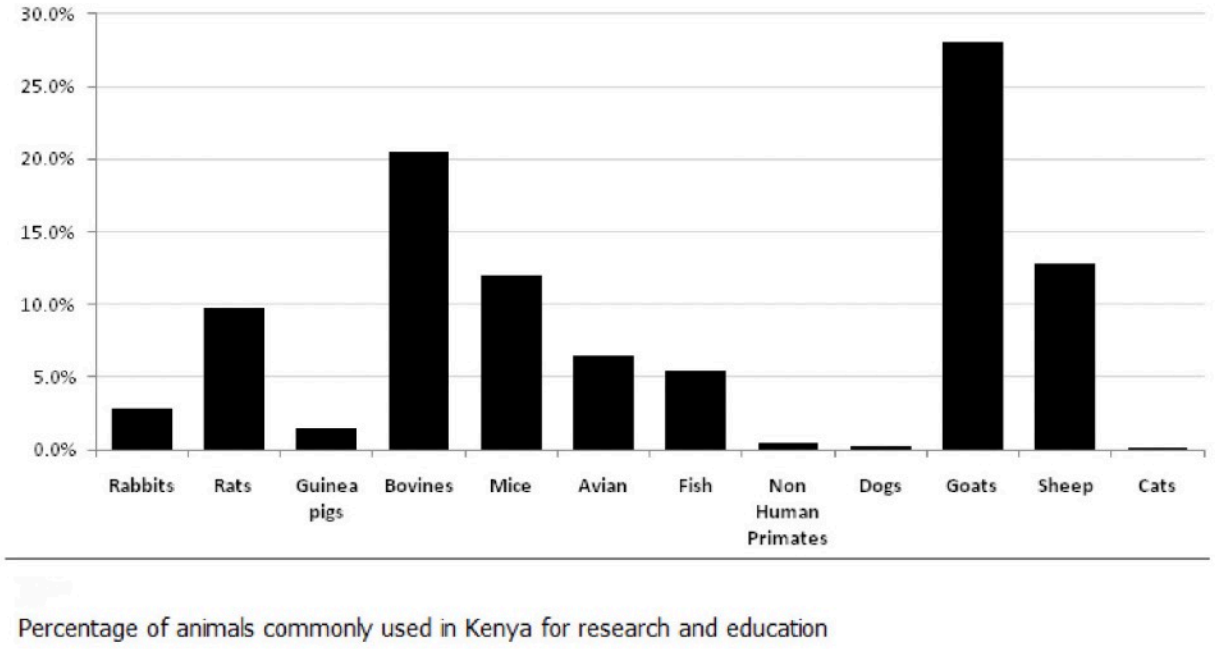
The research found:

Of the 39 institutions surveyed, 38 (97.4%) reported use of animals in research and/or education. The animals used included mammalian, avian and fish species.

According to survey results, the authors estimated that an annual total of 35,284 animals were used.
Of the total animals used:
28% were caprines [goats]
20.5% were bovines [cattle/bison/buffalo]
12.8% were ovines [sheep]

9.7% were rats
2.9% were rabbits
1.5% were guinea pigs
0.4% were non human primates
0.2% were dogs

Chart 6: Species of animals use in research and education in Kenya (from Kimwele, Matheka and Ferdowsian, 2011)



Respondents reported different sources of animals. These sources were categorised as:
Academic or research institution breeding facilities (76.8%)
Farms (12.2%)
Commercial breeding operations (7.4%)
Animals' natural habitats (2.4%)
Local council animal control facilities (1.2%)

The use of species such as goats, bovines and sheep, and the sourcing of animals from farms, suggest that much of this research is related to the commercial farming of animals. This is discussed in section 12.2.

Non-human primates are used in Kenya and other African countries. The National Museums of Kenya's Institute of Primate Research (IPR), located in Nairobi, conducts research using primates, particular vervet monkeys and baboons, for studies of human reproductive disorders and tropical infectious diseases (Hau, et al., 2018).

In 2013, UK NGO Cruelty Free International conducted an undercover investigation at the Institute of Primate Research in Nairobi (Cruelty Free International, 2013), reporting that:
- "Wild baboons were held in poor conditions at the Institute of Primate Research […] Some baboons were kept for years in solitary confinement in small, barren cages"
- Many of the experiments they were used for "were highly invasive and caused immense suffering. Some were even fatal"
- The experiments carried out on baboons included invasive brain surgery
- Other experiments involved force-feeding male baboons the herbal stimulant khat to examine how khat affects sperm
- Researchers infected female baboons with Chlamydia

- Other female baboons were forced to suffer surgery to test new IVF techniques and contraceptive devices.

In response, the Institute of Primate Research claimed that the capture of baboons from the wild "is both a species management issue for the country, as well as a source of animals for much needed medical research on diseases that impose a high burden on Kenyans and globally" (Kariuki, 2014).

A Kenyan scientist responding to our questionnaire said: "live animals are still used in clinical teaching and research in many Kenyan institutions. Ethical committees are not coordinated."

An NGO respondent informed us:
"In Kenya, countless animals are used in universities and animal health training institutes to develop the skills of students undertaking courses in Veterinary Medicine and Animal Science. To improve their skills in surgical procedures, rabbits, dogs and cats undergo countless procedures in these institutions and sadly put down afterwards.
"A majority of testing is done in universities, animal health training institutes and government research facilities; As a trained veterinarian, use of animals in developing surgical skills was commonly done in universities. This practice is still ongoing even now."

Mauritius

Mauritius is one of the world's largest suppliers of monkeys for the research industry, ever since the company Bioculture began shipping the animals in 1985. The country is now the second-largest source, after China, of long-tailed macaques (*Macaca fascicularis*) (Wadman, 2017).

There are seven breeding 'farms' on the island: Bio Culture, Noveprim, Biodia, Biosphere, Les Campeches Ltd, Cynologics, and Le Tamarinier (One Voice, 2023b).

The primates are not native to the island, having been introduced in the early 1600s from Indonesia. That the species is not native to the island is used as the primary pretext for the trapping of the animals and their sale to research laboratories worldwide (Padayatchy and Vincent Florens, 2022; Padayatch, 2011).

Landowners are encouraged to trap the monkeys, receiving a payment from the companies for each one (Padayatchy, 2011). A levy is taken on macaque export which is supposedly used to fund conservation of threatened native biodiversity on the island (Padayatchy and Vincent Florens, 2022).

According to One Voice, a French NGO that carried out an undercover investigation into the macaque trade in Mauritius in 2023, those primates who were "injured during the capture, or those who are infertile, sick, or have been affected by a simple skin condition are killed". They claim that up to 200 monkeys are killed every day (One Voice, 2023b).

In 2020, 10,827 long-tailed macaques were exported from the country, an increase of 40% from 2019. Between January and September 2021, the number of macaques sent to overseas laboratories included 1,913 to Spain, 758 to France, 642 to the UK, 109 to the Netherlands, 112 to Canada and 7,276 to the USA (Glenn, 2021).

In 2021, there was a sharp increase to 14,640 in the number of long-tailed macaques exported from Mauritius for research and toxicity testing (Action for Primates, 2023).

The macaques are captured in the wild on the island. In 2021, Biosphere Trading, one of the companies exporting monkeys, was granted permission by the government to expand its facility and to capture up to 1,000 monkeys to be used for breeding. Biosphere intended to provide landowners and their tenants with traps to capture monkeys and would then offer to buy selected individuals (Action for Primates, 2023).

Bio Culture has also moved into experimentation directly, with Mauritius aspiring to be a biomedical hub. “A biomedical contract research organization, Centre International de Développement Pharmaceutique, was established in Mauritius in 2004, and in 2011, the country began promoting itself as a clinical trial destination (Wadman, 2017).

Campaigns against the trapping and export of the macaques to laboratories have been co-ordinated by NGOs in Europe (for example, see: One Voice, 2023b; Action for Primates, 2022; Cruelty Free International, 2016).

Long-tailed macaques are viewed as a major research export. Yet globally they are under threat. In 2022, they became classed as Endangered by the International Union for Conservation of Nature (IUCN) in its Red List of Threatened Species. The IUCN stated “the demand for non-human primates in research is threatening the species” (IUCN, 2024).

According to The Long-Tailed Macaque Project, the IUCN’s assessment “is based on the levels of exploitation, driven in particular by trade for research (biomedical and toxicology), pets and entertainment, and culling, and the decline of native habitats, which is suspected to result in a ≥50% decline in population size over the coming three macaque generations (36-39 years), if not mitigated” (Long-Tailed Macaque Project, 2022).

Photos 5 and 6: Macaque at a ‘breeding farm’ and a pen for trapping macaques in the wild, both in Mauritius, 2023. Credit: One Voice

Nigeria

Mohr et al., (2016) claim that Nigeria "has the highest number of tertiary institutions where animals are used in research, teaching, and testing".

As shown by Tables 2 and 3 in section 11.2 above, the number of papers published in Nigeria on both animal-based studies and studies primarily based on non-animal methods are amongst the highest in Africa, superseded only by Egypt and South Africa. The number of papers based on non-animal studies (2965) was just slightly higher than those using animals (2686) for the period examined.

South Africa

For South Africa, Taylor and Rego Alvarez's model (Taylor and Rego Alvarez, 2019), based on papers published in 2016, estimated the number of procedures involving the use of animals in 2015 (or the nearest year) to be 127,549.

This is similar to the non-specific estimate of 100,000 animals used annually for scientific and teaching purposes in South Africa reported elsewhere (e.g. Mohr, 2013).

According to Coetser (2022), "the use of animals for research is especially prevalent within the research facilities that focus on biomedical sciences, like the South African Medical Research Council and National Institute for Communicable Diseases."

There are several companies in South Africa exporting non-human primates to other countries, both to labs directly and to other breeding farms or dealers. According to a 2023 investigative report by EMS Foundation and Ban Animal Trading (EMS Foundation and Ban Animal Trading, 2023):

- South Africa exports hundreds of common marmosets and pencilled marmosets (black-tufted marmoset) every year to breeding farms and labs in China and the USA
- One South African animal trader has exported more than 1,000 marmosets to a US primate dealer since 2016. The US company sells primates directly to labs
- Another South African company exported at least 240 captive-bred marmosets for biomedical research to China from 2016 to 2019 (China has banned the import of live animals into the country since 2020). The report states "it is impossible to determine the true number of exotic (nonhuman) primates exported for vivisection to China, since Chinese brokering companies often act as middlemen for buyers"
- South Africa was also one of the main importers of rhesus macaques and crab-eating macaques from China in 2003
- Another company in South Africa imported 300 live macaques from the USA, between 2016 to 2022

The report discovered cases of incorrect recording of official data on animal import and export; therefore the correct level in the trade in non-human primates from and to South Africa may not be known.

A 2009 article about South Africa's growing health biotech industry noted a "dearth of certified animal [research] facilities" as a reason for alliances between the industry and overseas (very often European) companies (Al-Bader, et al., 2009). The lack of these facilities in-country means that the work has to be contracted out overseas, "adding considerably to development costs" and being a key barrier to growth.

By basing themselves in academic environments, some companies have minimised overheads. One example given is Altis Biologics being based at Tshwane University of Technology. "Altis

recognised the shortage of good laboratory practice (GLP) quality animal facilities in South Africa and funded an upgrade of Tshwane's preclinical facility so that it would meet GLP standards" (Al-Bader, et al., 2009).

Tanzania

The Department of Traditional Medicine at the National Institute for Medical Research (NIMR) performs animal research on herbal products for Pharmacokinetics (Seth and Saguti, 2013).

Tunisia

The situation in Tunisia appears similar to that of neighbouring Algeria. There are no official statistics, but a 2015 survey by Dr M'Barek (M'Barek, at al., 2015) of the High Institute of the Applied Biological Sciences of Tunis found that most animals used were rodents, especially mice and rats and that local species, in particular dromedary camels (*Camelus dromedarius*) or desert rodents (*Meriones* and *Psammomys*), were also used.

Zimbabwe

Two NGOs responding to our questionnaire said that animal research took place at universities, agriculture institutes, farm laboratories and research institutes and was often related to animal farming: e.g. experimental research on feed formulations in goats.

12.2 Region-specific animal research

Table 2 provides examples of publications on animal-based studies specific to diseases and agricultural research in African countries. These include testing of pesticide sprays for tick infestations in cattle, studies of particularly prominent diseases (e.g. African swine fever, Schistosomiasis or Marburg virus) and research into dramatic rises of pandemics such as Avian Bird Flu.

A great deal of animal research across Africa is related to animal farming ('livestock' production) and associated diseases. The World Organisation for Animal Health (OIE) notes that "animal production is seen as the backbone of rural development and food security in all the Southern African Development Community (SADC) Member States" (OIE, 2011) and this likely applies to other parts of the continent as well.

The OIE further notes that "governments are promoting and encouraging modern production of animal products/commodities, as a business and export opportunity" and that increased industrialisation of animal farming "can bring major health problems unless aspects of animal welfare are taken into consideration in design and planning" (OIE, 2011). An increase in animal farming, particularly intensive farming, could lead to more animal use in research. This is a circular pattern of animal suffering, using animals in laboratory research to improve productivity of animals who will be routinely exploited for their flesh, milk and skins or other industrial scale suffering such as blood harvesting for antibodies or other research purposes.

According to the Food and Agriculture Organization of the United Nations (FAO), the continent of Africa is projected to account for the largest absolute increase in farmed land animal numbers of any continent between 2012 and 2050 (as commented by Kortschak, 2023).

While Table 3 does include some examples of in-vitro agricultural studies (e.g. in-vitro studies in Malawi of cow cells to improve reproduction rates in agriculture), this should still be seen in the context of continued exploitation of animals.

Table 2 shows agricultural research examples in thirteen countries, such as:
- Cattle studies for the dairy industry (Ethiopia)

- Genetic sampling studies to 'improve performance' in chickens for the poultry industry (Ethiopia)
- Tick studies to improve wool industry exports (Lesotho)
- Drug resistance studies in pigs and goats (Malawi)
- Experimental infection and killing of goats with goatpox to prevent 'economic losses' (Morocco)
- Three month food additive testing studies in cattle including repeat blood sampling before slaughter to increase animal performance and profitability in 'beef cattle' production (Mozambique)

The above are just some examples to illustrate, as such studies are conducted routinely across many more African countries.

Another common area of research relates to medicinal plants. The use of plants in traditional medicine is centuries old in Africa and "still remains the main recourse for a large majority of people for treating health problems", leading to an increase in toxicological research using animals (El-Aal, 2014, p17), despite all the human-relevant data.

"Research in natural medicinal products puts Africa in an excellent position in the area of drug discovery. […] Research in this field is highly diverse across the continent. In particular, several West-African countries with tropical and subtropical climates have invested heavily into this branch of neuroscience, most notably Cameroon (30%) as well as Nigeria and Ghana (18% each)." (Maina, et al., 2021).

The publications in Table 2 reveal there is a high prevalence of animal use for plant extract testing for medicinal use. Many of these extracts are very well known globally with a vast history of data on human use for a variety of medical, herbal and consumer purposes (e.g. vanilla, ginseng, countless essential oils, as just a few examples). Yet the volume of 'off the press' 2023 publications for these types of animal studies shows how they are routinely and unnecessarily conducted across Africa too.

Table 2 shows examples of plant research using animals in eleven countries, such as:
- Acute toxicity studies in mice force fed plant extracts to check for benefits against deliberately induced arthritis and inflammation (Ghana)
- Studies of Mauritian plant extracts on mouse cancer cell lines (Mauritius)
- Testing in mice of plant extracts already in wide human use across West Africa to "treat diverse ailments including piles, rheumatism, oedema and wound healing" (Niger)
- Testing the anti-seizure effects of plants *already in use for epilepsy in South Africa* in zebrafish bred with epilepsy (South Africa)
- Tunisian plant extract (widely available for human consumption) used for acute toxicity testing in rats (alongside in-vitro studies) to predict gastric benefits in people (Tunisia)
- Fruit and herb extracts forced fed to diabetes-induced baby rats to check protection against fatty liver disease (Zimbabwe)

As above, these are not exhaustive examples. Many more are conducted across Africa.

Nyika (2019) refers to "research on many diseases that affect Africa" being conducted on animals, such as:
- Vervet monkeys have been used for leishmaniasis studies conducted in Ethiopia
- DNA vaccine candidates for cowdriosis were tested in mice in studies conducted in Zimbabwe
- Studies to investigate the immunological effect of schistosomiasis and malaria co-infection were done in mice in Kenya
- In South Africa researchers used rabbits in immunisation research into Human Papillomavirus (HPV).

The following laboratories are just some examples of institutions conducting animal research discovered during our search of publications for the results in Table 2 (publications involving animal research). This is by no means comprehensive but may provide a useful starting point for outreach and awareness on non-animal methods:

- Laboratory of Farm Animals Reproduction, Institute of Veterinary Science, University of Tiaret, Algeria

- Laboratory of Physiopathology/Molecular Pharmacology and Toxicology, Department of Animal Physiology, Faculty of Science and Technology, University of Abomey-Calavi, Benin
- The National keys laboratory of Basic Sciences of Stomatology of Kinshasa University, School of Medical University of Kinshasa, Democratic Republic of Congo
- Zagazig University, Egypt
- Nuclear Research Center, Atomic Energy Authority, Inshas, Egypt
- Eswatini Snakebite Research and Intervention Centre, Simunye, Eswatini
- Eswatini Antivenom Foundation, Simunye, Eswatini
- Department of Biological Sciences, University of Eswatini, Kwaluseni, Eswatini
- The Bioinformatics Institute of Kenya
- Unit of Animal Health and Safety of Animal Products, Institute for Studies and Promotion of Animal Exports, University of Khartoum, Sudan

13 In-vitro and in-silico research

Table 3 shows papers published (generally between 2020 and 2023) of 'alternatives' to animal experimentation, such as in-vitro and in-silico (computer-based). It is noted that these methods may still contain an element of animal use and so we refrain from using the term 'non-animal methods'. Also, as described below, many were carried out prior to or in parallel to in-vivo/animal studies.

On the topic of research into plant properties, the use of 'alternatives' is shown in sixteen countries. Examples include:
- In-vitro studies of essential oils on human cancer cell lines (Burkina Faso)
- In-vitro studies of plant extracts as cardiovascular drugs (Eritrea)
- In-silico and in-vitro testing of Jasmine extract against Covid-19 (Libya)
- In-vitro antibacterial studies of local vanilla extract (Madagascar)
- In-vitro/in-silico studies of cinnamon and rosemary extracts against parasitic infections (Leishmaniasis) (Mozambique)
- In-silico and in-vitro study of a traditional plant for hypertension, diabetes and rheumatism (Sudan)
- In-silico testing of plants for anti-diabetic benefits (Zimbabwe)

However, in some cases animal experimentation was still used alongside the in-vitro and in-silico research:
- In-vitro alongside mice in-vivo studies of senna extract (Benin)
- In-vitro combined with in-vivo study of anti-fungal property of plant (Guinea-Bissau)
- In-vitro tests of essential oils to treat scabies, based on earlier (and leading to later) animal studies (Madagascar)
- In-vitro tests of plant extract alongside acute lethal toxicity (LD50) tests in animals (Morocco)
- Ex-vivo, in-vivo, in-vitro studies of evergreen plant/shrub extracts against malaria (Uganda)
- In-silico and in-vitro tests of plant extracts on human breast cancer cells, prior to animal tests (Zimbabwe)

Examples (from Table 3 results) of institutes involved in in-silico and/or in-vitro methods (sometimes in parallel to animal studies)
- Algeria - Laboratory of Applied Organic Chemistry LCOA, Synthesis of Biomolecules and Molecular Modelling Group, Badji-Mokhtar-Annaba University, Annaba
- Algeria - Laboratory of Applied Thermodynamics and Molecular Modeling, Department of Chemistry, Faculty of Science, University of Tlemcen
- Botswana - Department of Chemistry, University of Botswana
- Botswana - Botswana Institute for Technology Research and Innovation
- Burundi - Centre de Recherche Universitaire en Pharmacopée et Médecine Traditionnelle (CRUPHAMET), Faculté des Sciences, Université du Burundi, Bujumbura
- Comoros - University of Comoros, Faculty of Sciences and Technology
- Djibouti - Centre d'Étude et de Recherche de Djibouti, Institut de Recherche Médicinale
- Egypt - Institute of Chemical Industries Researches, National Research Centre, Dokki, Cairo
- Eritrea - Asmara College of Health Sciences, Asmara, Eritrea./National Health Laboratory, Asmara

- Liberia - Data Science Research Laboratory, BlueCrest University College, Monrovia
- Mauritius - Computational Chemistry Group, Department of Chemistry, Faculty of Science, University of Mauritius, Réduit
- Morocco - University Mohammed Premier, Faculty of Sciences, Department of Chemistry, Laboratory of Applied Chemistry and Environment (LCAE), Oujda
- Mozambique - Departamento de Pré-Clínicas, Faculdade de Veterinária, Universidade Eduardo Mondlane
- Sudan - Department of One Health, Medical and Cancer Research Institute; Animal Welfare Center, Nyala

From our searches and the examples above, it is clear that the level of awareness and use of in-silico and in-vitro approaches is very encouraging. However, as anticipated it is also clear that a significant level is conducted either before or in parallel to animal studies. These findings provide scope for outreach and investigation to promote better use of 'alternative' approaches - and ultimately non-animal methods - to advance animal-free science across Africa.

14 Replacing the use of animals in research, testing and education in Africa

In addition to the results (Table 3) of the scientific literature search, other publications over a longer period of time help build a picture of the replacement of animals in research across Africa. These were limited in number, localised and old, with a few examples from a small number of countries.

Of all the respondents to our questionnaire or emails, none were aware of any scientists working on the replacement of animal testing in their country (beyond those NGOs or individuals who mentioned their own work), other than one that referred to the African Network for Alternatives Approaches to Animal Testing, "a pan-African organisation that promotes alternative approaches to animal testing." However, we were unable to find any information on ANAAAT and received no further information from the NGO.

14.1 Countries

Algeria

In 2020, Benmouloud, et al., commented: "The use of alternatives to animal experimentation in research and education has been rarely employed [in Algeria]. There are a few non-animal methods that have been used in teaching, and their use may be hindered by the limited resources available to the Algerian academic institutions."

They refer specifically to "films, videos, plastic models, physiological systems modelling and observational field study" as being used in some institutions in place of live animals in some institutions. In addition, "in basic research, a few Algerian institutions (USTHB, Algiers and University of Tlemcen) used animal cell culture as alternatives, particularly in cell physiopathological research."

Egypt

Elzaabalawy, et al. (2011) reported:

The first North Africa and Middle East Seminar on Alternatives in Education and Training was held at Cairo University in 2010 and produced a resolution for full replacement of harmful animal use. The seminar brought together teachers, students, researchers, veterinary professionals, campaigning organisations and others from 24 countries across North Africa, the Middle East and other areas to learn about replacement methods.

One of the organisers, InterNICHE (the UK-based International Network for Humane Education), also discussed with the university's Faculty of Veterinary Medicine, and the University of Benha, the potential for replacement by innovative alternative methods such as training mannekins and advanced software.

As well as interest from teachers, a group of veterinary students established Cairo University Vets for Alternatives (CUVA), dedicated to full replacement, the implementation of alternatives, and a positive vision of the profession. Some CUVA members even conscientiously objected to an animal-based practical class, forcing its cancellation.

Photo 7: North Africa and Middle East Seminar on Alternatives in Education and Training, Egypt, 2010 (Elzaabalawy, et al., 2011)

Ms Meeting and demonstration of alternatives with sheikhs at Al-Azhar Mosque, Cairo

Meeting and demonstration of alternatives with Deans and Heads of Department at Faculty of Veterinary Medicine, Cairo University

Lecture and demonstration to students at Faculty of Veterinary Medicine, Cairo University

Trial of alternatives by students at Faculty of Veterinary Medicine, Cairo University

Dr Fawzy Elnady, at the Faculty of Veterinary Medicine, Cairo University, developed the 'Elnady Technique' for tissue preservation to replace the use of animals killed for teaching basic anatomy, embryology, pathology, parasitology and forensic medicine (Elnady, 2016).

This inexpensive modified form of plastination can support training in clinical skills and surgery, including for clinical examination, endoscopy, surgical sutures, and obstetrics simulation.

Most of the animals (camel, buffalo, ox, horse, donkey, sheep, goat, dog, cat and chicken) were euthanised in the clinic due to serious non-recoverable injury or terminal illness.

Dr Elnady and colleagues also produced a model for training of upper respiratory endoscopy in the horse that replaces the use of a live animal (Elnady, et al., 2015).

Kenya

A 2011 paper based on a survey at 39 highly ranked academic and research institutions in Kenya (Kimwele, Matheka and Ferdowsian, 2011) found:

- Sixteen (41.0%) institutions used alternatives to the use of live animals, most commonly animal cell cultures and computer simulators
- Only one institution used human cell cultures as a replacement to live animal use
- In all, thirty-six (92.3%) respondents cited financial constraints as a major obstacle to the use of alternatives in research and education

In 2015, the African Network for Animal Welfare (ANAW), Egerton University's Faculty of Veterinary Medicine and Surgery and InterNICHE organised a two-day workshop titled *From Animals to Alternatives* (Macharia Theuri, Ngonyo and Wangari Kagai, 2016). Forty participants from different education and government institutions, as well as civil society organisations, attended the first session. The second session, attended by 38 participants, was aimed mainly at veterinary students and faculty staff, teaching "the availability of alternatives and to demonstrate that alternatives provide research and education institutions with authentic, affordable and ethical training resources that reduce the demand for live animals otherwise needed to deliver the same lessons."

The ANAW workshop was funded by the prize money received when ANAW won the 2014 Lush Prize for Training in non-animal methods of research.

"The overall objective of the workshop was to raise awareness, provide skills and knowledge, and adopt the use of alternatives to animals in education and training. Specific objectives were:
– To provide a platform for participants to learn new, humane alternative innovations and techniques;
– To share experiences, ideas and lessons on the use of alternatives;
– To formulate a roadmap and a platform for adoption of alternatives."

Following the successful workshop, Professor Munene (Deputy Vice Chancellor of Egerton University) said, "From the workshop, I now believe that replacement of harmful use of animals in education and training is possible up to 99% if not 100%."

The 'actions and way forward' set out by ANAW, based on the results of the workshop, provide a suitable model for other organisations, institutions and governments to support the replacement of animals in education and training. These include:
- Conduct an audit of the current curricula to determine which available alternatives can be adopted in the short term, mid-term and long term
- Organise knowledge and skills training on the use of alternatives for the implementers including lecturers and heads of departments in specific institutions
- Organise students' seminars and workshops to create demand for alternatives by making the students aware of alternatives
- Create a resource centre (physical and virtual) where alternatives can be developed, people can be trained, alternatives can be loaned, and an open library where people can access a database with a variety of alternatives
- Identify and document animal welfare issues affecting animals used in education and research in Kenyan institutions. This will inform further development of interventions that address animal welfare, development of alternatives specific to various animal welfare issues, and development of guidelines for use of animals in education and research.

ANAW told us in 2023 (personal correspondence):

“Unfortunately, due to lack of funding, there has not been any progress in the subsequent years with regard to the same. We are however eager to continue the campaign and drive the agenda on the importance of alternatives in alleviating unnecessary suffering to animals in Africa.”

South Africa

Grobler, et al. (2020) report on live-animal replacement models used in veterinary and farmed animal related practical research (especially for anatomy and physiology modules) by students in South Africa. These are used for a variety of reasons, including the limited availability of cows for a large number of students, as well as ethical and welfare constraints:

- Model animals or organs - alternative to using live animals and slaughtering animals for dissections
- Models include ‘Breed n Betsy, “an education tool for practical teaching of the internal reproduction anatomy of a cow, as well as allowing students to practise skills that are used in pregnancy testing, artificial insemination, and embryo transfer.”
- Synthetic organs “to improve the quality of teaching and learning anatomy and are especially useful for anatomical regions or organs that are difficult to dissect and/or visualise.”
- “Use of computer software programs to formulate diets and model animal production performance efficiency”

However, they also note: “traditional teaching and learning of modern animal science students cannot be fully replaced by alternative methods and/or models.”

Photo 8: Live-animal replacement models, South Africa (Grobler, et al., 2020)

At the University of Pretoria synthetic organs are used for animal anatomy and physiology training.

Tunisia

M'Barek, et al. (2015) reported the following:

A training course on replacement methods took place at the National School of Veterinary Medicine of Sidi Thabet (University of Manouba), Tunisia in 2015. It was a collaboration between ICLAS (International Council for Laboratory Animal Science), ATSAL (Tunisian Association for Laboratory and Animal Science) and ENMV (National School of Veterinary Medicine of Tunisia) with CAAT-Europe (Center for the Alternatives to Animal Testing), Episkin Academy and Biopredic International.

During the workshop, entitled *From in vivo models to cell models,* Dr Masmoudi from Tunis El Manar University "showed how cell culture minimised the number of animals needed to perform an experiment".

CAAT presented New Approach Methodologies such as in-silico, in-vitro and organs-on-a-chip, Episkin presented in-vitro human reconstructed epidermis and epithelial tissue models and Biopredic International showed veterinary students, doctors and scientists how human hepatic HepaRG cell culture were developed.

Dr Masmoudi "reported on the enthusiasm among the majority of her students on using alternatives in practical work instead of sacrificing animals."

15 Ethical reviews, guidelines and animal care committees

Although several countries in Africa have some regulations and guidelines dealing with ethical issues in research, usually regarding human participants, rarely does this extend to implementing measures for the protection of animals used in research (Benmouloud, et al., 2020; Mohr, et al., 2016; Fahmy and Gaafar, 2016).

Mohr, et al. (2016) note that in Nigeria most institutions using animals in experimentation used health research committees that are registered with the National Ethics Committee, although "most members of the committees may have little or no experience with animal care and use". This led to the incorporation in Nigeria of ACURET, Animal Care and Use in Research, Education and Testing, with the aim to promote the "humane care and use" of animals for scientific purposes in 'developing' countries.

The authors on a book chapter regarding legislation and guidelines on animal experimentation in Africa revealed the obstacles they faced in trying to determine what guidelines existed: "Inaccessibility of legislation is an issue in Africa; and not only concerning animal experimentation and welfare. It is possible that some African countries may have developed guidelines that are not available in the public domain and are therefore not known by experts in the field, and that are generally unknown to the larger scientific community" (Hau, 2018).

This concurs with the findings of other papers (for example, El-Aal, 2014, p37; Kimwele, Matheka and Ferdowsian, 2009).

Where African countries have trade negotiations and agreements with countries outside the region, this may lead to the implementation of specific standards relating to animal welfare. For example, a country may be required "to implement legal frameworks that emulate relevant EU [European Union] laws before being able to gain access to the internal EU market" (Mohr, et al., 2016).

According to Hosney, et al. (2021), "Some of the key factors for international recognition of an educational institution are its research integrity and its implementation of principles and guidelines that govern the various areas of research." They give the example of Egypt. As a member country of the World Organisation for Animal Health (OIE), Egypt signed the mandate that states in its

Terrestrial Code, Chapter 7.8, the obligatory establishment of an institutional animal care and use committee (IACUC).

It has been suggested that the lack of ethical and legal frameworks on the use of animals in many countries in Africa may actually create a temptation on behalf of some researchers in other parts of the world "to 'export' their research activities to collaborating African institutions" (Nyika, 2009).

Cruelty Free International's 2013 undercover investigation at the Institute of Primate Research in Kenya, mentioned earlier [section 12.1] (Cruelty Free International, 2013) claimed that:
"Researchers from the University of Newcastle bypassed UK law and travelled to Kenya to use wild-caught baboons in disturbing and highly invasive animal experiments. In doing so, they breached guidance by UK funding bodies which requires UK animal researchers to maintain UK animal welfare standards when carrying out experiments overseas."

In a survey of 39 institutions in Kenya, it was discovered (Kimwele, Matheka and Ferdowsian, 2011) that the majority "did not have established committees to review experimental protocols or to provide oversight regarding the use of animals in educational and research settings. Only two of the institutions with an established animal care and use committee referred to documented guidelines".

The authors added that institutional animal care and use committees "were rare across Kenyan academic and research institutions. More than seventy percent of the institutions had no animal care and use committee, despite their use of animals in education and research."

A few years later, Mohr et al. (2016) reported that in Kenya "although there are no legislative requirements for ethical review prior to animal experimentation, initiatives to establish ethical review systems have been made by leading research institutions like the National Museums of Kenya's Institute of Primate Research (IPR) in Nairobi."

Hau, et al. (2018) added:
"These National Guidelines for the Care and Use of Animals in Research and Education in Kenya (produced by the Consortium for National Health Research) provide excellent guidance on all aspects of an animal care and use program and compliance with these guidelines would assure standards similar to those of quality programs in the United States (US) and Europe."

The South African Medical Research Council first published guidelines on ethical considerations for the use of animals in research in 1979. In 2008 this was replaced by the South African National Standard (SANS) for the Care and Use of Animals for Scientific Purposes (Mohr, 2013). SANS establishes minimum standards and defines responsibilities as well as the functioning of Institutional Animal Ethics Committees (Hau, et al., 2018). However, is only voluntary and cannot be legally enforced (World Animal Protection, 2020i).

Mohr (2013) reported:
"Though not a legal prerequisite, the majority of South African research institutions have adopted the SANS. The responsibility to ensure compliance with the SANS rests with institutional AECs, whose members are required to regularly inspect all animal holding areas and laboratories, to ensure compliance."

Even if institutions have guidelines and policies, there are often no committees responsible for overseeing enforcement. "Thus, implementation becomes difficult or impossible", according to El-Aal (2014, pp36-37).

Another incentive for establishing guidelines or ethics committees is that this is often a requirement for publication in international peer-reviewed journals (for example, see Biological Conservation, 2023; Journal of Animal Science, 2023; Scientific Reports, 2023). Fahmy and Gaafar (2016) cite this as the reason behind Cairo University's Faculty of Science establishing its own institutional animal care and use committee in 2012.

It also supports grant applications to funds and institutions and helps gain the scientific co-operation of universities based outside the continent (Fahmy and Gaafar, 2016).

There are examples of individual institutions in several countries establishing local ethics committees relating to the treatment of animals in labs. For example:
- The Consultative Ethics Committee on Animal Experiments at the Pasteur Institute of Tunis
- The Consultative Ethics Committee of the Biotechnology Research Centre in Constantine, Algeria
- The Animal Care and Use Committee of the Faculty of Science in Cairo University

(Mohr, et al., 2016).

Likewise, some individual countries or institutions have produced guidelines on animal use. For example, Uganda's National Guidelines for Use of Animals in Research and Teaching was published in 2021 (Uganda National Council for Science and Technology, 2021) and in 2022 the first Institutional Animal Care and Use Committee was established in the country, at Makerere University (Musinguzi, 2022).

Group discussions led by Fakoya (2012) during a one-day national workshop on "IACUC [Institutional Animal Care and Use Committees' in Nigeria" in 2011 reported:
- "A few cases of functional animal care and use programs exist, but many attempts have failed
- Weak institutional development and access to knowledge in animal welfare management
- Limited and unbalanced capacity to undertake effective training at universities on animals used in research
- Lack of, or inadequate, national policies related to animal welfare
- In many developing countries, there is no legal framework for regulation of animal use in research, education, and testing"

El-Aal (2014, p36) lists some of the challenges of applying health research ethics in Africa. They include (but are obviously a broad generalisation not applicable to all countries):
- "Insufficient funds for public health.
- Limited local infrastructures as research centres and other facilities
- Inadequate training opportunities
- Absence of national legislation and guidelines on Research Ethics
- Absence of laws that control the use of animal models in scientific research
- Limited number of qualified investigators and trained researches who are familiar with the ethical guidelines of health research"

Fakoya's (2012) "recommendations on development of guidelines for animal care and use for scientific purposes in developing countries" concludes that "it would be inappropriate to adopt international standards implemented in developed countries. Each developing country should evolve its own standards based on its individual priorities."

El-Aal (2014, p18) agrees: "Initiatives to build research ethics capacity in developing countries must attempt to avoid imposing foreign frameworks and engage with ethical issues in research that are locally relevant."

To try and address some of these issues, "Africa-centric" Animal Ethics Committee guidelines were published in 2023 by the Pan-African Network for Laboratory Animal Science and Ethics (Mohr, et al., 2023c). "The Guidelines are based on universal principles for the care and use of sentient animals for scientific purposes, with consideration of the cultural, religious, political and socio-economic diversity in Africa."

These guidelines "apply to all live non-human vertebrates (i.e. fish, amphibians, reptiles, birds and mammals) and higher invertebrates (i.e. cephalopods and decapods), of all life stages from half of gestation or being capable of independent feeding (whichever comes first)."

The authors further state (Mohr, et al., 2023c):
"On a broader level, the Guidelines are intended to encourage the growing discourse in Africa regarding the moral principles and standards for the care and use of animals."

16 ‘Laboratory animal’ associations and training

Because of the general lack of legislation and guidelines relating to the treatment of animals in laboratories across the continent, several international organisations representing animal researchers and technicians have been involved in workshops in several African countries.

The International Council for Laboratory Animal Science (ICLAS) has organised or supported various workshops since at least 2016 in South Africa, Ghana, Tunisia, Algeria, Egypt, Nigeria, Uganda and Kenya, including a Workshop to Develop Guidelines for the Establishment and Functioning of Animal Ethics Committees (IACUCs) in Africa, held in Tunisia in 2019. There is also an ICLAS Africa Regional Committee (ICLAS, 2019).

Such ICLAS workshops in 2022 have included ‘Skills workshop on zebrafish’, ‘The ethics of animal experimentation and ethical review processes in Africa’ and ‘Good practices in animal experimentation (ICLAS, 2022).

Mohr, Magagula and Lewis reported in 2023 that “there are currently no formal E&T [Education and Training] courses available in South Africa that are specifically tailored to the needs of LACs [Laboratory Animal Caretakers], with variable on-the-job training being provided by employers.” (Mohr, Magagula and Lewis, 2023).

It was also reported that, in South Africa, “undergraduate programmes for the training of veterinarians contain limited coverage of the ethics, care and use of animals for scientific purposes” (Mohr, et al., 2023a).

In 2015 (or 2012 according to Fahmy and Gaafar, 2016), Cairo University was the first academic institution in Egypt to establish an Institutional Animal Care and Use Committee (IACUC). It was prompted to do so as a member country of the World Organisation for Animal Health (OIE), which, in its Terrestrial Code, obligates the establishment of an IACUC (Hosney, et al., 2021).

However, the IACUC website (http://acuc.sci.cu.edu.eg/home, accessed 06.07.23) contains minimal information and the ‘upcoming conference’ page refers to a conference being held in 2015. When checked again in June 2024, the website appeared to no longer exist.

In 2018, the Egyptian Association for Animal Research Advancement (EAARA) organised the first international course in ‘laboratory animal science’, based on one by the Federation of European Laboratory Animal Science Associations. Prior to this, it was not common for laboratory workers to receive formal training in the handling or husbandry of animals in their care (Hosney, et al., 2021).

There are several ‘laboratory animal science’ organisations in Africa. However, based on their website and/or social media posts, some appear to be far less active than others.

- South African Association for Laboratory Animal Science (SAALAS) - established 1978
- Association Tunisienne des Sciences des Animaux de Laboratoire (ATSAL) - Tunisian Association for Laboratory Animal Science - established 2007
- Moroccan Association for Laboratory Animal Science (AMSAL) - established 2009
- Animal Care and Use in Research, Education and Training (ACURET) - incorporated in Nigeria, working across ‘developing’ countries, with focus on Africa - established 2014
- Algérienne des Sciences en Expérimentation Animale (AASEA) - Algerian Association for Experimental Science - established 2015
- Egyptian Association for Animal Research Advancement (EAARA) - established 2018

These various organisations came together in 2017 to form the Pan-African Network for Laboratory Animal Science and Ethics (PAN-LASE) to help develop education and training in ‘laboratory animal science’ and ethics across the continent and support the establishment of institutional Animal Ethics Committees (Mohr, et al., 2023b; Mohr, et al., 2023c).

It is clear from this section that international organisations promoting the continued use of animals in research and testing have for some time been organised in co-ordinating in several African

countries. Whilst this may be useful from a 3Rs perspective (replacement, reduction and refinement of animal use), raising awareness of a 'culture of care' and the 'humane treatment' of animals, there appears to be far less focus on the replacement of animal use than on reduction or refinement.

The authors of the latest 'Africa-centric' guidelines for example, state (Mohr, et al., 2023c): "The increased establishment of appropriately functioning animal ethics committees and robust ethical review procedures across Africa will enhance research quality and culture, strengthen societal awareness of animals as sentient beings, improve animal well-being, bolster standards of animal care and use, and contribute to sustainable socio-economic development."

Aiming to bring conditions in African countries 'in line' with the situation in, for example, the European Union, USA or Australia, could further entrench the use of animals rather than encourage researchers in Africa to move away from animal use and focus their resources on more biologically-relevant, non-animal, methods of research.

17 Legislation relating to the welfare of animals in laboratories in Africa

Legislation regarding the use of animals in research in Africa is so limited that the authors of the Africa chapter of the 2018 book *Laboratory Animals: Regulations and Recommendations for the Care and Use of Animals in Research* focussed on just Kenya, Tanzania and South Africa as they have produced the most comprehensive pieces of legislation (Hau, et al., 2018).

El-Aal (2014, p36) comments:
"Policies, legislative frameworks, and guidelines on the use of animals are all poorly developed in Africa. Most African countries have laws aimed at protecting the welfare of animals, but for some countries, the laws seem to cover the welfare of animals in general without specifically addressing animals used in research or teaching."

On this point, Hau, et al. (2018) added: "To regulate and legislate animal welfare on such a general level, as is commonplace in most African countries, will not suffice in protecting animals in research and education (Hau, et al., 2018).

The only African countries for which Hau, et al. (2018) found specific legislation concerning the welfare of animals used in research and education were: Kenya, Tanzania, the Seychelles, Zimbabwe and South Africa.

It appears that former British colonies in Africa that have introduced animal welfare legislation based it on Britain's Protection of Animals Act, which was introduced in 1911 (Hau, et al., 2018; Kimwele, Matheka and Ferdowsian, 2011). The British Act was largely replaced by the Animal Welfare Act 2006. Animal use in laboratories is excluded from the Animal Welfare Act as it is the subject of its own legislation, the Animals (Scientific Procedures) Act 1986.

Masiga and Munyua (2005) criticise the lack of policies and legal frameworks to support legislation and regulation on the issue: "To compound the situation, in countries such as Kenya and other former British colonies, the legal system criminalised animal abuse without any provisions for community awareness or education about animal welfare."

They further bemoan that institutions using animals in research "are governed by different statutes that protect them from the scrutiny of external parties (i.e. the institutions are only subject to reviews by internal animal welfare and ethics committees). Furthermore, the internal committees, which are often subservient to the directorate, do not have the capacity and/or authority to perform self-inspections or enforce regulations, which makes them essentially powerless" (Masiga and Munyua, 2005).

World Animal Protection (2020a) compiled a global Animal Protection Index in 2020, a ranking of 50 countries according to their legislation and policy commitments to protecting animals. The

publication includes nine countries in Africa and key findings related to animals used in scientific research are included below, along with other sources.

17.1 Countries

Algeria

There is no specific law protecting animals used in scientific research, but Article 58 of Law 88-08 of 1988 includes a general prohibition of committing 'bad treatments' towards animals. According to World Animal Protection (2020b), "Article 58 also states that the same prohibition applies in relation to animals used in biological, medical and scientific experiments, which experiments are required to be 'limited to cases of strict necessity'." Infringement of the provisions is punishable by fines and/or imprisonment.

In 2017, a draft law entitled 'Draft of the national charter for ethical use and welfare of animals in experimentation' was prepared by a working group of researchers, scientists and council members of the Association Algérienne des Sciences en Expérimentation Animale (Benmouloud, et al., 2020).

We have been unable to confirm whether this charter has been implemented.

Egypt

Egypt was the first country in the Middle East region to implement animal welfare regulations, although this is not specific to animal use in research. Of the two official decrees of the Egyptian Ministry of Agriculture relating to animal welfare (introduced in 1967), one criminalises the inhumane treatment of animals as a whole, while the other deals with animal slaughter. In addition, the 2014 Egyptian Constitution guarantees the humane treatment of animals (Hosney, et al., 2021).

World Animal Protection (2020c), in its analysis of animal welfare protection in Egypt states: "There is no policy or legislation related specifically to the use of animals in scientific research" and "no evidence was found demonstrating government interest or engagement in this issue. The Government is encouraged to address the protection of animals used in research."

Ethiopia

World Animal Protection (2020e), in its analysis of animal welfare protection in Ethiopia states: "No legislation has been found specifically relating to animals used for scientific research" and "There are no guidelines on animals used in scientific research for this country, including educational, cosmetic or other forms of surgical or invasive manipulation. It appears that there has been no attempt made to regulate the use of animals in research, falling behind international trends and animal welfare standards. None of the Three Rs principles – Replacement, Reduction, Refinement – are enshrined in legislation. There is also no restriction on animal testing for cosmetic products. Furthermore, there is no indication or evidence of existing financial or human resource allocated to develop policy and legislation relevant to this indicator."

Kenya

Enforcement of the Prevention of Cruelty to Animal Act (1962, revised in 1983) has been largely ineffective according to Kimwele, Matheka and Ferdowsian (2011):

- there are no regulations that require monitoring of animal breeding facilities in Kenya, as this is not covered in the Prevention of Cruelty to Animals Act
- there is an unenforced requirement that animal experiments must be conducted under anaesthesia, with undefined exemptions
- there are no requirements for protocol review by an ethics committee

In 2019, a new bill, the Animal Welfare and Protection Bill, was drafted to replace the existing Prevention of Cruelty to Animal Act that dates back to 1962 (Ngotho, 2022). The aim of the new legislation is to "have more enforceable sections and align animal welfare protection to international standards and guidelines" (Ngotho, 2022).

According to Kenya-based NGO Africa Network for Animal Welfare (personal correspondence, 2023), the bill is still in discussion at the National Parliament and is yet to be enacted into law. ANAW told us that the bill is an improvement on the current Prevention of Cruelty Act and there is a need to push for accession of the bill for better enforcement of the set standards.

Responding to our questionnaire, a Kenyan NGO commented:
"Policies, legislative frameworks and guidelines on the use of animals are all poorly developed in Kenya. The Prevention of Cruelty to Animals Act (CAP 360) requires researchers to obtain a permit to conduct research from the minister for livestock development, for which justification must be made to include one of the following aims: (a) advancement of human and animal health, (b) discovery of new scientific knowledge, or (c) testing of an earlier discovery. There is also an unenforced requirement that animal experiments must be conducted under anaesthesia, with undefined exemptions. There are no requirements for protocol review by an ethics committee. Finally, this Act has no enforcement mechanism."

Mauritius

The Mauritius Animal Welfare Act of 2013 requires anyone conducting animal experiments to obtain a licence (Parliament of Mauritius, 2013), "although the conditions of ethical review and required standards are not clearly defined" (Mohr et al., 2016). The Act was strengthened in 2022, increasing penalties for cruelty (Le Mauricien, 2023).

The Act also makes provision for inspection of animal facilities (Mohr et al., 2016).

There is a growing biotechnology and life sciences sector on the island and it is a major supplier of primates to laboratories worldwide - see section 12.1 for more details.

One Voice, a French NGO that conducted an undercover investigation into the capture and trade in primates on Mauritius for the animal testing industry, claims that "Some situations filmed by our investigators in 2023 at Noveprim [one of seven primate 'farms' on the island] directly contradict this legislative text [The Mauritius Animal Welfare Act]" (One Voice, 2023a).

Morocco

There is no policy or legislation relating specifically to the use of animals in scientific research (World Animal Protection, 2020h).

However, a draft animal welfare law titled Projet de Loi 122-2 was produced in 2013, where Article 14 concerns maltreatment and Article 15 addresses experiments on animals (Hau, et al., 2018).

Moroccan NGO Association Le Phénix Pour La Protection Animale et de l'Environnement informed us that, ten years on, the law has not yet been implemented (personal correspondence, 2023).

Niger

According to World Animal Protection (2020f):

Article 3 of Law number 2004-048 provides that 'the mistreatment of animals, whether done publicly or not, is forbidden', but this Article appears as part of a chapter titled 'Domestic Animals', and the associated enforcement measures (Articles 100 and 101) are expressly

restricted to domestic animals, therefore it appears that this provision does not apply to any non-domestic animals which are used for scientific research.

“Article 5 of Law number 2004-048 states that ‘experimentation on animals must be done according to the Regulations in place’. However, it does not appear that further regulations on animals used in experimentation have been made, and it is not clear whether the intention is for such regulations to contain any welfare considerations.”

World Animal Protection continues:
“The lack of secondary policy or legislation renders Article 5 of Law number 2004-048 ineffective for making the welfare of this category of animals a priority for animal research practitioners. There appear to be no additional regulations in place. Until measures are in place to ensure that the use of animals in experimentation is highly regulated, animals will suffer when used for experiments. It is regrettable that none of the Three Rs principles – Replacement, Reduction, Refinement – are enshrined in legislation.”

Nigeria

World Animal Protection (2020g) state:

“Section 495 of the Criminal Code (1990) applies to all domestic and captive animals, including birds, fish and reptiles, and prohibits deliberate causing of suffering to animals, and suffering through failure to act. The existing legislation does not contain any specific mandates on the use of animals for education and scientific research.”

“The reference to ‘unnecessary suffering’ may provide the ability for those carrying out some research procedures to argue that they are necessary. It would be useful to have detailed rules and guidelines on the use of animals in scientific research. […] There are ethics committees at some Nigerian Universities.”

“Although the provisions […] give some limited protection to animals used in experimentation from certain welfare concerns associated with scientific research, there are no explicit guidelines on animals used in scientific research in this country.”

The “Government has made an attempt to regulate the use of animals in research, by inaugurating the maiden edition of the animal care and use research ethics committee in one of the leading Nigerian Universities. Other universities have since established their own ethics committee for use of animals in research.”

South Africa

“In South Africa, there is currently no specific legislation governing the use of animals for scientific purposes and as such, research animal facility management must be mindful of other legislation that have an impact on animal welfare […]” (Chipangura et al., 2021).

According to World Animal Protection (2020i):

- The anti-cruelty provisions of Section 2(1) of the Animal Protection Act 1962 apply to animals used in scientific research.
- The National Health Act of 2004 states that all animal research that could impact on human health, requires the ethical approval from a research ethics committee in South Africa that is registered with the National Health Research Ethics Council.
- The South African Medical Research Council first published guidelines on ethical considerations for the use of animals in research in 1979.

- Before being carried out, all proposals of experiments using animals must be submitted to an Animal Ethics Committee (AEC) and obtain its written approval. These Committees have "no power to prevent animal experiments and there is no enforcement of its recommendations. […] the committee can propose amendments, but these are not legally binding and adherence to the recommendations is voluntary."

- No formal reporting requirements exist for collecting data on national statistics for animal experiments in South Africa.

- The South African National Standard for the Care and Use of Animals for Scientific Purposes "encompasses all aspects of the care and use of animals for medicine, biology, agriculture, veterinary and other animal science as well as industry and teaching and includes all sentient vertebrate animals, eggs, foetuses and embryos and higher invertebrates such as cephalopods and decapods. The purpose of this standard is for scientific experiments using animals to abide by the 3Rs principles of Replacement, Reduction, Refinement". However, this is only voluntary and cannot be legally enforced.

There is a variety of legislation in South Africa relating to animal testing. The Medicines and Related Substances Act No. 101 of 1965 and the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act No. 36 of 1947 (Act 36 of 1947) require testing of products to be conducted on animals before the product can be sold (NSPCA, 2023). The Genetically Modified Organisms Act, No. 15 of 1997 addresses genetically altered animals (Hau, et al., 2018).

There are three organisations in South Africa that cover the issue of animal research and testing:

The South African NSPCA Animal Ethics Unit was established in 2001 and promotes the 3Rs, serves on institutional Animal Ethics Committees, performs welfare inspections of animal labs and promotes the use of 'alternatives' (non-animal methods of research (NSPCA, 2023; Mohr et al., 2016).

Beauty Without Cruelty South Africa: Established in 1975, BWC is the only organisation focussed on animal research and specifically cosmetics testing. It has been producing the 'Humane Guide' to non-animal-tested cosmetics and toiletries since 2017 (www.humaneguide.co.za) and it also supported the Bill to ban cosmetics animal testing in South Africa (officially initiated in 2017) and presented to parliament (personal correspondence, 2023).

Ban Animal Trading launched in 2014 with a focus on the pet trade and now have "active animal rights campaigns spanning all the industries that abuse and exploit animals", including the use of animals in research (Ban Animal Trading, 2023).

17.1.1 Bill to ban cosmetics testing on animals in South Africa

In 2020, a Member of the South African Parliament proposed amending two Acts - the Animal Protection Act and the Foodstuffs, Cosmetics and Disinfectants Act – to make animal testing of cosmetics illegal (Chemical Watch, 2020).

According to the NSPCA (2023):
"There is no legal requirement that cosmetics be tested on animals in South Africa. Although we are not aware of any companies in South Africa that test cosmetic products on animals, some companies and/or franchises are selling products tested on animals in other countries."

The Animals Protection Amendment Bill was introduced to the National Assembly in 2022 with the sole intention "to amend two Acts with the intention to prohibit the sale and manufacturing of cosmetics that were tested on an animal in the Republic [of South Africa] and to criminalise the testing of cosmetics on animals" (South African Government, 2021).

In June 2023, the government's Portfolio Committee on Agricultural, Land Reform and Rural Development claimed "there is no need for the Bill." It noted that cosmetics testing on animals does not take place in South Africa and that there would be an impact on imported cosmetics or ingredients as most ingredients used in the manufacturing of cosmetics in the country are

imported. It further claimed that “the Bill may not provide a significant benefit to the country but a negative impact on employment in the local cosmetics industry and its development and international trade” (South African Government, 2023).

The Committee highlighted “the need for a holistic approach to animal welfare instead of piecemeal amendments to an outdated piece of legislation”, basically kicking the issue into the long grass.

Tanzania

According to World Animal Protection (2020d):

“Domestic animals used for scientific research do fall within the scope of the Animal Welfare Act (2008), and the definition of animal in the Act extends to invertebrates as well as to vertebrates. Section 59(1) of the Animal Welfare Act (2008) creates cruelty offences which apply to this category of animals. These include cruelly ill-treating, torturing, infuriating or terrifying an animal; without any reasonable cause or excuse administering a poisonous or injurious drug or substance to an animal; and subjecting an animal to any operation which is performed without due care and humanity.

“The Act also contains further provisions specifically addressing issues related to animals used for scientific research, including on genetic manipulation. The […] Act explicitly includes the 3Rs Principles – Reduction, Refinement, Replacement - as one of the fundamental principles of the Act. Experiments using animals for experimental or other scientific purpose can only be done under permit from the Director (section 40). Permits will be granted if the experiment is intended to benefit, either directly or indirectly, the health or nutrition of a human being or an animal and “any other purpose deemed to be of sufficient value” […] and if the practice in question does not adversely affect the welfare of the animal and is not in breach of ethical rules and standards prescribed by the Minister.

“Although animal experimentation is not prohibited, animal welfare considerations are in place in the decision-making process. Specific prohibitions apply to undertake experiments on animals for which there is a replacement or a lower severity alternative and of experiments for a purpose which does not justify the distress caused. It is understood that research involving animals takes place under supervision of an Animal Welfare Council. However, this stipulation is not included in the Animal Welfare Act (2008).

“Whilst the government has enacted legislation, it appears that many institutions have yet to establish oversight committees and that in institutions with guidelines and policies, there are reported to be no responsible committees or units to directly oversee if and how these guidelines and policies are enforced. Implementation and enforcement of the legislation therefore appears problematic presenting a barrier to improving animal welfare. It may be that there are resource constraints providing further challenges.”

Regarding enforcement of the Act, World Animal Protection reports:
- contravention of the prohibitions in section 59(1) is punishable by imprisonment for up to one month or a fine up to 100,000 shillings
- section 43(1)(c) of the Act provides that permits for experiments can be revoked where the holder does not comply with the conditions of the permit.
- Other than this, there do not appear to be enforcement mechanisms for the other sections of the Act specifically relating to animal experiments

Under the Tanzanian Animal Welfare Act, a special permit is also required for creating genetically altered animals (Hau, et al., 2018).

The Animal Welfare Act was enacted in 2008 but five years later enforcement was said to remain a problem as no one is responsible for ensuring that the Act is implemented. The Act’s provisions are general and not specific to the use of animals in research. Seth and Saguti (2013) have called

for ethics committees to be established and for the government to impose heavy fines and penalties to those who violate the law.

Tunisia

A respondent to our questionnaire commented that Tunisia has enacted Law No. 94-43 (1994), which includes provisions related to experimental research on animals and aims at ensuring their protection during scientific procedures.

Table 5: Legislation on animal research in African countries
NB: No country in Africa has legislation specific to the use of animals in research

Country	Legislation relevant to animal research	Future legislation planned
Algeria	Under Article 58 of Law 88-08 of 1988 the general prohibition of committing 'bad treatments' towards animals also applies to applies to animals used in biological, medical and scientific experiments; experiments are required to be 'limited to cases of strict necessity'	2017 - 'Draft of the national charter for ethical use and welfare of animals in experimentation' was prepared but we have been unable to confirm whether it been implemented
Kenya	Prevention of Cruelty to Animals Act (1962, revised in 1983) requires a permit to conduct animal research. Enforcement problems widely reported	2019 - Animal Welfare and Protection Bill drafted. Still in discussion at the National Parliament and not yet enacted into law
Mauritius	Mauritius Animal Welfare Act of 2013 requires anyone conducting animal experiments to obtain a licence; also makes provision for inspection of animal facilities. "Conditions of ethical review and required standards are not clearly defined" (Mohr et al., 2016)	
Morocco		2013 - draft animal welfare law titled Projet de Loi 122-2 includes sections on experiments on animals. A decade on, the law has not yet been implemented
Niger	Article 5 of Law number 2004-048 states that 'experimentation on animals must be done according to the Regulations in place'. "However, it does not appear that further regulations […] have been made, and it is not clear whether the intention is for such regulations to contain any welfare considerations." (World Animal Protection, 2020f)	
Nigeria	Section 495 of the Criminal Code (1990) prohibits deliberate causing of suffering to animals but there are no explicit guidelines on animals used in research	

South Africa	Several varied laws also relate to animal research, including Animal Protection Act 1962 and National Health Act of 2004, but no specific legislation regarding animal research	2022 - Animals Protection Amendment Bill was introduced with the intention to prohibit the sale and manufacturing of cosmetics that were tested on an animals but appears stalled
Tanzania	Animal Welfare Act (2008) - permits required to conduct animal research; 3Rs are explicitly addressed; special permit required for creating genetically altered animals. However, oversight and enforcement appears to be a problem	
Tunisia	Law No. 94-43 (1994), includes provisions related to animal research	

As the examples above show, no country in Africa has implemented legislation specifically relating to animal use in scientific research. In the eight countries where we found general animal welfare legislation which does provide some provisions around animal research (e.g. that permits are required), there are reported problems with oversight and enforcement in at least six. “All efforts to regulate the welfare of research animals become to a large extent meaningless if there is no authority to enforce regulations”, according to Hau, et al. (2018).

No country in Africa has banned animal testing for cosmetics (Humane Society International, 2023), with only South Africa proposing, but so far not implementing, it (see section 17.1).

We are aware of four countries in which some attempts have been made to update legislation that would also impact on animal research, but in each case none of these have yet been implemented. Only one of these specifically relates to animal research - the South African bill to end animal testing of cosmetics.

18 Challenges, opportunities and moving forward

As this study shows, there is little activity highlighting the use of animals in research, or scientific endeavours to replace animal use, across the continent of Africa. There are numerous challenges in trying to improve this situation. Similarly there is very low awareness of some basic principles which are better known elsewhere. These include the ‘3Rs’ (replacement, refinement, reduction of animal use), with notable exceptions such as their inclusion in Tanzania’s Animal Welfare Act (see section 17). As described above, such inclusion in legislation may still fall short of appropriate enforcement and oversight.

There are 54 countries on the continent, with differing languages, cultures, histories and attitudes towards animals. A different approach is required for each country.

In some countries, target audiences (whether they be the general population, scientists, academic institutions or politicians) face many challenges on a personal and professional level which will impact on the possibilities to engage them in the issue. These include socio-economic issues as well as political instability in some, but not all, countries. However, there are animal welfare organisations in most countries and they are already conducting public outreach on several issues such as the welfare of farmed, working and companion animals.

Although there are no organisations working solely on the topic of animal research, there are some (notably in South Africa) that do highlight animal testing on a public and political level. In addition, an NGO in Tanzania is educating students on non-animal methods of replacing animal research and another in Kenya has done comprehensive work in the past (see case studies, section 10). From responses to our questionnaire, we learned about an NGO in Ghana doing advocacy work at veterinary colleges and universities and another in Zimbabwe working with the

local university to end the use of animals in lab testing, although we have no further details (see section 10).

Many animal welfare organisations already have a well-established programme for educational outreach, with the public, schools and university students (particularly veterinary students). For example, Meru Animal Welfare Organization provided practical and field training on the importance of animal welfare to 375 veterinary college students in Tanzania in 2022 (Meru Animal Welfare Organization, 2022). This type of outreach could provide the perfect opportunity to obtain data on the levels of animal use in research, education and testing in a particular country, as well as provide the vehicle for disseminating information on alternatives to animal research. Several organisations contacted as part of our questionnaire (section 9) expressed an interest in working to highlight the issue of animal testing in their country and/or to help promote non-animal methods. We have provided details of these organisations to InterNICHE, the International Network for Humane Education, an organisation supporting "fully humane education and training in medicine, veterinary medicine and biological science" (InterNICHE, 2024).

Our research has revealed an urgent need to identify and engage with scientific colleagues across Africa who are committed to working towards the replacement of animals in research, or the implementation of biologically-relevant or non-harmful use of animals (e.g. ethical veterinary research to the benefit of animal patients). Our discovery that a significant level of NAMs (non-animal methods of research) is conducted either before or in parallel to animal studies, shows that NAMs still need to be promoted as superior to, and a complete replacement of, animal research.

There are some additional challenges in this area. Section 16 describes the activities of international and regional organisations promoting animal use in laboratory research in Africa. In addition, others have encouraged the increase use of animals in particular fields; Maina, et al. (2021), for example, have called for greater use of genetically modifiable animals and "ultra-low-cost models" such as fruit flies and *Caenorhabditis elegans*, as well as zebrafish. They consider that "the promotion of the use of such model systems should be considered as part of strategies aimed to modernise Africa's research landscape."

Contrary to this, we consider this to be an opportunity to instead promote the use of innovative, more predictive scientific techniques that do not rely on animals that would truly 'modernise' research across Africa.

Much has been made of how Africa can, and is, developing in a way that 'leapfrogs' some of the older, more damaging, technologies used in the West. This leapfrogging would include the use of decentralised renewable energy generation systems instead of giant fossil-fuelled power plants (Moner-Girona, et al., 2021). It would also include the use of cellphones and mobile payment systems rather than landlines and banking networks (Kitimbo, 2021, p251).

We now know how poor animal-based models are for studying and regulating human health (for example, see Pound, 2023 and Pound, 2020). Given our observations of the use of animals in laboratories across much of Africa, this sector too looks ripe for another case of 'leapfrogging'. By focusing on the new molecular and digital technologies of the future, African economies could move much faster towards better science than in continents where they are entrenched.

Although several countries have implemented basic animal welfare legislation, some of which specifically includes animals used in research, this remains extremely limited in scope and depth.

We have found no evidence of political outreach outside of South Africa and Kenya and very few examples of training scientists and students in non-animal methods of research (or non-harmful methods, such as veterinary students working on patient animals).

In addition, there is a huge economic incentive to continue promoting animal-based research. Mauritius is one of the world's largest suppliers of monkeys for the research industry, exporting 14,640 long-tailed macaques in 2021 to laboratories globally (see section 12.1).

Several of the papers from African researchers discussed in this report provide useful insights into how those of us from outside the continent should approach this issue:

“There are cultural differences as to how different communities view animals and different species. Africa is a vast continent, often resource constrained, with significant distances between institutions, making travel to educational interventions challenging. Language complexities create challenges. IT constraints (e.g. access to computers, internet access or interrupted internet connectivity, instability of electricity supply networks, expense of data) hinder digital delivery and the use of, or access to, courses or digital resources offered in the high income countries is prohibitively expensive and beyond the means of the vast majority.” (Mohr, et al., 2023b).

As stated elsewhere in this report, several authors have cautioned about “honour[ing] the sovereignty of African nations” (Hau, et al., 2018), allowing each to “evolve its own standards based on its individual priorities” (Fakoya, 2012) and “engage with ethical issues in research that are locally relevant” (El-Aal, 2014, p18).

Marchant, et al. (2023) add:
“As animal welfare science expands globally, we must be cautious that it retains its relevance to cultural issues, and that a ‘euro-centric’ focus of animal welfare defined by its evolutionary origin is not imposed upon other cultures, in a form of neocolonialism. The answers to animal welfare issues within Africa, Asia and Latin America lie within these areas.
[…] It is imperative that internal and external stakeholders invest in animal welfare science inside these geographic areas, both in terms of people—animal welfare scientists, lecturers, auditors, etc.—and infrastructure, and that local and national animal welfare issues are primarily addressed by local and national expertise.”

Animal Advocacy Africa’s (2021) recommendation to animal protection campaigners include “when approaching governments, linking animal welfare with other imminent social issues such as climate change, public health, employment, and food security will be crucial to ensure animal welfare does not get de-prioritised”.

A similar approach was reported by Sinclair and Phillips (2018) in their interviews with international animal welfare organisations:
“One leader outlined novel thinking in regards to finding mutual benefits and collaborating with other charitable causes, outside animal welfare, to broaden the bigger picture impact of the animal welfare movements. Discussing an animal rescue project being conducted in developing areas of Africa, they stated, 'by partnering with people who may be concerned about water, they may be concerned about livelihoods, they may be concerned about gender issues, all of these things would help us find partners that are trying to achieve one or the other or usually multiply the sustainable development goals’”.

One animal welfare advocate also told Sinclair and Phillips (2018) that animal welfare initiatives could benefit governments through budget-saving and improved human health and disease control. This may be an area most relevant to supporting the replacement of animals in research, education, training and testing.

The African Union Commission’s *Animal Welfare Strategy for Africa* (African Union, 2017) has as its first ‘area of focus’ “establish the current status of animal welfare in Africa”, to understand “the status and dynamic evolution of animal welfare”; the research within this report may be able to contribute to that understanding.

There are two conferences that could provide opportunities to promote the replacement of animal use and to network with scientists, NGOs and other interested parties. The annual Africa Animal Welfare Conference has already been mentioned (see section 10.1, case study) and in 2023, the first Zimbabwe Animal Law Conference was held, with 150 attendees from five countries (African Animal Law, 2023).

The ‘actions and way forward’ set out by ANAW (Africa Network for Animal Welfare), based on results of their 2015 workshop in Kenya (Macharia Theuri, Ngonyo and Wangari Kagai, 2016), provide a suitable model for other organisations, institutions and governments to support the replacement of animals in research, education and training.

These include:

- Form an inter-institution working group that can steer the adoption of the alternatives
- Conduct an audit of the current curricula to determine which available alternatives can be adopted in the short term, mid-term and long term
- Advise on which alternatives can be developed locally versus which need to be procured
- Organise students' seminars and workshops to create demand for alternatives by making the students aware of alternatives
- Ensure engagement and involvement with the Kenya Veterinary Board since they influence curriculum reviews and guidelines
- Create a resource centre (physical and virtual) where alternatives can be developed, people can be trained, alternatives can be loaned, and an open library where people can access a database with a variety of alternatives
- Identify and document animal welfare issues affecting animals used in education and research in Kenyan institutions. This will inform further development of interventions that address […] development of alternatives specific to various animal welfare issues […]
- Document and share success stories on the adoption of alternatives in institutions
- Secure formal commitments from the institutions for the adoption of alternatives to harmful use of animals in education and training
- Make the workshop an annual event

In addition, Education has been chosen as the African Union Theme of the Year for 2024. Aims include addressing the shortage of teachers on the continent and advocating for the quality of education (Raafat, 2023). This may provide opportunities for NGOs and scientists to help improve education and training in the replacement of animal use.

Although we have not looked at this in-depth as it is outside the scope of this report, there may be useful lessons to be learned from India, a country in which NAMs have only started to be used in recent years (Parvatam, 2022).

The Centre for Predictive Human Model Systems has set out some of the roadblocks to progress (Parvatam, 2022), which are also likely to apply to at least some countries in Africa, such as: "lack of infrastructure, lack of a skilled pool of researchers trained in NAM methodologies, supply chain blocks, lack of awareness amongst academic and government bodies, […] and lack of communication between technology developers, regulatory bodies, and end-users."

The organisation has also made recommendations on developing human-relevant research (Parvatam, Bharadwaj and Poojary, 2021), which again may be useful for those wanting to create some progress in Africa. We recognise that it is impossible to make direct comparisons between 54 in Africa and one country on a different continent, so raise this purely as a potential line of interest.

19 Concluding remarks

The purpose of this project has been for Lush Prize to assess the use of animals in research across Africa and similarly, awareness and use of alternative approaches, whether for ethical or scientific reasons (or both). Our investigations have confirmed that some animal research appears to be carried out in every country in Africa. This is a great cause for concern for animal welfare, given that there is little or no legislative oversight or monitoring, and in the absence of official statistics.

However, there is some encouraging use of alternative approaches, albeit with the caveat that these are often performed alongside animal-based studies. Nonetheless, our findings have been useful as what we consider to be a foundation framework for further projects and ideas. This will also include a positive foundation for outreach and investigation and to engage with the African scientific and animal welfare communities, which align with the five main categories of the Lush Prize (Science, Training, Public Awareness, Lobbying and Young Researchers). It will also help people looking to promote improved use of ‘alternative’ approaches - and ultimately non-animal methods - to advance animal-free science in research, testing and education across the entire continent of Africa.

Appendix 1 - Author Biographies

Craig Redmond
Craig Redmond is a member of the team co-ordinating the Lush Prize, a global prize fund supporting the complete replacement of animal use in research and testing. This role includes research and communications. Craig has a background as a researcher and campaigner with animal protection NGOs, as well as a photojournalist and videographer specialising in social justice issues.

Rebecca Ram
Rebecca Ram is an independent scientific consultant to the Lush Prize. After working in clinical trials in the pharmaceutical industry, she became involved in scientific and policy work on the need for science to transition away from animal use, towards more human and environmentally relevant animal-free approaches in research, education and testing. Rebecca has consulted for a number of scientific and animal protection organisations during the last two decades.

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Appendix 2 - The 54 nations of Africa

Algeria	Equatorial Guinea	Mali	South Sudan
Angola	Eritrea	Mauritania	Sudan
Benin	Ethiopia	Mauritius	Swaziland
Botswana	Gabon	Morocco	Tanzania
Burkina Faso	Gambia	Mozambique	Togo
Burundi	Ghana	Namibia	Tunisia
Cameroon	Guinea	Niger	Uganda
Cape Verde	Guinea-Bissau	Nigeria	Zambia
Central African Republic	Côte d'Ivoire	Rwanda	Zimbabwe
Chad	Kenya	Sao Tome & Principe	
Comoros	Lesotho	Senegal	
Democratic Republic of the Congo	Liberia	Seychelles	
Republic of the Congo	Libya	Sierra Leone	
Djibouti	Madagascar	Somalia	
Egypt	Malawi	South Africa	

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