



# Marginalisation of Indigenous Knowledge in African Education: The Case of Rwandan Traditional Medicinal Treatments for Livestock

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## Abstract

This study explores the use of Indigenous medicinal knowledge by rural Rwandan livestock farmers to treat cattle and, at the same time, the degree to which that ethno-veterinary knowledge is reflected in the country's technical and vocational education and training (TVET) instruction. The research finds that while farmers use numerous Indigenous medicinal innovations to treat their animals—with most of the treatments drawing on locally occurring Indigenous herbs—there is a near-complete absence of this knowledge in the TVET Animal Health curriculum, which focuses only on Western-origin modern veterinary practices. This leaves Rwandan TVET graduates unprepared for optimal engagement with rural farmers who bring their cattle in for treatment at veterinary clinics, a step which farmers typically take only after having attempted cures through traditional means or when the treatment needed is available only via modern veterinary medicine.

## Keywords

livestock farming, cattle, animal health, Indigenous knowledge, ethno-veterinary medicine, medicinal herbs, technical and vocational education and training (TVET), Rwanda

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## I. Introduction

Repudiation of Africa's Indigenous knowledge systems was the paradigm that defined the core curricula introduced across Africa by missionaries and colonial, including apartheid, authorities. Often dismissed as fetish, retrogressive, superstitious, and of no scientific validity, Africa's Indigenous knowledge systems were mostly ridiculed by the colonial administrations. Many Africans bought into the racial superiority rhetoric promoted through colonial education and became convinced that Western knowledge was the only knowledge that all humanity should strive to master. There was little critical consciousness of the implications of the imposition of an alien episteme on local communities possessing their own sophisticated Indigenous knowledge systems.

The end of colonial rule in Sub-Saharan Africa did not generate a meaningful departure from reliance on Western knowledge systems, and the colonial state of affairs largely persists in many African countries in respect of the treatment of Indigenous knowledge in official, formal education curricula. Meanwhile, in other parts of the world—for example, in China, India, and Japan—there has been tremendous progress in the recognition of traditional knowledge in the fields of governance, medicine, architecture, social organisation, technology, agriculture, and conflict resolution.

In this study, we explore the current reality in Rwanda in respect of the use of Indigenous knowledge to treat ailments in cattle and, at the same time, the degree to which this ethno-veterinary medical knowledge is reflected in the country's technical and vocational education and training (TVET) instruction in Animal Health. As we outline in this article, the research identified a stark contrast between the large body of Indigenous knowledge that is used by Rwandan rural livestock farmers to treat their animals and the near-complete absence of representation of this knowledge in the country's TVET system.

## II. Research Design

Rwanda was judged to be an appropriate context for this case study because of its majority agrarian population and that population's centuries of Indigenous knowledge, particularly agricultural and ethno-veterinary knowledge held and curated by the traditional pastoral farmers. We conducted the study via qualitative means, with data collected in two forms: semi-structured interviews, guided by an interview protocol, with rural livestock farmers, TVET Animal Health teachers, and TVET graduates; and scrutiny of the curriculum content for the Rwandan TVET Animal Health qualifications (WDA, n.d.).

*Figure 1: Data Collection*



*Researcher with one of the experienced farmer interviewees, Musanze District*

*Photo source: Vedaste Ndungutse 2020*

Eighteen interviews were conducted, with:

- six experienced livestock farmers (three female, three male), aged between 62 and 84, who had been keeping livestock for between 17 and 50 years;
- four less-experienced, younger livestock farmers (all male), aged between 27 and 34, who had been keeping livestock for between five and 10 years;
- three TVET Animal Health teachers (males), with teaching experience of two, three, and nine years, respectively, and two of whom were involved in TVET Animal Health curriculum development; and
- five TVET Animal Health graduates (males) now working in rural communities (three as veterinary pharmacists, two as veterinary clinicians), all in their positions for between three and six years.

The interviews were conducted in two locations:

- Mpenge cell, Muhoza sector, Musanze District, Northern Province; and
- Remera cell, Kiyumba sector, Muhanga District, Southern Province.

Purposive sampling was used to identify the farmers, TVET teachers, and TVET graduates interviewed in the two districts. The interview questionnaire was developed in English and translated into Kinyarwanda. The interviews were conducted in Kinyarwanda, and the responses were translated and transcribed into English for the data analysis. Each interview took about 30 minutes to complete.

### III. Research Context

#### A. Indigenous Knowledge, Education, Colonialism, and African Agriculture

Our definition of Indigenous knowledge takes account of elements of definitions of Indigenous knowledge and its synonyms or constructs (such as, notably, traditional knowledge and local knowledge) in law (WIPO IGC, 2019) and in the extant literature (Oguamanam, 2006; Kiggundu, 2007; Bruchac, 2014). We use the term to reference multiple, open-ended, and complex sites of lived experiences through which non-Western Indigenous peoples and local communities engage with phenomena by way of language, practices, innovations, and ways of life, including stewardship (and co-stewardship with other life and non-life forces) for sustainable living; ecological and environmental cohesion; and spiritual, cultural, social, and economic harmony.

The theoretical underpinnings of Indigenous knowledge systems in general, and the place of Indigenous knowledge in education curriculum development, are still evolving. However, if education is generally accepted as a process through which individuals are able to acquire knowledge for specific goals that will be beneficial to themselves and society, then for education to successfully fulfil its objectives in any locale, an acknowledgement and incorporation of the pre-existing knowledge of its host community in curricula is needed. In several classic works on education, Dewey is specific about the place of community in successful learning. For Dewey, one of the aims of learning should be to work with communities in inculcating their banks of knowledge into younger generations (Dewey, 1959).

#### B. Indigenous Knowledge and Education

In the 1962 book *The Structure of the Scientific Revolution*, Kuhn opines that reference to “knowledge” as “universal” is in fact a reference to Western scientific knowledge, which, in turn, calls into question all other forms of knowledge and assumes they are either irrelevant or subpar (Kuhn, 1962). The idea that knowledge generated in the West should be wholly embraced by other regions is instrumental in the West’s continued domination of the rest of the globe. Oguamanam (2006, p. 19) describes so-called Western culture “as a local tradition, which has been spread worldwide through intellectual colonization.”

For a curriculum to produce learners who are aware of the opportunities and challenges within their immediate environment, its contents must reflect the real life and lived experiences of learners. White (1983) notes that no curriculum, educational programme, or policy should be analysed outside of its ideological, political, or environmental foundations. Educational curricula are inherently and directly connected to societal dynamics and power, therefore, whether intentionally or inadvertently, more emphasis is often placed on some knowledge form or system of knowledge over others. What is included, highlighted, downplayed, or excluded will grant or deny power to a segment of the population (White, 1983). In *Pedagogy of the Oppressed*, Freire maintains that it is critical that curricula in any educational setting are representative of “situations familiar to the individuals whose thematics are being examined, so that they can easily recognize the situations (and thus their own relation to them)” (Freire, 1968, p. 107).

Educators who aim to produce learners who create innovations around Indigenous knowledge must focus attention on how their curriculum either affirms the knowledge forms, values, and ideals of the student’s cultural milieu or ignores, de-emphasises, and even ridicules it (McLaren, 2003). The real



challenge then lies in integrating locally generated content, instructional strategies, and techniques in the curriculum design (Trifonas, 2003).

### **C. Indigenous knowledge, Education, and Colonialism**

One of the functions of education is to ensure continuity from one generation to another. The ideals and traditions of a community that have served as a uniting and stabilising force should be conserved and handed over by one generation to the next, and this can be achieved only through the right kind of education. No generation should, as a result of the form of colonially imposed education it has received, lose touch with the investments and knowledge bank of prior generations. Van Niekerk (2004) makes a case for the contextualisation of all curricula in order to reflect societal dynamics. This calls for a re-assessment of curricula, especially in formerly colonised territories (Danmole, 2011). In the words of UNESCO, “there is an urgent need to enhance the intergenerational transmission of indigenous knowledge, as a complement to mainstream education” (UNESCO, n.d.). And UNESCO promotes efforts “to bring indigenous language and knowledge into school curricula and to move learning back into the community, thus reaffirming the status of elders as knowledge holders” (UNESCO, n.d.).

A revamping of curricula, however, does not necessarily mean that what is considered universal knowledge among humanity should not be included. Indeed, students should also be exposed to a form of universal curriculum that gives an idea of life outside of their own environment. The place-based pedagogy encompasses much more, however, by instilling in learners a sense of self-awareness (Danmole, 2011), pride, and confidence, which the supposedly “universal curriculum” lacks (Trifonas, 2003, p. 35). Rugg contends that a curriculum should be a collection of a “succession of experiences and enterprises” familiar to the learner, which aims to provide broad insights and delve into meanings, therefore equipping the learner to adequately face and skilfully manage real-life situations (Rugg, 1927, p. 8).

National education systems in most parts of Africa have their origins in colonialism. Curricula were copied verbatim from the education systems of colonial authorities and introduced to Africans, without thought being given to the Africans’ cultural practices, Indigenous epistemologies, ontologies, and pedagogies. In the few instances where Africa’s Indigenous knowledge found its way into colonial era curricula, it was often included in order to ridicule it, deride it, or cast it in a negative light, while holding up Western knowledge as the ideal. Empowerment, creativity, and innovation did not play a role in the design of academic programmes in colonial Africa (Freire, 1968; Nkhavilo, 2013; Owuor, 2007). For if those were considered, Africa’s epistemologies would have been at the forefront, since their aim is to build confidence in learners and a sense of respect for their environments and lived realities.

The colonial governments’ Victorian-era norms for male and female roles likewise influenced the structure of education in the colonised territories (Ezeanya-Esiobu, 2019). Despite the fact that across much of the continent, African women worked alongside their husbands, the colonisers established all-male schools and hired mostly men to work in government offices and establishments. For women, domestic management and training schools were established to orient them towards skills in, for example, “sewing, dressmaking, baking, cooking”, decoration, and general home and housekeeping skills (Oguamanam, 2019, p. 16).

The end of colonial rule did not result in significant changes in curricula across much of Sub-Saharan Africa, since post-colonial governments remained dependent on the colonial authorities for education funding. Beyond that, many educated Africans whose task it was to educate the younger generation were beholden to the West and looked derogatorily upon Indigenous knowledge (Msila, 2016). For the most part, Western-based education continued to thrive across Africa, decades after the end of colonial rule (Gumbo, 2016). In a few instances of deviations from this norm, such as in Kenya, the government recognised the need to incorporate Indigenous knowledge in education curricula. However, the government abandoned the idea due to the lack of manpower and technical know-how needed to adequately conceptualise and aggregate the Indigenous knowledge of the many ethnicities that make up that country (Owuor, 2007).

#### **D. African Agriculture**

Across Africa, pastoralists have for generations successfully employed Indigenous medicinal knowledge in rearing livestock. Such ethno-veterinary medical knowledge abounds on the continent, especially in rural areas. However, practitioners of this knowledge are scarcely recognised.

Much of the agricultural production in Africa happens at the smallholder level (Kamara et al., 2019). A report released by the Alliance for a Green Revolution (AGRA) in Africa concluded that smallholder farmers “will be vital to the continent’s long-awaited green revolution” (AGRA, 2019). In terms of sustainability and conservation, smallholder farmers use predominantly natural or biodegradable pesticides, which are less toxic to the body and the environment than the conventional pesticides used in industrial agriculture (Barucha, 2019). Studies have established that “many of these small farmers are increasingly using innovative ways of reducing greenhouse gas emissions and adapting to climate change” (Barucha, 2019).

Goal 2 of the UN Sustainable Development Goals (SDGs) is the eradication of hunger. To achieve that goal, the UN targets an increase, of no less than 200 percent, in agricultural productivity for smallholder farmers (UN, 2020). There is an expectation of increase by the same percentage in the income of vulnerable populations who engage in smallholder agriculture, such as women, pastoralists, and fishing communities. A commitment to working with smallholder farmers inevitably places Indigenous knowledge of agriculture at the core of discussions of the SDGs (IISD, 2020). In a report, *Realizing the Future We Want for All*, the UN System Task Team on the Post-2015 UN Development Agenda noted the significance of Indigenous knowledge in the sustainability discourse, by observing that “[t]raditional and indigenous knowledge, adaptation and coping strategies can be major assets for local response strategies” (UN, 2012, p. 28).

Indigenous knowledge of animal health is essentially an organic-friendly endeavour (Chander et al., 2011). Organic farming supports the use of local or native breeds since they are “less susceptible to stress and disease, and so the need for allopathic medicines and antibiotics is much lower.” Therefore, “indigenous technical knowledge, available in poorer and developing countries, may provide an effective substitute for veterinary care” (Kumar et al., 2006, quoted in Chander et al., 2011, p. 977). According to a 2008 UN report on a study that explored the relationship between organic agriculture and food security in Africa, the study findings “support the argument that organic agriculture can be more conducive to food security in Africa than most conventional production systems, and that it is more likely to be sustainable in the long term” (UNCTAD & UNEP, 2008, p. iii).



### **E. Rwandan Livestock Farming and Indigenous Treatments**

The place of livestock in Rwanda agriculture is self-evident in the designation of the supervising sector as the Ministry of Agriculture and Animal Resources (MINAGRI, 2000). The country's livestock sector contributes 16% of the country's GDP (Mazimpaka, 2017). Cattle are intertwined with Rwandan culture. The Inyambo breed was traditionally used in royal ceremonies. A cow signifies friendship, and it is an established practice to give a cow as a gesture of friendship and goodwill. Cows are also gifted as dowry, and can be offered as a sacrifice to the gods (Hirwa et al., 2017a). Due to the embeddedness of cows in Rwandan culture, their health and wellbeing is a robust aspect of Indigenous knowledge that is generationally transmitted from parents to children. Moreover, for the purpose of reducing poverty, the Rwandan Government has initiated the Girinka (One Cow per Poor Family) Programme, promoting the rearing of cattle to increase wealth and productivity (USAID Rwanda, 2016).

Cattle breeds reared in Rwanda can be divided into three categories: Indigenous, imported, and cross breeds. A study conducted in Nyagatare District, Eastern Province, reported that 67.03% of cattle in the district were Indigenous breeds, 28.37% were cross breeds, and 4.6% were imported breeds (Mazimpaka, 2017).

*Figure 2: Imported-Breed Cattle*



**Imported-breed cattle in Musanze District**

*Photo source: Vedaste Ndungutse 2020*

Due to low milk production by Indigenous breeds, imported breeds were introduced into the country. However, these imported breeds are very susceptible to disease, and thus the government encourages cross breeding between imported and local Indigenous breeds (Mazimpaka, 2017). The government also promotes the rearing of Indigenous breeds due to their resilience to disease (Hirwa et al., 2017a). Indigenous cattle also have better heat tolerance, and adapt to low quality food and limited quantity of feeds compared to exotic ones (Hirwa et al., 2017a). Indigenous breeds are also more resilient to tsetse flies, whose attack is often fatal for foreign breeds (Hirwa et al., 2017a; Mazimpaka, 2017).

In terms of feeding, 40% of cattle in Rwanda are fed via open grazing, and the rest are fed via semi-grazing, which is a hybrid between open grazing and zero-grazing (where all feeds are transported to pens to feed animals) (USAID Rwanda, 2016). The Rwandan Government encourages zero-grazing, due to a shortage of land and in order to prevent the land degradation caused by open grazing (USAID Rwanda, 2016). Research conducted in Nyagatare District reported 64.7% of animals grazing in non-fenced areas, 12% grazing in fenced land, and 23.3% being fed through zero-grazing (Mazimpaka, 2017).

**Figure 3: Feeding**



**A cow consuming a mix of medicinal herbs and regular feed in Musanze District**  
*Photo source: Vedaste Ndungutse 2020*

More than 600 Rwandan Indigenous plant species are used as herbs in cosmetics, agriculture, food and beverage production, traditional medicine, and construction (Rwanda Environment Management Authority, 2019). In the areas surrounding Buhanga Forest in the Northern Province—specifically in Bikara Cell, Nkotsi Sector, Musanze District—around 45 herbs belonging to 28 families have been identified as useful in Indigenous medicine (Runyambo et al., 2016). The Buhanga Forest study identified six plant species that are traditionally used in treating cattle diseases, while another three species were identified as being used for the traditional treatment of both cattle and human diseases (Runyambo et al., 2016). At the same time, veterinary doctors providing modern treatments are spread all over the country, and thus most livestock holders in Rwanda, if they have the resources to pay for the service, have ready access to a veterinary doctor to take care of their sick animals.

Traditionally, Rwanda's pastoralists prepare medicine in the form of juice by pounding or crushing plant parts with wood or stone. Water is then typically used to dilute the juice (Runyambo et al., 2016). In Rwanda's Indigenous veterinary medical practice, medicine is administered through oral application 84% of the time, 8% through external application on the skin, 5% through the ears, and

3% as an anal application, depending on the infected part of the animal and the type of disease (Runyambo et al., 2016).

The effectiveness of medicinal herbs is related to the chemical compounds they contain. Plants contain primary and secondary metabolites. Primary metabolites include both macro- and micro-nutrients produced by plants, which include carbohydrates, proteins, lipids, minerals, and vitamins. Plants contain another portion of metabolites known as secondary metabolites; they are produced for the purpose of protecting plants against different diseases and include compounds like tannins, phenols, and saponins (Hamburger & Hostettmann, 1991). These compounds have been confirmed to be active against microbes or parasites. They include alkaloids, flavonoids, tannins, quinones, terpenoids, and saponins (Njoroge & Bussmann, 2006).

In Rwanda's indigenous pharmacology, herbs with high amounts of tannins are known to have healing effects in cases of diarrhoea and contain anti-inflammatory and antioxidant properties. Tannins were reported to heal wounds and boost anti-microbial activities of medicinal herbs, while herbs containing saponins, phenols, and flavonoids are reported to possess antimicrobial activities, antifungal, anti-allergenic, antispasmodic, and anti-inflammatory properties (Waweru et al., 2017).

The Government of Rwanda recognises the value of Indigenous knowledge. There is public policy on traditional human medicine, and a forum of about 3,000 traditional healers operating all over the country with government-sponsored training (Rwanda Environment Management Authority, 2019). Rwanda has signed the Nagoya<sup>1</sup> and Swakopmund<sup>2</sup> Protocols and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) for the use and protection of indigenous knowledge, including farmers' practices (Rwanda Environment Management Authority, 2019).

## **F. Rwandan TVET Provision**

TVET was introduced in the Rwandan education system following a 2009 national audit that indicated a 60% shortage of skilled people in the country (Kiberu et al., 2009). The number of Vocational Training Centres (VTCs) grew from 61 in 2010 to 116 in 2012, resulting in a roughly 50% increase in TVET enrolment (Ministry of Education, 2013). In 2013, for every 10 students attending TVET schools, eight were from rural areas, compared to 2005, when there were only four rural-origin students for every 10 TVET learners (Ministry of Education, 2013).

The policy establishing TVET is aligned with Rwanda's Science, Technology, and Innovation (STI) Policy, National Employment Policy, development of nation's economic sector, district strategies, and other related policies (Ministry of Education, 2008a). The training offered under TVET aims to respond to the labour market in the country and in the East African region (Ministry of Education, 2008b). In 2009, the government established a public institution, the Workforce Development Authority (WDA), responsible for coordinating TVET via the identification of subjects to be taught; the development of curricula; the training of teachers; the provision of examinations; and the certification, accreditation, regulation, and inspection of TVET institutions (Ministry of Education, 2013).

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<sup>1</sup> Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity (Nagoya Protocol).

<sup>2</sup> Swakopmund Protocol on the Protection of Traditional Knowledge and Expressions of Folklore.

In its curriculum development work, the WDA largely considers the labour market needs of the private sector and potential employers, who are included in curriculum development meetings. Emphasis is placed on hands-on-skills, with more hours allocated to practical activities than to theoretical learning. In order to be part of the TVET curriculum development process, a TVET teacher must possess knowledge and skills in the subject matter being developed; knowledge and skills in information and communication technologies (ICTs); and a minimum of three years of teaching experience built around learner-centred, competence-based curricula.

## IV. Findings on Livestock Farmers' Use of Indigenous Treatments

Of the six experienced livestock farmers interviewed, most stated that they had learned livestock farming from their parents, with one farmer specifying that he had also acquired knowledge from other livestock farmers. All four of the younger, less-experienced livestock farmers interviewed said they had learned farming from parents and grandparents.

*Figure 4: Interview with Farmer*



**Researcher interviews experienced farmer in Musanze District**

*Photo source: Vedaste Ntunguste 2020*

When asked if they are familiar with, and have used, traditional cures to treat sick animals, all six of the experienced farmers, and three of the four less-experienced farmers said they have done so, and gave numerous examples (Table 1). The experienced farmers were found to have far more knowledge of the Indigenous treatments than the younger farmers. One young farmer, who stated that he has some appreciable knowledge of Indigenous animal medicine, said that he occasionally goes to traditional healers when his cattle fall sick.



Table 1: Indigenous treatments of cattle, as identified by farmer interviewees

Ailment	Symptoms	Treatments, and medicinal substances used
<i>rutandara</i> , or <i>intandara</i>	<ul style="list-style-type: none"> <li>retention of fluids in the mouth of the cow</li> <li>increased temperature, unstable limbs, immobility, refusal to graze</li> </ul>	<ul style="list-style-type: none"> <li>A blood vessel located on the neck of the cow is cut and allowed to bleed (a process known as <i>irago</i> in Kinyarwanda).</li> <li>Leaves of traditional <i>Colocasia</i> are pounded, mixed with water, and administered orally to the animal.</li> <li>The <i>Tetradenia riparia</i> (<i>Umuravumba</i>) plant is administered orally (dosage depends on the animal's age).</li> <li>The <i>Umusange</i> (<i>Entada abyssinica</i>) plant is mixed with a <i>Colocasia</i> plant called <i>Iteke</i> and administered orally.</li> <li>The animal is beaten using <i>Acanthus pubescens</i> (<i>Amatovu</i>), a plant with thorns (a remedy known to be especially effective and allowing for speedy recovery of the sick animal).</li> </ul>
<i>Ikibagarira</i> , or <i>inka igira umuriro mwinshi</i>	<ul style="list-style-type: none"> <li>fever caused by ticks</li> </ul>	<ul style="list-style-type: none"> <li>The <i>Ikibomwe</i> plant is administered orally to the animal (a remedy said to not be very effective, with many cows dying even after receiving the treatment).</li> <li>A hot knife is used to burn the Ganglion cysts, caused by fever, under the ears.</li> </ul>
<i>gufuma</i>	<ul style="list-style-type: none"> <li>retained placenta: inability to release placenta and afterbirth from the uterus after delivery</li> </ul>	<p>One of these two treatments is implemented to induce release if a cow's placenta and afterbirth are not released within six hours of giving birth (if not treated, a retained placenta can cause complications, include heavy bleeding and infection, which can be terminal):</p> <ul style="list-style-type: none"> <li>The <i>Phyllanthus nummulariifolius</i> (<i>Umuhankuba</i>) or <i>Umuhoko</i> (<i>Phytolacca dodecandra</i>) plant is pounded, mixed with water, and administered orally.</li> <li>The <i>Umuyobora</i> and <i>Umubogora</i> herbs are mixed.</li> </ul> <p>As a preventive measure, animals are orally given the pounded leaves of <i>Umuhoko</i> or <i>Ikawa</i> mixed in water, minutes after delivery, in order to speed up the process of placenta and afterbirth discharge.</p>
<i>Akanyaga</i>	<ul style="list-style-type: none"> <li>general body pain, lethargy, loss of hair on skin</li> </ul>	<ul style="list-style-type: none"> <li>Approximately 3-4 litres of blood are bled from the cow via the process known as <i>irago</i> (see treatment of <i>rutandara</i> above). Then animal hair is used to stop the bleeding, while <i>umwumano</i> (milk from a cow in gestation) is poured over the hair to bind the hair to the incision.</li> <li>Another treatment, mentioned by a single farmer among the experienced male farmers, is to collect human bodily fluids, after sexual intercourse, on a towel, and then rub the fluids on the body of the animal (in order to prevent the disease from progressing to the hair-loss stage).</li> </ul>
<i>Uruhiga</i> or <i>amashyuyo</i>	<ul style="list-style-type: none"> <li>fever, causing disruption of feeding and loss of weight</li> </ul>	<ul style="list-style-type: none"> <li>The cow is bled via the <i>irago</i> process (see treatment of <i>rutandara</i> above), and then taken to a place where there is plentiful feed and encouraged to eat to its satisfaction.</li> </ul>
<i>Ibyashi</i>	<ul style="list-style-type: none"> <li>fungal infection between the hooves</li> </ul>	<ul style="list-style-type: none"> <li>Faecal matter of a hen in incubation (<i>amatoto y'inkoko irariye</i>) is rubbed on the infected area.</li> <li>Cow butter (<i>amavutay'inka</i>) is heated and melted on the infected area.</li> </ul>

		<ul style="list-style-type: none"> <li>Black “charcoal” from a disused radio battery is rubbed on the infected area.</li> </ul>
<i>Ifumbi</i>	<ul style="list-style-type: none"> <li>mastitis: pus and blood coming from teats</li> </ul>	<ul style="list-style-type: none"> <li>The herbs <i>Mitragyne rubrostipulosa</i> (<i>Umuzibaziba</i>), <i>Umunkamba</i>, <i>Umukuzanyana</i>, <i>Umutanga</i>, and <i>n’ imizi y’umutarishonga</i> are administered orally.</li> </ul>
<i>Ubutaka</i>	<ul style="list-style-type: none"> <li>fever, difficulty in breathing</li> </ul>	<ul style="list-style-type: none"> <li>The <i>Umusange</i> and <i>Magaru</i> herbs, and a banana species called <i>Intokatoki</i>, are mixed together and administered orally. (During the treatment, the cow is not provided with bedding, i.e., is not given organic materials such as straw and saw dust usually put in the pen to support the animal when at rest.)</li> </ul>
<i>impiswi</i>	<ul style="list-style-type: none"> <li>diarrhoea</li> </ul>	<ul style="list-style-type: none"> <li>The <i>Umuhati</i>, <i>Umuzingangore</i> and <i>Idoma</i> herbs (and sometimes also the <i>Umunaba</i> plant) are administered orally.</li> <li><i>Englerina schubotziana/solanaceae/solanum sp</i> (<i>Umutobotobo utagiraamahwa</i>) (without the thorns) is administered orally.</li> </ul>
<i>Amata acika</i>	<ul style="list-style-type: none"> <li>production of sedimented, non-homogenised milk</li> </ul>	<ul style="list-style-type: none"> <li>The <i>Magaru</i>, <i>Umureterezaho</i>, <i>Umuzigangore</i> herbs, and <i>Englerinaschubotziana/solanaceae/solanum sp</i> (<i>Umutobotobo utagiraamahwa</i>) (without the thorns) are administered orally.</li> </ul>
<i>Inkubasi</i>	<ul style="list-style-type: none"> <li>increased temperature in feet and legs, with liquids dripping from the mouth and nose (usually occurs in early months of gestation)</li> </ul>	<ul style="list-style-type: none"> <li><i>Umusange</i> herbs are administered orally.</li> </ul>
<i>Umuzimire</i>	<ul style="list-style-type: none"> <li>blood in faeces</li> </ul>	<ul style="list-style-type: none"> <li><i>Umuzigangore</i> herbs are administered orally.</li> </ul>

When implementing Indigenous treatment (as outlined in Table 1) of *ubutaka* (anthrax), where death can be rapid, the farmers said they usually employ the services of the Abaribata (a minority ethnic group) to provide the preventive medicine to animals.

All the farmers, both experienced and less-experienced, unanimously agreed that Indigenous treatments are still effective for animal disease treatment. They were of the view that some Indigenous methods are effective for ailments that defy modern veterinary treatment. However, according to one respondent farmer, the frequency of use of these Indigenous treatment methods is declining, due in part to a government mandate that requires a veterinary doctor to be called whenever a cow is sick.

One farmer indicated that he is no longer using Indigenous methods in treating his animals because, in his experience, the necessary herbs have become difficult to find. Another livestock farmer, who presently keeps only imported cows (also called “exotic” cows by farmers), claimed that Indigenous medicine tends to be practised mostly on Indigenous cows, especially in rural areas. However, for diseases such as *rutandara* and *akanyaga*, he confirmed that he still uses traditional methods for his imported cows.



Figure 5: Mastitis-Free Cow



Researcher milks a cow that has been cured of *ifumbi* (mastitis) with medicinal herbs, Musanze District

Photo source: Vedaste Ndungutse 2020

All the farmers were of the view that remedies based on Indigenous knowledge are much more cost-effective than their Western counterparts. For many farmers, despite the availability of government subsidies and generous livestock insurance programmes, they still find the cost of treatment for their cattle to be out of reach. According to a respondent: “Modern medicine is very expensive. [The] traditional one is cheaper, and with 2,000 Rwandan francs [approx. USD2.20], an animal can be treated with Indigenous methods since plants used are obtained locally.” For another respondent: “Modern medicine is very effective. Animals are treated after consultation to be sure of the disease to be treated. However, it is very expensive. Indigenous medicine is cheaper. In some cases, you offer one bottle of local banana wine to a traditional healer after he has healed the animal.”

When an animal develops a suspected feeding disorder, or in cases of the outright outbreak of disease, veterinary doctors are typically called to inspect the animal, make a diagnosis, and commence treatment. However, some of the interviewed farmers reported that when their animals fall sick, they commence treatment using Indigenous treatment methods. In that case, the attention of a veterinary doctor is sought only where no known traditional cure exists for the disease.

The farmers noted that modern veterinary medicine is very good at diagnoses and in the precise prescription of a remedy to treat identified disease. They said that Rwandan traditional veterinary medicine lacks this kind of diagnostic precision. The respondents also identified some modern veterinary medicinal remedies or practices for which there are no Indigenous alternatives or equivalents, including the procedures of artificial insemination and caesarean section. Thus, Indigenous knowledge of animal treatments is unable to address many situations where modern veterinary medicine appears to provide efficient treatment. In the words of one interviewee, “without modern medicine, all cows may die; modern medicine is very efficient.”

Figure 6: Grazing



Cattle graze on a mix of grass and herbs in Musanze District

Photo source: Vedaste Ndungutse 2020

One of the interviewees noted that fewer and fewer farmers are using Indigenous treatments—in part because of the many new diseases that have come to Rwanda with the introduction of foreign cow breeds. Another farmer noted that modern medicine is especially effective for foreign-breed cows who are susceptible to several diseases to which Indigenous breeds are resistant. Indigenous medicine cannot be used for foreign-breed cows, which can be treated only with modern medicine. However, local breeds can be treated with both indigenous and modern medicine.

All respondent farmers, both experienced and less-experienced, were generally of the view that as far as efficacy is concerned, modern medicine is superior to Indigenous medicine. According to the respondents, with Indigenous treatments, several different herbs are sometimes given to the animals without knowing exactly which one is most effective. Furthermore, with Indigenous medicine, there can sometimes be a poor diagnosis of diseases. Additionally, some farmers pointed out that the dosage regimes and treatment strategies for Indigenous treatments are not precise. This lack of precision may result in animal fatality. On the other hand, the farmers said they have not encountered any side-effects in animals treated with modern medicine.

One farmer was the view that Indigenous and Western medicines are complementary, although he added that modern medicine is superior—as evidenced by the fact that Indigenous treatments are used first and when they fail, modern treatments are a last resort. Another farmer pointed out that some diseases, such as *akanyaga* and *rutandara*, are best treated with Indigenous medicine, while others, such as *ikibagarira*, are more efficiently treated with modern medicine: “Traditionally, we did not know the cause of *ikibagarira*. It was in 1980 that we were trained on its cause, where they told us that it is caused by ticks. Since then, modern medicine has been used mostly in the treatment of *ikibagarira* very well.”

## V. Findings on TVET Animal Health instruction

### A. Curriculum Content

In the curriculum documents for the Rwanda's TVET Animal Health certificate and diploma programmes, there is no Rwandan Indigenous knowledge content (WDA, n.d.). The curricula could easily be applicable to any European or North American country. And although Kinyarwanda is the language most easily understood by many TVET students and teachers, none of the curriculum content is in Kinyarwanda. There is no indication that students serviced by the curriculum are going to apply their trades in locations where prior knowledge and practice of animal health has existed for centuries. There is, in fact, no mention of the Rwandan context in the curriculum.

### B. Farmers' Views

Most of the farmers interviewed were in favour of the idea of incorporating Indigenous knowledge in the TVET Animal Health curriculum. They believed that the TVET courses should teach students how to use local herbs in treating animal diseases, and how to effectively combine them with modern veterinary medicine. Interviewees pointed out that some cattle ailments are treated better with Indigenous medicine than with modern medicine, or are treated best with a combination of traditional and modern procedures. They were also of the view that including Indigenous knowledge in the curriculum would allow useful animal health Indigenous knowledge to spread all over the country, rather than being, in some cases, localised within districts.

Only two farmers had opinions that diverged strongly from the others. One believed that including Indigenous knowledge in TVET curriculum should be for the purpose of cultural preservation only, and that students should be taught to conduct all treatments using modern medicine. The other was of the opinion that modern medicine had effectively replaced its Indigenous counterpart, and that, accordingly, teaching Indigenous knowledge at TVET schools would amount to teaching "backwardness". Thus, in his view, there is no need to include Indigenous knowledge in the TVET Animal Health curriculum.

### C. Graduates' Views

All five of the TVET graduates interviewed said they are aware of the value that traditional livestock farmers attach to Indigenous knowledge of animal health treatments. They also confirmed that they were not taught any form of Indigenous animal health knowledge during their TVET studies.

Four of the five graduates interviewed did not consider the curriculum's exclusion of Indigenous knowledge to be problematic. According to one respondent, "it is not necessary to add indigenous knowledge in TVET curriculum. We have veterinary doctors who are trained, and their knowledge is enough." For another respondent, "modern medicine is more trustable, and we advise livestock farmers to use it rather than [the] Indigenous one." In their view, such knowledge is only fit to be passed on orally from generation to generation, since it is "archaic" and was only used prior to the advent of modern veterinary medicine. One graduate expressed his conviction that, by every standard, modern veterinary medicine is superior to Indigenous medicine, and that that any contrary belief is still upheld only in some rural areas. According to him: "[These] few remote areas are behind in development. Therefore, the adoption of modern vet medicine is slow." Another graduate noted that, often, livestock farmers try to convince him that Indigenous knowledge is superior to modern knowledge in the treatment of certain diseases, but his response is always to advise them to rely on

modern medicine only. Another graduate was of the view that Indigenous treatments for animal health can have severe side-effects, especially on foreign breeds that do not tolerate traditional medicine, and can even lead to livestock death.

The one respondent with a differing perspective was of the view that Indigenous medicine is equally as important as modern medicine, because in many cases animals can be treated and healed through its application. Thus, in this respondent's opinion, teaching Indigenous ethno-veterinary knowledge in TVET schools is necessary to equip students with all the available skills required for livestock management.

All five TVET graduates interviewed listed the disadvantages of Indigenous animal medicine when compared to Western approaches, including the concerns that, with Indigenous medicine, inaccurate diagnoses result in high rates of fatality, and there is a lack of standardisation of dosages. In contrast, they pointed out, in modern veterinary health care, diagnosis is much more precise, and the administration of medicine follows scientifically established dosages. One graduate now working as a vet practitioner observed that—unfortunately, in his view—the low cost of Indigenous medicine, compared to paying for the services of trained vets, has a countervailing effect on the patronage of animal clinics and formal veterinary medical practice.

#### **D. Teachers' Views**

According to the two TVET teacher respondents who participated in developing the TVET Animal Health curriculum, Rwanda's Indigenous knowledge is not considered during curriculum development. One participant teacher said that he is not sure why indigenous knowledge was neither considered nor included in Rwanda's TVET Animal Health curriculum development. He was of the view that it might be an oversight since the Government of Rwanda supports Indigenous knowledge in other sectors. He gave the example of the certification given by the government, through the Ministry of Health, to Indigenous knowledge practitioners of human medicine. Another reason could be the oral or undocumented nature of transmission of certain Indigenous knowledge, which is usually from parents to children, which results in much knowledge being lost along the way.

All three interviewed teachers were aware of the existence and use of Indigenous knowledge in animal health in Rwanda. However, they all considered modern medicine to be far more efficacious than Indigenous medicine, on the grounds that farmers who use Indigenous knowledge also need modern medicine, while those who use only modern medicine do not need Indigenous medicine. Two of the teachers never incorporate Indigenous knowledge in teaching or encourage its discussion in class. According to one,

Indigenous knowledge is allowed [as] it is a localised knowledge. It varies from one area to another. There is no regulation restricting people to teach it. Myself, I do not teach Indigenous knowledge because I do not know it. I only teach modern medicine.

The second teacher, who does not incorporate Indigenous knowledge in his teaching, said he believes that teaching such knowledge is not appropriate, and not allowed in the classroom, since it is not relevant, as "TVET is about teaching students modern medicine which is up to date." According to these two teachers, the TVET students are not interested in Indigenous knowledge, as they come to school to learn about modern medicine.



Figure 7: Animal Health TVET



TVET teacher with grazing cattle, Muhanga District

Photo source: Vedaste Ndunguste 2020

The third teacher interviewed, however, was of the view that Rwanda's Indigenous ethno-veterinary knowledge can assist TVET Animal Health students when they graduate and go into the field. This is so, he said, because some ailments are treatable only by Indigenous methods, with no available treatment in modern veterinary medicine. In addition, given the percentage of Indigenous cattle in Rwanda, it is important to ensure that Indigenous knowledge of animal husbandry is not marginalised. If incorporated in the TVET Animal Health curriculum, Indigenous treatments would complement the modern medicine. The teacher added that, even though it is not part of the curriculum, he sometimes incorporates Indigenous knowledge in his teaching. For instance, he sometimes references the practice of treating animals with charcoal or cow butter (*amavutay'inka*), and the process known as *kwina* (the administering of Indigenous medicine anally through a piece of local bamboo straw, usually a treatment for animal constipation). He does this because, in his view, many students are interested in knowing about Indigenous treatments, because some animal diseases are best treated using Indigenous knowledge.

## VI. Analysis, Conclusions, and Recommendations

It is clear in the findings of this study that Indigenous knowledge of cattle treatments is both held and used by rural livestock farmers in Rwanda and, at the same time, that such knowledge is not being supported by the country's TVET Animal Health curriculum or, for the most part, by the country's TVET Animal Health teaching.

The livestock farmers interviewed hold nuanced views about the interfaces between Indigenous and modern Western treatments for their cattle. The farmers, both experienced and less-experienced, know about the Indigenous techniques and use them on their cattle, either directly or with the assistance of traditional animal health practitioners. A key advantage of Indigenous medicine that the farmers cited is its cost-effectiveness, with the use of modern treatments, via modern veterinary clinics, being prohibitively expensive for the farmers and thus only used as last resort or for

treatments that are not possible via traditional means. The farmers did, at the same time, acknowledge the greater precision and predictability of modern veterinary treatments, and the greater efficacy of modern treatments for foreign breeds of cattle (with Indigenous breeds seen as compatible with effective treatment by both Indigenous and modern methods).

Meanwhile, in TVET Animal Health education, the Indigenous medicinal knowledge known and practised by rural livestock farmers is not provided for in any meaningful way. The TVET Animal Health curriculum covers none of the Indigenous knowledge detailed by the farmers in the research interviews. Moreover, four of the five TVET Animal Health graduates interviewed, and two of the three TVET Animal Health teachers interviewed, said they see absolutely no value in making Indigenous animal health treatments part of TVET instruction—and even the one graduate and one teacher who saw some value in making TVET learners aware of such knowledge did not see the need for it to be part of the formal curriculum.

Among other things, the findings indicate that the TVET graduates, who in their work as vets and animal pharmacists interact with livestock farmers, have not been equipped with the knowledge necessary to optimally interact with rural livestock farmers—who, in many cases (as was found in the farmer interviews), seek out the modern treatments practised by the TVET graduates only after attempting Indigenous cures.

Clearly, the interviewed veterinary medicine graduates in Rwanda's TVET system and even their teachers, who were at some point students themselves, lack confidence in the country's own knowledge system, even though there are many benefits within that system. The African learner feels disconnected from what is taught at school, since it is not generated from the knowledge bank of their forebears. Essentially, when the students graduate and begin to practise, they are not equipped to draw from preexisting traditional knowledge of livestock treatment, including the available medicinal herbs. Rather, they rely on imported medications to treat sick animals.

The interviewed TVET graduates and teachers hold the view that Western, modern medicinal knowledge in respect of animal health is not only superior to Indigenous medicinal knowledge, but also that Indigenous medicinal knowledge is so inferior as to be unsuitable for recognition alongside modern veterinary medicine in the same curriculum. As discussed earlier in this article, this idea that African knowledge systems are inferior to, and entirely alien to, Western knowledge systems has been ingrained in Africans since the advent of colonialism and Western education on the continent. The notion of a superior Western knowledge reflects the dynamic of the coloniser and the colonised (Memmi, 1965), as passed on across generations of Africans. Today it has become a strong barrier to the incorporation, let alone mainstreaming, of Indigenous knowledge in curricula across Africa.

To be relevant to the continent's overall advancement, Africa's education curricula need to incorporate the continent's Indigenous knowledge and practices across fields and sectors (Msila, 2016). In the planning and development of curricula, knowledge Indigenous to learners' locales must be infused generously, with the aim of such knowledge leading to appropriate human-centred development. As we saw in the passage quoted from UNESCO in the contextual section of this article, there is global recognition among education policymakers of the "urgent need to enhance the intergenerational transmission of indigenous knowledge" and "to bring indigenous language and knowledge into school curricula" (UNESCO, n.d.).



Rwandan policymakers need to pursue several elements if they wish to build Indigenous knowledge into the country's TVET Animal Health curriculum. At the foundation is a need for research into Rwandan Indigenous knowledge and a widespread dissemination of these research findings. Research is also necessary to improve Indigenous animal health practices in Rwanda, as the farmer respondents noted that lack of precision in dosages, and uncertainty about which herbs work for which disease, are hindrances to the effectiveness of Indigenous animal health practices. Western medicine, which many respondents in this study consider much more efficacious, is itself evolutionary, refined through centuries of research and development in order to attain the legitimacy and trust currently ascribed to it. Accordingly, there is a need to prioritise the establishment of research laboratories dedicated to indigenous Rwandan animal health by the nation's Ministry of Education, and specifically the Ministry's Directorate for Science, Technology and Research (DSTR).

Another important element is teacher training. Before the TVET Animal Health curriculum can be transformed, teachers must be educated about using Indigenous knowledge for Africa's advancement. Such training can be located within the larger UN Sustainable Development Goals (SDGs) framework, with appreciation of Indigenous knowledge presented as a prerequisite for sustainable development. That exercise should incorporate an appreciation of cultural diversity across all sectors, not only agriculture.

Another crucial element is the preservation and expansion of Rwanda's biodiversity. Farmers interviewees in this study noted that some of the herbs previously used to effectively treat certain diseases in animals are no longer in abundance (and some are even extinct), compelling farmers to increasingly resort to the use of Western medicines. One way in which Rwandan biodiversity relevant to Indigenous animal health care could be preserved is through the creation of herbal nurseries at TVET schools, where efforts could be made to cultivate known local herbs that are used in, inter alia, animal health maintenance. Such herbaria or farms could be maintained by TVET students and teachers in cooperation with community-based Indigenous knowledge practitioners.

Another necessary element is government policy. Some existing Rwandan Government policy dimensions, although not directly targeted towards education or Indigenous knowledge as such, have crucial effects on these areas, e.g., the policies advocating zero grazing for cattle and promoting the importation of foreign cattle breeds, and the lack of policy emphasis on the preservation of virgin forests. These have all had an impact on the extent of the practice of Indigenous veterinary medicine in Rwanda. Another policy matter is the TVET orientation promoted by the WDA—the government institution under the Ministry of Education in charge of technical schools. The WDA's curriculum development guidelines are oriented towards labour market needs as articulated by the private sector and potential employers, who are represented in curriculum development meetings. There is a need for the WDA to broaden the focus of its curriculum guidelines to include core consideration of the inclusion of Indigenous agricultural knowledge, in keeping with the country's available natural resources and sustainable national advancement.

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