UNIVERSITY OF NAIROBI

GOVERNANCE OF THE PRACTICE OF TRADITIONAL MEDICINE IN SELECTED MARKETS OF WESTERN KENYA.

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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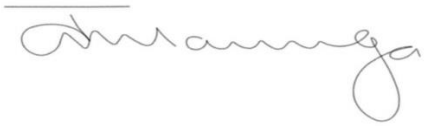
   Signature:  Date: 22nd May 2023

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LIST OF ABBREVIATIONS

CITES Convention on International Trade in Endangered Species of wild fauna and flora

EBDCS Economic Botany Data Collection Standard

FC Frequency of Citation

ICD International Classification of Diseases

ICPC International Classification of Primary Care

IP Intellectual Property

IPR Intellectual Property Rights

IUCN International Union for Conservation of Nature

KNDP Kenya National Drug Policy

M&E Monitoring and Evaluation

MGPs Modern Governance Practices

MPCDA Medicinal Plants Conservation Development Areas

R&D Research and Development

RFC Relative Frequency of Citation

STIs Sexually Transmitted Infections

TCM Traditional Chinese Medicine

TEK Traditional Ecological Knowledge

TGPs Traditional Governance Practices

TIK Traditional Indigenous Knowledge

TK Traditional Knowledge

TKDL Traditional Knowledge Digital Library

TM Traditional medicine

TMPs Traditional Medicine Practitioners

WHO World Health Organization

WIPO World Intellectual Property Organization

ABSTRACT

Traditional medicine (TM) is a conglomeration of natural products that are used in the treatment of diseases and sociocultural syndromes. Folk medicine employs a wider array of natural products that primarily include medicinal plants and in some instances the use of minerals or animal products. The practice of TM is gaining immense popularity among rural, urban and peri-urban populations, this is highly associated with the increasing challenge in the treatment of modern lifestyle diseases using allopathic or biomedical drugs. TM therefore provides a justifiable alternative medical system where uses find a lasting remedy or a complement therapy. The study attempted to evaluate the current governance practices of the TM industry, trade and uses, and finally assessed the sociocultural aspects that promote the conservation and preservation of medicinal plant resources. The survey used a purposive sampling technique incorporating snowball methods where knowledgeable and willing respondents were selected for oral interviews and allowed to recruit other competent respondents into the survey. Face to face oral interviews were conducted using a pre-tested and a liberal questionnaire after procuring prior informed consents. Herbarium techniques and standard Flora of Kenya literature sources were used to process and identify frequently sold medicinal plants in the informal markets of Western Kenya. The collected data was organized and presented in MS excel spreadsheets and subjected to descriptive statistics (frequencies, means, percentages). Concise literature and desktop reviews was conducted to address the recent sociocultural conservation strategies of TM. The data was presented on tables, column or bar graphs and pie charts. Frequency of Citation (FC) and Relative Frequency of Citation (RFC) ethnobotanical indices were key in the identification of useful and frequently traded medicinal plant species. Women practitioners' dominated the medicine markets whereas men dominated the TM leadership circles. Majority of the TM market practitioners (TMPs) were older with a mean age of 64 years and a mean practicing age of 24 years.

Slightly more than half of the TM traders (54%) were willing to be interviewed and only fifteen per cent (15%) of the practitioners had acquired a certificate of registration or recognition. From the market survey, 90 plant species belonging to 79 genera and 46 plant families were identified, with *T. emetica* (RFC = 0.37) registering the highest RFC followed by *D. schimperi* (RFC = 0.27), *C. spinarum* (RFC = 0.23) and *Aloe* spp. (RFC = 0.23) in that order. The exotic neem tree (*A. indica*) was commonly sought by buyers whereas trees and roots were the frequently traded plant habit and plant part respectively. Formal governance practices continue to attract a lot of interest and unrivalled attention as compared to community, cultural and societal driven informal governance practices. All practitioners followed the laid down formal governance practices whereas the traditional governance practices varied from market to market as their cultures, ethnic affiliations and herbal remedies vary in use and application. An all-inclusive effort must be put to place to ensure effective mainstreaming and long-lasting integration of TM into the general healthcare. Finally, most commonly traded medicinal plants are threatened daily with uncontrolled extraction must be conserved in the wild, cultivated or domesticated to preclude decline or extinction in the wild.

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Traditional medicine, widely dubbed TM primarily refers to the utilization or consumption of medicinal plants for curing various human ailments or diseases and to a less extent the sociocultural illnesses (McMullin *et al*., 2012; Kaigongi & Musila, 2015). Other traditional medicines used include animal products, minerals, honey, charms, amulets, fungi, wax *et cetera*. Some practitioners may also invoke spirits, make incantations or promote healing through cursing ceremonies and/or rituals (Alves *et al*., 2013; Enumah *et al*., 2016). The growing interest in traditional medicine is strongly associated with the challenge faced in treating modern lifestyle infections and chronic ailments like diabetes, blood pressure challenges, HIV/AIDS and cancer using conventional or allopathic therapies. Among rural and peri-urban communities, the resurgence is attributed to few or distant modern healthcare facilities (Kimutai *et al*., 2019).

The primary goal of this survey was to assess the common traditional (informal) governance practices and modern (formal) governance practices that streamline the TM practice in Western Kenya. The survey also evaluated the sociocultural aspects that promote conservation and sustainability of the traditional medicine practice.

1.2 Statement of the Research Problem

For many years, traditional medicine has been used by cultural-rich rural communities in the treatment of various diseases. These medicines are also traded in urban and peri-urban areas that otherwise have easy access to allopathic medicines. However, there is scanty documentation on the trade and uses of TM in local medicine markets within administrative counties of Western Kenya.

This information gap has been compounded by the difficulty and complexity of conducting ethnobotanical studies in an urban setting. There is also limited data and information on commonly practiced formal or modern governance practices (MGPs) and informal or traditional governance practices (TGPs). Finally, there is scanty documentation on local or traditional conservation strategies with few publications highlighting about this important local governance of TM.

1.3 Objectives

1.3.1 General objective

To assess the practice of traditional medicine, uses of herbal remedies and sociocultural conservation strategies for the commonly traded medicinal plant resources in the selected markets of Western Kenya.

1.3.2 Specific objectives

i. To assess the use and trade of traditional medicine in Western Kenya.
ii. To assess the modern and traditional governance of the practice of traditional medicine in Western Kenya.
iii. To assess sociocultural aspects that promotes conservation of medicinal plant resources.

1.4 Research questions

The research study was guided by the following research questions:

i. What are the frequently used and traded traditional medicines?
ii. What are the existing legal, policy and regulations that guide the practice of traditional medicine and trade?
iii. What sociocultural aspects aid in the conservation of traditional medicine and herbal remedies?
iv. What are the formal and informal practices of traditional medicine in Western Kenya?

1.5 Justification of the study

This study evaluates how traditional medicine markets are governed and managed, and identified challenges faced by both traditional healers and local regulators. The study also assesses both traditional (informal) and modern (formal) conservation strategies that aid perpetuation of frequently traded medicinal plant species. Frequently traded native species have been reported to demonstrate therapeutic versatility (Ladio *et al*., 2021).

CHAPTER 2

LITERATURE REVIEW

2.1 Definitions of Terminologies

World Health Organization (WHO) refers to traditional medicine (TM) as the "sum total of the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, that are used in the maintenance of human health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness". Ethnomedicine and TM have been used interchangeably, whereas traditional medicine encompasses ethnomedical traditions and beliefs representing different cultures, ethnomedicine is considered in the broader sense (Jansen *et al*., 2021).

Herbal medicines are therefore defined by WHO as a collection of herbs, herbal preparations and herbal products that contain whole plants, plant parts or plant extracts that have therapeutic value or benefit to humans. TM is widely regarded as a branch of ethnobotany discipline that pays more emphasis on medicinal plant uses, minerals and other organic sources invaluable in the effective treatment of disease ailments and sociocultural syndromes.

On a broader scale, traditional medicine is termed CAM referring to the Complementary and Alternative Medicine, although many herbalists do not favour this categorization as it implicitly relegates their herbal remedies as merely complementary. An even broader categorization does exist, where all traditional medicine are combined as Traditional, Natural – Complementary, Alternative Medicine (TN-CAM) or even dubbed TAM referring to the Traditional and Alternative Medicine (Guido *et al*., 2015; Kpobi & Swartz, 2018). African Traditional Medicine or ATM is also a widely used synonym in the continent and broadly refer to virtually all folk or indigenous medicines (McFarlane, 2015). ATM incorporates other forms of medication that include divine interventions, spiritualism and herbalism (Ozioma & Chinwe, 2019).

Ethnobotanical surveys have been carried out for centuries and several authors have attempted to define and redefine the discipline and also determine nexus between the people and plant use. Mutwiwa *et al*., (2018) simply redefined ethnobotany as the study of people or culture and plant use. Ethnobotany helps to reveal the traditional medical knowledge and plant uses in several cultures. Ethnobotanical resources broadly covers general plant uses, for instance, food, medicine, timber, forage, fibre, rituals and ceremonies *et cetera* most of which are captured under the Non timber forest products (NTFPs) of our forest ecosystems (Tarigan & Widayati, 2021). An in-depth review on the development, definitions and relevance of the ethnobotany discipline has been carefully documented (Rahman *et al*., 2019).

The purpose of ethnobotany studies vary from general to specific where plant use against various diseases are meticulously documented. General ethnobotanical surveys document all plant uses whereas specific ethnobotanical studies only addresses a single component, for instance, medicinal plants used against bacterial, fungal or viral infections (Kimutai *et al*., 2019). Ethnobotany is one of the sub-discipline of ethnobiology and a multidisciplinary science that encompasses taxonomy and biosystematics, conservation biology, ecology, phytochemistry, pharmacology and Pharmacognosy (Dapar & Alejandro, 2020).

Ethnopharmacology is defined as an interdisciplinary or multidisciplinary science that deals with scientific exploration of the bioactive agents or active ingredients of traditional medicine used by people belonging to different cultures and ethnic compositions. The increasing capacity to investigate and analyze active compounds and activities of plant extracts has introduced a modern aspect to folk medicine (Süntar, 2020). Finally, in 1987, a special United Nation commission defined sustainability as “meeting the needs of the present without compromising the ability of future generations to meet their own needs”.

Formal governance normally refers to a set of rules that are collectively applied and not impersonal, whereas the informal practices are a set of norms, traditions and beliefs observed by a particular group of people. With an organized governance setting, formal governance should complement informal governance; over-emphasizing one form of governance may be detrimental to the other. It is also believed that these two forms of governance should go hand in hand and exist in a symbiotic manner or display (Ma, 2021).

In this regard, modern governance practices will focus mostly on formulated laws (acts), bills of parliament, policies, government plans, ratified conventions and sessional plans, whereas traditional government practices shall include norms, standards, customs and social taboos. Historically, traditional governance in a society basically refer to a set of rules that have been in existence since time immemorial and are unique and specific to different cultures, whereas modern governance is multidimensional and accommodates plurality of cultures despite the changing trends and patterns of globalization and cosmopolitanism (Hinz, 2008).

2.1.1 Ethnomedicine as a sub set of Traditional medicine

The practice of ethnomedicine entails the use of TM (mainly herbal remedies) in the management, treatment and curing of diseases or sociocultural illnesses by members of a particular ethnic community or affiliation. Ethnomedicine practice is historically and culturally built over the years and practiced by traditional healers from different ethnic, cultural or tribal groupings. Traditional medicine treatment is often accompanied by spiritual chants, rituals, magico-spiritual or even religious acts. This is because most members of traditional societies believe that diseases or sociocultural illnesses are caused or triggered by supernatural and/or natural causes. Ethnomedicine is in line with the local medical knowledge, norms, beliefs and traditions associated to a particular ethnic grouping and community (Anyinam, 1995; Prasad, 2013; Bhuyan, 2015; Bag, 2017; Dar *et al*., 2018).

With huge influence of religion or religious activities in our societies, ethnomedicinal practices carry with it social, psychological and also physiological roles and effects (Bhuyan, 2015). Some religions, for instance, Buddhism and Bon of the Himalayas are huge proponents of natural health remedies and recommends the use of TM in the treatment and management of diseases, maintenance of good health and general wellbeing (Kunwar *et al*., 2006).

It is of great concern that ethnomedical knowledge is on a declining trend, this is largely linked to decreasing interest by the younger and educated members of the society and the dynamic lifestyles common in this globalized and industrial set up (Bag, 2017). In the same regard, younger practitioners are known to trade in few medicinal plant species as compared to older practitioners. Ethnomedicine practitioners face a growing challenge of having a small number of committed young apprentices and the markets dominated by older practitioners (Coe, 2008). This low level of mastery of mastery by young practitioners and disinterest is largely attributed to increased access to modern education, modern lifestyles and cultural evolution (Nguyen *et al*., 2019).

Ethnomedicine studies have proven significant in the determination and identification of medicinal plant species of both phytochemical and pharmacological relevance (Kumar & Bharati, 2014). Most cited medicinal plant species from surveys are normally subjected to further phytochemical screening to validate the therapeutic claims from local healers (Kimutai *et al*., 2019). Rafts of empirical tests including clinical trials have been developed to authenticate ethnomedicines and provide scientific standards and pharmacological validation (Adnan *et al*., 2014). Frequently used ethnomedicinal plant species should be correctly identified and prioritized for conservation in their original habitats or even domesticated. Conservation measures of prioritized ethnomedicinal plants should target species that are mostly used in treatment of common diseases afflicting the people, slow growing ones, and those that carry huge cultural importance and significance (Kunwar *et al*., 2006).

Ethnomedicines are favoured by most users since they are considered cheaper, available, adaptable and accessible to members of local communities as compared to biomedical therapies (Anyinam, 1987).

2.2 Uses and trade of herbal remedies in traditional medicine

2.2.1 Traditional medicine trade and uses

Traditional medicine expresses diverse attributes drawn from different communities and traditions which are key in the treatment of physical and mental illnesses (Ung *et al*., 2017). Remarkably, a considerable percentage (80%) of human population in developing countries take TM medication. The consumers of TM are attaracted mostly by their their low cost, simple drug administration, use of simple dosage prescriptions, availability in remote locations and difficulty in the access of conventional or allopathic medicines compounded by a favourable sociocultural environment and understanding of the local populations (Meke *et al*., 2016; Tinitana *et al*., 2016; Moges & Moges, 2019).

The increasing demand of traditional medicine as opposed to allopathic medicine by somewhat rural populations is also largely fuelled by the growing difficulty in curing modern lifestyle infections including malaria, tuberculosis, arthritis, nervous system breakdown, respiratory challenges among others. These stubborn diseases coupled with shortage of conventional medical personnel, medical supplies and difficulty in the access of quality medical services has increased the consumption of TM products (Innocent, 2016). A well-organized TM industry is invaluable in promoting social welfare of practitioners, vendors and other major stakeholders. However, the consumption of traditional medicine is affected by declining sociocultural trends in an ever changing society (Kaigongi & Musila, 2015).

The resultant decline in traditional medical knowledge is also associated to modern trends of harnessing natural resources and waning cultural practices. These practices in turn slow down traditional medicine use and hampers wider societal acceptance.

A compensatory means of dissemination and restoration of traditional medical knowledge can therefore be realized more through oral narrative, folk songs, indigenous languages and customary practices (Jasmine *et al*., 2016). In some unfortunate circumstances, an elderly practitioner may exit active practice before passing the traditional medical knowledge to the younger generation causing an abrupt end of this largely unique and unpatented medical knowledge (Maara *et al*., 2014). Traditional knowledge (TK) is vulnerable and prone to distortion, loss or even forgotten and this underscores the fragility of this orally transmitted medical knowledge system (Cheruiyot *et al*., 2013). Salim *et al*., 2019 reported that the regulation of TM trade helps in the retention of traditional medical knowledge, and at the same time allows for mixing of traditional knowledge from diverse cultures.

Negative and stereotypical perceptions about indigenous health systems since time immemorial have derailed the TM practice as exemplified by the impact of colonization and subsequent de-valuation of this important cultural enterprise. TMPs were assigned derogatory names such as witchdoctors, sorcerers or even terms like mganga (Swahili name for witchdoctor). These stereotypical or prejudicial nomenclature negatively affects the traditional medicine markets, client choices and preferences. Western colonization has also been blamed for decline in traditional Aboriginal medicine knowledge of the native Australian indigenous populations. This was mainly fueled by the unethical displacement of native people from their indigenous lands. This displacement of populations from their original habitats influenced the transfer of undiluted autochthonous cultural knowledge to future generations (Oliver, 2013).

Rife suspicions among traditional medicine stakeholders escalate the existing tensions among the legitimate actors and to some extent affect the way the industry is viewed and supported by governmental and non-governmental institutions. Suspicions limits any attempts of collaborative engagements or productive communication among the stakeholders (Enumah *et al*., 2016).

It is apparently clear that modern medical practitioners have a limited understanding of the indigenous TM knowledge and this affects positive collaborative engagements in policy making and integrative efforts (Redvers & Blondin, 2020). The wider application and acceptance of folk ethnotaxonomy and use of vernacular languages in the TM informal trade has enabled understanding of the TM practice.

On the other hand, the decoding of these local ethnotaxonomy is a challenging task and thus underscoring sheer complexity of the TM industry. Despite these taxonomic limitations, the global trade in herbal medicine was estimated at 107 billion USD (Asmelashe *et al*., 2017). The overall trade in traditional medicine products has been estimated to represent 50% of the known herbal remedies. In Benin, for example, only a few identified traded traditional medicine products accounting for 655 tonnes and amounting to 2.7 million US dollars each year were documented (Quiroz *et al*., 2014). These numbers could change with determination of more traded TM products and establishing their accurate volumes traded in the markets.

In most traditional medicine markets, ethnotaxonomy is the norm as influenced by the ethnic affiliation and associated cultural knowledge of the practitioners. Market surveys often consider professional language translations in order to make sense and communicate to the global community the true nature of TM markets (Miara et al., 2019).

Formal and progressive trade in traditional medicine introduces complex aspects of wrong labelling or wanton disregard of official recommendations from relevant regulatory institutions. This labelling hitches and ineptness in scientific botanical nomenclature may expose buyers to toxic substances or associated health risks (do Amaral *et al*., 2020).

Regarding the complexity in TM trade, there exist limited documentation on the nature and volume of TM trade in most local markets. The trade in traditional medicine products also opens up economic opportunities especially for vulnerable groups in the rural, peri-urban and marginalized settings (Rasethe *et al*., 2019).

It has also been documented that the absence of proper regulation for domestic and international traditional medicine trade threatens their sustainability. Therefore, effective regulation of TM trade covering all important stages of processing and value chain (collection, drying, packaging, storage, marketing to conservation) serves to streamline the sector (Meke *et al*., 2016).

Current progressive research in TM provide more opportunities in the investigation and determination of bioactive compounds, mode of action, efficacy and even their toxicity levels. Scientific investigation of herbal remedies have led to the discovery of new drugs and offered avenues for bioprospecting. Some authors have also reported marked differences in floristic compositions in local medicine markets and hence the need for a broader and targeted survey to provide an in-depth overview on medicinal plant species composition, uses and supply (Bussmann *et al*., 2018). Weak governance laws on bioprospecting exposes a nation to biopiracy practices. These practices may disadvantage the indigenous communities from fully sharing or benefiting from their natural resources (Kiraithe *et al*., 2019).

2.2.2 Secrecy in the TM practice.

There is scanty information and data on traditional medicines sold in our markets, particularly in W. Kenya. Trade in TM is not a completely a formal sector and is mostly dominated by conservative practitioners with less formal education. This trade is often characterized by suspicion, secrecy and limited exchange of information among and between traditional medicine actors. The practitioners are constantly worried and jittery of losing their cumulative knowledge and experiences to formal actors. TM knowledge is largely unpatented and this is the main reason why TM practitioners hold onto it tightly and freely transfer to close family relatives (Giday *et al*., 2009). Therefore the traded plant species in most medicine markets continue to be a mystery and thus the need to study and present a true picture or overview of the actual TM markets (Pyakurel *et al*., 2019).

Secrecy is positively acknowledged and endorsed by some practitioners and is often considered a reliable means of preserving traditional medicine knowledge. If kept intact, secrecy has an advantage over IPR since it lacks formal spaces and confined boundaries for ultimate disclosure and external regulation (Tong, 2010). Secrecy of traditional medicine carries with it elements of confidentiality and professionalism as referred to by conventional practitioners. In this regard, local languages aid in the perpetuation of secrecy for traditional healers (Kwame, 2016). Varadarajan (2011) argued that intellectual property rights may not effectively protect traditional knowledge but instead proposed a trade secret law that serves to narrow the divide between traditional knowledge and intellectual property law. As much as some limits of secrecy protects and preserves authentic traditional medicine knowledge from exposure, it also threatens its transmission to current and future generations (Gonfa & Wirtu, 2019).

Failure or unwillingness to disclose the nitty gritty of traditional medicine does not stop with an individual practitioner, some practitioners strongly resist the temptation to disclose critical TM aspects, for instance, the identity of useful medicinal plant species, their growing habitats and even their income earnings from TM trade (Uzun & Koca, 2020). As much as traditional healers do not disclose the esoteric elements of traditional medicine, these elements should be protected under local patents, intellectual property rights or even patented with some financial compensation.

Traditional healers easily disclose the non-esoteric elements of traditional elements and not those of esoteric nature where secrecy is maintained for livelihood and posterity (Masango, 2020). The concept of secrecy in the traditional medicine can be manifested in the difficulty in sharing, transmission and documentation, where in most instances, traditional medical knowledge is often passed to close family relatives and dependants (Ozioma & Chinwe, 2019).

2.2.3 Sociocultural and historical aspects of Traditional Medicine conservation

Traditional medicine practice has developed over generations with increased harvesting or extractions from their original sources, mostly from the wild, intended to match the ever increasing market demand. This rising demand and consequent extraction of medicinal plants from wild sources is linked to their perceived better healing powers as opposed to the cultivated or domesticated species and thus exerting strain on natural plant resources (Lee *et al*., 2008). Medicinal plants conservation can be initiated and conducted locally by Traditional Medicine Practitioners (TMPs) or conventionally led by modern conservationists and scientists. But several questions arises, for instance, how efficacious are traditional conservation strategies as compared to modern conservation strategies?. Can these strategies be harmonized, reconciled or synchronized?. This study delved into the theoretical assumptions touching on TM conservation and provide prospects for a sustainable industry.

The traditional medicine industry support livelihoods of growers, vendors, collectors, conservationists, practitioners, gazetted institutional officials, trade regulators and other legitimate stakeholders. As previously stated, the extent, value and magnitude of TM trade has not been clearly documented owing to its sheer complexity and largely informal nature (Chebii *et al*., 2020). In most rural settings, medicinal plants contribute immensely to the primary healthcare, whereas in some remote areas, they are the only and easily accessible medication. TM cultural acceptability, particularly with the consumption and utilization of herbal remedies, has been associated with folk healing beliefs (Agrawal & Danai, 2017; Bizuayehu & Assefa, 2017).

The traditional indigenous knowledge (TIK) of the local medicine practitioners directly influences administration of TM natural products in curing or treating diseases. Traditional local healers are culturally the major custodians of TM knowledge, in which case most of it to-date is undocumented (*Mathibela et al*., 2015).

Notably, the primary bearers of the social and cultural knowledge are the elderly practitioners, rural folk and local people leading traditional lifestyles (Plieninger *et al*., 2020). For a meaningful cultural significance, the indigenous knowledge systems should be fully entrenched in the modern day thinking philosophies. These systems are often masked by imperialism, neocolonization and the persistent elevation of western ideals to the detriment of the global south (Basheka & Auriacombe, 2020).

Gunjan *et al*. (2015) documented popular drugs derived from plant sources and they include the fever reliever (salicylates) or popular pain killer aspirin extracted from the willow bark tree (*Salix alba*), anti-malarial quinine derived from the Cinchona fever tree (*Cinchona officinalis*) and morphine pain suppressor from the opium poppy (*Papaver somniferum*). However, most advanced societies have harnessed even the known poisonous plant species for traditional medicine due to their proven bioactive compounds. For instance, the culturally rich Tibetan TM practitioners have positively exploited the poisonous *Aconitum pendulum, Datura stramonium, Anisodus tanguticus* and *Strychnos nux-vomica* by making use of their aconitine, scopolamine, anisodamine and strychnine bioactive compounds respectively (Ma *et al*., 2015). The overall traditional medicine consumption is somewhat hampered by over-extraction of medicinal plants, aromatic herbs and spices particularly those sourced from the wild. This contributes to habitat loss, decreased abundance, low species count or even a resultant low genetic diversity. Habitat loss implicitly refers to a future decline of natural drug supplies given that only few species have so far been empirically investigated and their bioactive compounds validated (Rajasekharan & Wani, 2020). Community and public forests have been cited as the major sources of medicinal plants traded but still faces threats from human encroachment targeting useful rare species (Mollel *et al*., 2022).

Since TIK is mostly passed verbally or orally through generations, the transmission remains a collective and not an individual function and thus the need for shared experiences and continuous learning (Tilahun, 2018; Ageh & Lall, 2019). As a matter of concern, this invaluable and closely guarded indigenous medical information, ecological knowledge and ecotourism must be conserved or protected (Caballero-Serrano *et al*., 2017). Little has been done regarding the actual assessment of the positive outcome and performance of TM on actual plant populations, sustainability and future prospects.

Sustainability is a broad concept that underscores satisfying the current and future needs and requirements of the people while ensuring unlimited supply of natural resources (Shahrajabian *et al*., 2019). Since most traditional medicine sources are gathered from the wild, these sources are constantly threatened by irresponsible extraction and harvesting, unsustainable exploitation of medicinal plants for other uses (livestock, fuelwood, charcoal, timber, and construction poles), unmonitored trade, habitat loss and agricultural expansion or intensification.

Other threats include human encroachment, mining activities, wanton littering, inadequate data on threatened medicinal plants, secretive nature of the TM practice, unfair competition from imported traditional medicine products, covert bioprospecting and biopiracy, overgrazing, uncontrolled livestock browsing, increase in human population, detrimental exotic and invasive plants, indiscriminate forest fires and adverse vagaries of change in climate (Maara *et al*., 2014; Barata *et al*., 2016; Beyene *et al*., 2016; Gafna *et al*., 2017; Sanwal *et al*., 2017; Amsalu *et al*., 2018; Duguma & Mesele, 2019; Chebii *et al*., 2020; Okyere-Manu *et al*., 2022).

Climatic variability is known to affect plant phenology, alter habitats, impact floral distributions, change individual species population and disrupt collection periods of some medicinal plant species (Maikhuri *et al*., 2017). Biopiracy and unethical publications on indigenous plant resources for individual and selfish gains hampers the conservation of local medical knowledge (Ageh & Lall, 2019).

Failure to tame biopiracy heightens suspicion, breeds mistrust, exacerbates decline in the wealth of indigenous medical information, fuels loss of culture and obstruct dissemination of indigenous knowledge (Ens *et al*., 2016). The decline in cultural-based conservation measures has been linked to societal changes and is directly influenced by religion, migration, education and globalization which in return weakens the current traditional natural resource management practices (Abugiche *et al*., 2017).

Cultural rich communities have a wealth of traditions or norms that promote conservation of nature through a socio-religious, sociocultural thinking, maximum respect and strong traditional beliefs. And therefore they should not be relegated or disregarded in the mainstream conservation actions (Onyekwelu, 2021). The absence of a vibrant and robust system of governance coupled with irresponsible harvesting practices, unregulated use, rising poverty, ignorance, unsustainable land uses, unemployment and total disregard of public participation continue derail medicinal plants conservation (Khan *et al*., 2019). Public participation is a constitutional requirement and at the heart of good governance, it is important in sustainable resource management and fosters the dual concept of sustainability (Chandra & Sharma, 2019). Other notable and scientifically proven threats to conservation of herbal remedies include pollination inadequacies, lack of sufficient seed dispersers and unproductive scattered plant distribution. Efficacious conservation efforts should therefore prioritize saving the endemic, economic, endangered and slow growing plant taxa (Chen *et al*., 2019). High levels of knowledge on traditional medicine positively correlates with the threats that medicinal plant resources face in their natural habitats. Therefore, sensitization and awareness measures help mitigate the effects of various medicinal plant threats (Nguyen *et al*., 2019). However, the intentional introduction of medicinal endemic plants into the market value chains may open up the market to elitist consumers and consequent environmental destruction (Volenzo & Odiyo, 2020).

Unfortunately, most developing nations lack adequate capacity to effectively assess the actual state of conservation of local natural resources, with limited information on prioritization of threatened plant species (Rajasekharan & Wani, 2020; Gowthami *et al*., 2021).

Without disrupting normal extraction and consumption of medicinal plants, sustainable harvesting is fronted as a reliable means of ensuring that supply matches demand (Susanti & Zuhud, 2019; Gakuya *et al*., 2020). The attitudes of local communities towards conservation is largely influenced by their cultural-religious beliefs and ecosystem needs.

Therefore it is very important to increase community and societal awareness on effective conservation approaches, and also to evaluate both constructive and destructive local knowledge, attitudes and practices (Talukdar & Gupta, 2018). The existing and tested modern conservation methods and information management systems should be blended with the existing traditional conservation strategies mostly implemented by the rural folk (Onyema *et al*., 2016; Chebii *et al*., 2023). But holistic conservation of vital natural resources calls for a multipronged approach that considers economic, ecological, ethical, sociocultural and political strategies that are effective in reversing declining biodiversity trends (Pati, 2017).

2.2.4 Role of governments in Traditional Medicine

A holistic sustainable management and conservation efforts must be an all-inclusive venture that involves all stakeholders, for example, the traditional medicine practitioners, local communities, local government authorities and relevant research institutions (Sen & Bhakat, 2020). Governments do play an invaluable role in the advancement of TM, key being the development of refined technologies in effective utilization and preservation of medicinal flora, prudent utilization of traditional medicine resources, effective coordination of education and research, and lastly in the compilation of plant databases, botanical checklists and inventories (Ramawat & Goyal, 2008).

The Chinese government with her successful mainstreaming of Traditional Chinese Medicine (TCM) promotes investment in research development and administration (Xu & Yang, 2009). In Ethiopia, the government values and support TM as a national heritage and a good example in the sub Saharan Africa (Kassaye *et al*., 2006). Governments aid in the formulation of laws that protect TM, traditional medical formulae and pharmacopoeia (Robinson & Kuanpoth, 2008).

2.2.5 Use of plants in traditional medicine

Several ethnobotanical surveys have demonstrated that medicinal plant uses are wide and various, most of which are harnessed for medicine and some for food, construction and building materials, and some are exploited for sociocultural events (mainly ceremonies and cultural rituals). Medicinal plants have also been explored for agroforestry, as ornamental flowers, barrier hedges, shade provision, wind breakers, fire breakers, soil improvers, stemming soil erosion and few act as indicators of pollution (Ulian *et al*., 2016). From these numerous medicinal plant uses, the traditional medicine trade and practice continue to be a major source of income and therefore supports lives and livelihoods (Augustino & Gillah, 2005).

As much as local healers are major holders of TM medical knowledge, this knowledge is on a worrying decline due to urbanization, encroachment, western lifestyle, increased access to formal education, climate change, wanton deforestation, cultural erosion, underegulation and increased human settlements (Bussmann, 2006; Kiringe, 2006; Brandão *et al*., 2013; Kipkore *et al*., 2014). General decline in medicine plant resources has also been linked to overgrazing among the pastoral and agro-pastoral communities (Bussmann, 2006).

In most ethnobotanical surveys, the tree habit is the most harvested growth life-form followed by shrubs and herbs. However, roots are considered the most utilized plant part followed by leaves, stem and barks, although the use of these plant parts vary with gender, culture and locality (Okello *et al.,* 2010; Kipkore *et al.,* 2014; Kaigongi & Musila, 2015).

2.2.6 Vegetables as source of traditional medicine

For many years, people have been using traditional vegetables with or without the knowledge of their actual medicinal importance. And just like for many medicinal plant species, traditional uses of local vegetables are established to be area-specific and ethnic-affiliated (Kimiywe *et al*., 2007). Most often than not, these vegetables are consumed by migrant populations to keep abreast with their traditional cultures or culinaries for medicinal use or harbouring perceptions of good health (Zhang *et al*., 2020).

A market survey of South Asian communities of Bradford in Northern England highlighted some common traditional vegetables that include *Asparagus racemosus, Brassica rapa, Colocasia esculenta, Cicer arietinum, Cordia dichotoma, Daucus carota, Coccinia grandis, Luffa acutangula, Hibiscus esculentus, Momordica charantia, Musa paradisiaca, Raphanus sativus, Solanum melongena* and *Brassica juncea* (Pieroni *et al*., 2007).

Traditional vegetable consumption are cross-cultural and form an important segment of dietary needs of many households. Vegetables are generally known to be good antioxidants and popular sources of vitamins, low fat and carbohydrates, low fibre and good sources of essential minerals (both macro and micro), proteins and amino acids.

A recent ethnobotanical survey in the Northern Uganda revealed a few dominant plant families that include Malvaceae, Fabaceae (Leguminosae), Cleomaceae, Asteraceae (Compositae), Solanaceae, Cucurbitaceae, Euphorbiaceae and Tiliaceae. The commonest traditional medicine vegetables species cited include the *Cleome gynandra*, *Hibiscus* spp., *Brassica oleracea, Solanum nigrum, Crassocephalum rubens, Acalypha bipartita, Cucurbita maxima, Capsicum* spp., *Crotalaria* spp. and *Cassia* (*Senna*) spp. (Kamble & Jadhav, 2013; Nakaziba *et al*., 2021).

In Bangladesh, commonly used medicinal vegetables include *Alternanthera, Amaranthus, Basella, Coriandrum, Chenopodium, Solanum, Ipomoea, Coccinia, Cucurbita, Spinacia, Lagenaria, Oxalis, Portulaca, Rumex, Moringa, Raphanus* and *Corchorus* genera (Rahman *et al*., 2015). Commonly cited vegetable herbs in Senegal include *Hibiscus, Senna, Leptadenia, Balanites, Boerhaavia, Cordia, Euphorbia, Manihot, Vigna, Tamarindus* and *Adansonia* genera (Mathieu & Meissa, 2007). Whereas in Turkey, common exploited herbs include *Salvia* spp., *Tilia tomentosa*, *Mentha pulegium*, *Ceratonia siliqua* and *Zingiber officinale* (Akbulut & Bayramoglu, 2013). These local vegetables have become increasingly important in the treatment of gastrointestinal disorders, reproductive and musculoskeletal diseases (Nakaziba *et al*., 2021).

2.2.7 Use of weeds as traditional medicine

Weeds have been exploited as medicine for many years, particularly by the rural folk who mainly collect traditional and local vegetables in farms, gardens and yards. Popular weed plant families exploited for medicine include the Amaranthaceae (for kidney diseases, sexually transmitted infections (STIs, inflammation), Euphorbiaceae (for stomach, chest infections), Poaceae (Gramineae) or the grass family (coughs and fever) and Fabaceae (Gastrointestinal disorders and diarrhoea).

Unlike the trees, shrubs and other growth plant habits, weeds are mainly herbaceous or woody, but whole plants or leaves are dominantly used for medicinal purposes (Panda *et al*., 2014; Abiodun & Tunji, 2019; Bhatt *et al*., 2021). Some of these weeds are also serve as nutritious local vegetables (Cruz-Garcia & Price, 2012; Maroyi, 2013). Undervaluation of the extent of destruction of useful endemic weed species is detrimental to the levels of existing local knowledge of those weeds in future (Khajoei &Esmailpour, 2019).

2.2.8 Traditional medicine markets

The proliferation of medicine market locations in both rural, peri urban and urban areas are linked to the positive attitude shown by growing TM users. Most users believe that herbal remedies have better efficacy, safe and easy to to use. Herbal markets serve as active retention centres of traditional medical and ecological knowledge and provide direction on having a focused conservation approach. These markets are ideal spaces for training and relaying knowledge to younger generation. Due to a relaxed regulatory and legal framework or lack of it, informal medicine markets can still be operated without proper certification, this provides a lacuna for trade in non-validated, non-standardized and non-vetted medicinal products.

Un-certifed practitioners are motivated by economic gains and lack of professional ettiquette. Established and properly regulated medicine markets have the capacity to vet both the practitioners and traditional medicine products (preparations, formulations, plant parts *et cetera*) where questionable products are removed from the markets (Uzun & Koca, 2020).

Traditional medicine markets in Kenya can be classified into three (3) categories namely herbal medicine clinics, final product dealers and semi-processing enterprises. Herbal clinics dispense prepared formulations and concoctions to visiting patients or buyers whereas the final product dealers sell processed plant products that are also sold in other retail stores and super markets. Lastly, the semi-processing enterprises deal with processed and refined plant products into powder, liquids and so forth. However, some medicine markets operate as pseudo-formal herbal clinics that sensitize would-be clients through electronic and print media (Muriuki *et al*., 2012; Ondicho *et al*., 2016). Commonly traded medicinal plant species from the three (3) Kenyan cities of Nairobi, Mombasa and Kisumu, and Mt. Kenya areas of Meru, Mbeere, Embu and Meru include the *Urtica dioica, Azadirachta indica*, *Moringa oleifera* and *Prunus africana* (Muriuki *et al*., 2012). The traditional medicine drugs are locally presented in several forms, some are crushed or grounded, presented as a paste or sold in inhalable forms.

These medicines can be administered as an infusion, applied topically as a poultice, through bathing, massage and some delivered as a smoke (Divakar *et al*., 2016; Taek *et al*., 2019). Therefore, herbal markets offer opportunities for showcasing and marketing these innovative herbal preparations, formulations and recipes (Uzun & Koca, 2020).

Ghana herbal markets are regarded as the most progressive in the Africa continent and has efficiently regulated TM markets spread across her major towns and cities. Some of the leading plant species sold in the informal markets of Ghana include *Xylopia aethiopica, Monodora myristica* and *Afromomum melegueti*. Frequently treated psychosocial illnesses and health concerns include women health issues and enhancement of sexual performance alongside the performance of cultural rites and ceremonies, issuing aphrodisiacs and treatment of STDs or sexually transmitted diseases (van Andel *et al*., 2012).

For smooth market operations, registered herbalists elect, select or appoint a market leadership that takes care of the welfare and interests of the registered members (Ondicho *et al*., 2016). TM market economies suffer usual setbacks of geographical remoteness and spiraling poverty (Coe, 2008). From the global market survey data of 2000 - 2014, countries with high importing advantage of medicinal and aromatic plants (MAPs) include Germany, USA, Singapore, Japan and Malaysia (Roosta *et al*., 2017).

2.2.9 Traditional Medicine markets and formalization

Over the years, formalization has gained prominence in both developed and developing countries. In Nigeria, for instance, a formal market is governed using a national regulatory framework that regulates medicinal plant sources, collection, processing, good handling, storage, distribution, advertisement, marketing and pricing. Standard processes must always be checked to ensure improved safety, quality and efficacy (Oguntade & Oluwalana, 2011). Liberians had a successful blend of both traditional and modern medicine particularly during their long civil war (Kruk *et al*., 2011).

The world still learns from the relatively developed TCM and Traditional Indian Medicine industries with regard to efficacious regulatory frameworks, policies, standards, integration practices and even efficient TM research models. Both progressive traditional medicine industries are founded on strong philosophies that have steered emerging markets in designing advanced therapies, drug discoveries and drug development (Patwardhan *et al*., 2005). Formalization intends to revolutionize supply of medicinal plants from dependency on collections from the wild to cultivation and domestication of prioritized and highly valued species. A systematic review of the Asia TM reveals a slow but dynamic shift from collection in the wild to cultivation sources. It also underscores the role of brokers or 'middlemen' in the overall TM enterprise (Astutik *et al*., 2019).

Therefore, formalization in the form of increased packaging of medicinal plant products and the growing demand by urban and peri-urban medicine markets, positively heightened the need for cultivation and domestication of most sought after medicinal plants (Muriuki *et al*., 2012). Formalization of herbal markets positively fosters conservation, sharing of benefits and increased revenue. It also opens space for exploitation of those in the base of pyramid through formal exploitation, heightened marginalization and unfair trade practices (Wynberg *et al*., 2015). Safety of TM products have been pegged on age-old usage and limited scientific evidence where no users have reported adverse reactions or side effects (Mosihuzzaman, 2012; Mensah *et al*., 2019). TM formalization agenda in advanced nations have enabled setting up of research institutions, for instance, colleges, hospitals, research organizations and pharmacies to advance formal development agenda (Han & Ballis, 2007).

2.3 Modern and traditional governance of the practice of traditional medicine.

2.3.1 Stakeholder theory in the effective governance of traditional medicine.

A stakeholder can be referred to an individual or a group that are positively or negatively influenced by actions and decisions related to trade, value creation and consequent improvement (Freeman et al., 1984). Traditional medicine key stakeholders include the Traditional Medicine Practitioners, market traders, traditional medicine vendors, buyers, professional experts, county/government officials, relevant institutions and regulators. Stakeholder theory could be aptly applied in the social, environmental and sustainability context where it proposes a raft of solutions to prevailing challenges in the traditional medicine sector. Major theoretical challenges reported include anchoring and creating sustainability citing nature as a key stakeholder component. Freeman called for a clear audit of expectations of both stakeholder and societal standards (Freeman *et al*., 1984). The common Stakeholder theory key instruments include incentives and the legal aspects, and they serve to bolster normative expectations (Elms *et al.*, 2002).

An acceptable legal regime must reconcile the interests of the ethical and legitimate stakeholders and demonstrate sensitivity to the cultural beliefs of the local communities, their moral, economic and bonafide rights to health and privacy. Any engagements with TK bearers should also observe the local communities rights to benefit sharing and fidelity to the consented prior informed consents (Vadi, 2007).

The overall flow of the study was summarized and projected in the conceptualized framework as shown in Figure 1.

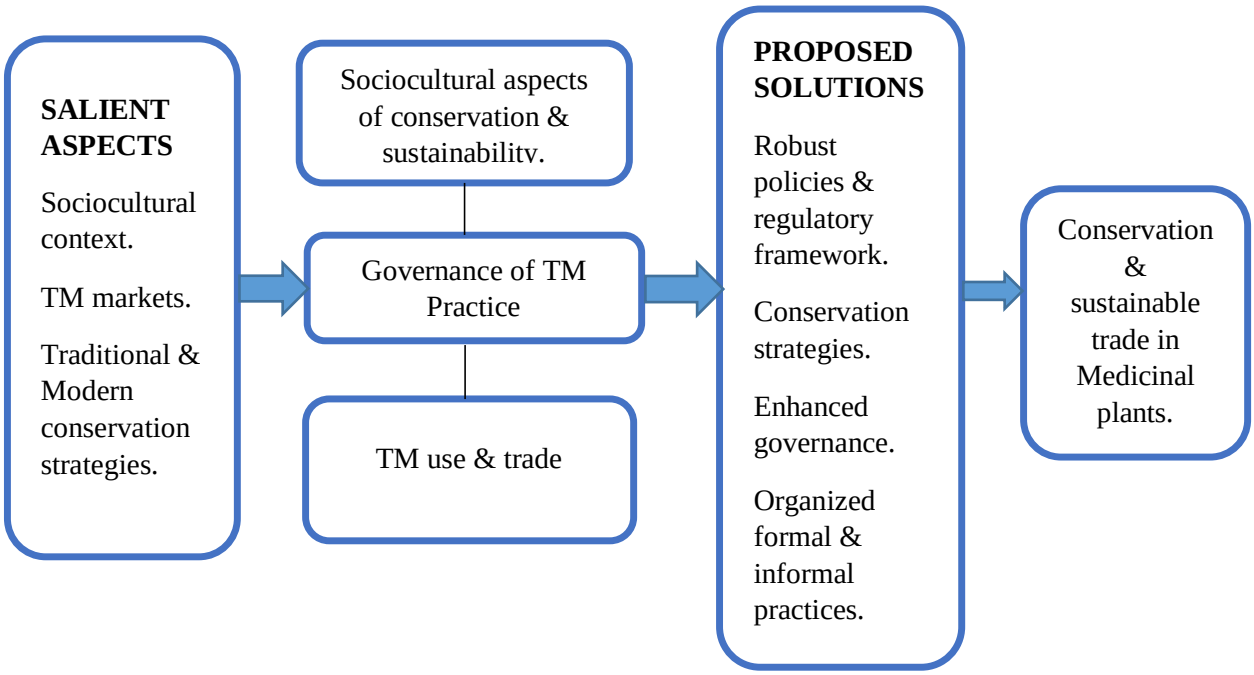

Figure 1. A diagrammatic representation of the theoretical framework of the survey (Modified from Hörisch *et al*., 2014).

The survey looked at the contributions of the major TM players, describing the current state of traditional medicine practice and laying future prospects about the traditional medicine trade. The key stakeholders therefore include those who seek value and have a desire to contribute positively or benefit from the traditional medicine trade or practice (Freeman *et al*., 2010). Stakeholder theory places strong emphasis on ethics with limited recognition on incentives thus curtailing its goal of providing managerial direction or predictability of actions.

The Stakeholder theory vaguely espouses normative doctrine where decision makers appreciate the interests of all legitimate stakeholders although marginally, and aid in the allocation of resources. Observation of clear priorities and decision making leads to appropriate actions being taken on the set priorities.

In the provision of universal healthcare, it is imperative to align both ethical standards and incentives since incentive structures enable realization of ethical behavior (Elms *et al*., 2002). However, Pinto (2019) posits that successful performance management requires a blend of both Stakeholder and Paradox theories. The Stakeholder theory tackles several seamless and sometimes conflicting goals of many stakeholders whereas Paradox theory tackles how various tasks or conflicting priorities are executed and resolved. In essence, the Stakeholder theory answers the 'what' and the Paradox theory answers the 'How' of an effective performance management.

The Stakeholder theory also serves to enrich the Resource-based view theory by adding normativity, sustainability, viewing people beyond resources and allowing more space for cooperation. Based on this useful blend, a huge potential lies in the combination of both Stakeholder and Resource-based view theories (Freeman *et al*., 2021). However, the most common set back of the Stakeholder theory emanates from conflicting interests and expectations from diverse cultures (Fadare, 2013).

Habermas's theory of deliberative democracy together with the right to health has been positively identified to bolster community and individual participation in the overall implementation of a robust health policy. This theory aids a stakeholder in demonstrating the power of speech and credible legitimacy where participation is expressed beyond consultation, community mobilization and awareness programmes (Mulumba *et al*., 2021). A collaborative engagement based on democratic deliberation equitably tackles diverse ethical challenges (Tilburt & Kaptchuk, 2008).The Stakeholder Theory has grown in prominence and application since 1984 and has aided the general understanding of the stakeholder characteristics, behavior, values, cultural position and broader social context.

A robust stakeholder approach must protect the needs and interests of legitimate stakeholders that include research and regulatory institutions, TM practitioners, herbalists associations, vendors, collectors, buyers, county and national government officials (Freeman, 2004; Miles, 2017; Wood *et al*., 2021). Other active stakeholders include scientists, legislators, policy makers, herbarium curators, plant taxonomists and members of local communities. The stakeholder theory enjoys wider acceptance and applicability replete with wide-ranging narratives, interpretations and multi-contextuality therefore serving diverse disciplines (Miles, 2017).

The strength of the stakeholder theory lies in its integrative and overarching advantage to other related models and theories, for instance, the resource-based view, cognitive and institutional view theories. This overarching theoretical ability of the Stakeholder theory help in the projection of the critical concepts of ethics, human relationships and environment. Ethical guidelines in the traditional medicine sector implicitly refer to the quality of natural products, involvement of all legitimate stakeholders in key decision making and thorough purge on unqualiafied practitioners (Freeman, 2004).

2.3.2 Basic principles of Good Governance

The five most outstanding principles of good governance that is applicable to traditional medicine industry include: legitimacy and voice, direction, performance, accountability and fairness. Legitimacy and airing one's voice is considered *via* active participation and consensus building. Direction encompasses a broader and long term perspectives on governance and development, whereas performance principle involves responsiveness to all stakeholders, effectiveness and efficiency of institutions and processes in delivering results to the legitimate stakeholders. Accountability principally entails making good decisions and taking responsibility for actions and processes.

Good governance encompasses elements of transparency where it ensures a free flow of credible, reliable and well-thought out information. Finally, fairness is a key principle of good governance that entails equity and fidelity to the rule of law (Graham *et al*., 2003). These basic principles of good governance are reflected in aspects of environmental governance and ensures that processes are effective, equitable, responsive and robust in nature. This should be accompanied by the capacity to showcase important elements of good governance in institutional, structural and process driven sense. This included constitution and framing of efficient and pragmatic regulations, making smart decisions, policy making, resolution of emerging conflicts and taking responsibilities for decisions, actions and constituted regulations (Bennett & Satterfield, 2018).

Outcome-oriented and process-oriented approaches have proved effective in the evaluation of good governance as far as natural resources are concerned (Rauschmayer *et al*., 2009). The eight (8) outstanding governance principles include legitimacy, direction, performance, accountability, fairness, inclusiveness, capability and transparency are widely documented and are considered significant in gauging good governance (Pomeranz & Stedman, 2020).

2.3.3 Critical aspects of Traditional Medicine governance

Stoll-Kleemann *et al*., 2006 highlighted the effective governance of organizations which can also be applied in most indigenous medical systems. These indigenous systems are controlled by the laid customs and traditions of local communities. Regulation of traditional medicine products, practice and information require timely policy interventions in the provision of subsidies for local practitioners and also guide the industry. Therefore, the implementation of sound and robust policies is often constrained by political will, funding and conflicting opinions from legitimate stakeholders (Spinks & Hollingsworth, 2012).

Good policies therefore, should prioritize traditional medicine quality and safety concerns and bolster a functional public agenda that engenders the sociocultural, economic, political, ethical and equity values, knowledge creation and management, capacity building and expansion of the research environment. An advanced complementary and alternative medicine sector endeavors to reduce existing gaps or lacunae and render the complementary or alternative, orthodox versus conventional debate redundant (Bodeker & Kronenberg, 2002).

However, the increased need for herbal remedies may trigger conflict as a consequence of over-harvesting or over-exploitation and the need for sustainable means of plant resource management (Kunwar *et al*., 2013). This calls for urgent adoption of good harvesting etiquette for medicinal plants so as not to deplete the natural sources (Augustino & Gillah, 2005). Addressing critical health safety concerns and their contribution to national development should be consistently checked and valued by traditional medicine stakeholders. The practitioners and key players in the industry must respect sovereignty in line with established national or international borders, and institute checks on biopiracy (Sen & Chakraborty, 2017; Harrington, 2018).

The progressive 2010 Kenyan constitution clearly spells out and underscores the "role of science and indigenous technologies in the development of the nation" and empowers national assembly to "recognize and protect the ownership of indigenous seeds and plant varieties, their diverse genetic traits and their use by the communities of Kenya". Existing health regulatory laws and policies as currently constituted are ambiguous and less efficacious hence the need for rigorous tightening and enforcement measures (Okumu *et al*., 2017).

2.3.4 Modern and traditional governance practices of Traditional Medicine

Governance on an environmental point of view determines how decisions on prudent use of natural resources are made and actualized (Chaffin *et al*., 2016; Greer, 2018). Traditional medicine thematic concept has been considered a pluralistic and diverse medical care that encompasses some aspects of religion and spirituality. In some instances, it involves the use of incantations, animal sacrifice, exorcism and herbs (Ozioma & Chinwe, 2019). The growing interest in TM plant resources is connected to the challenge in combating common diseases using modern and biomedical science (Job *et al*., 2016; Kala, 2017; Misawa *et al*., 2019).

Some consumers of TM products have fully embraced TM as an additional therapy (Othman & Farooqui, 2015). Globally, a number of pharmaceutical drugs have been extracted from medicinal plants (Sen & Chakraborty, 2017). Other than healing, the TM practice is notably significant for income generation and in the improvement of lives and livelihoods of traders or practitioners (Hishe *et al*., 2016). Some medicinal plants are also exploited value addition in lucrative cosmetic industry and also critical in the food industry (Makunga *et al*., 2008). In addition, the conservation of biodiversity must go hand in hand with sustainable utilization designed to visualize, realize and actualize a self-sustaining universal primary healthcare system (Eshete & Molla, 2021).

Traditional medicine remedies increasing popularity among local communities has also been attributed to their huge cultural importance (Wassie *et al*., 2015; Umair *et al*., 2019). Lack of adequate formal documentation of traditional medicine contribute to a continued loss of ethnomedical information and accompanied loss of tribal cultures and customs (Bhat *et al*., 2013; Jaganathan *et al*., 2015). Local medicine markets have recorded an increased value with regard to the entire traditional medicine enterprise but their exact nature, governance and complexity is still not clear and largely undocumented (Bussmann *et al*., 2016).

Proper management of these markets are primarily achieved via effective harnessing and processing technologies (Kunwar *et al*., 2013). TM trade in Nepal and China was estimated to grow 9-fold since 2011, a trend attributed to the growing demand in China and the resultant improvement of the Nepal's transport infrastructure (He *et al*., 2018).

Globally, income attained through the sale of botanicals have been estimated at annual value of 32.702 billion USD with nearly half of these earnings attributed to the vibrant Asian TM markets (Riaz *et al*., 2021). The three (3) critical issues in practice of herbal remedies include proper documentation, efficacious legal and policy framework, and finally, effective traditional medicine mainstreaming and integration (Kigen *et al*., 2013).

In addition, the major challenge in the current development of traditional medicine is irresponsible bio-prospecting and biopiracy phenomena where the local communities and knowledge holders risk losing their heritage to undeserving entities. This challenge triggered the recognition and compensation debate that stressed on the need and significance of ethnobotanical knowledge (Eldeen *et al*., 2016).

As a remedy, sound traditional medicine policies will help protect traditional knowledge systems and tame biopiracy and unscrupulous bioprospecting networks (Mposhi *et al*., 2013). Bioprospecting refers to the search for new substances, for instance, active ingredients and bioactive compounds from natural resources. It capitalizes on the cumulative traditional knowledge not protected by ethical intellectual IPR, but conflict arises when local communities fail to get a share from the exploited resources (McGaw *et al*., 2005).

2.3.4.1 Modern Governance Practices

The outstanding aspects of modern governance relies on superb legal and policy framework, therefore a vibrant traditional medicine industry should have proper definition of what traditional medicine entails, ensuring efficient and procedural formulation of laws and policies (Kala, 2017). Slow and protracted struggle to have an efficacious and robust traditional medicine act may be attributed to several factors including low levels of public participation and underwhelming inclusion of key stakeholders. Furthermore, the requirements of the practitioners to have some formal training, uncertainty and worries in the decline of TM knowledge and the composition of traditional medicine committees/authorities/councils has cemented the marginalization of traditional healers. In addition, the under-representation of traditional healers in the constitution of regulatory laws and limited participatory or lack of it, contribute to further alienation of traditional healers in the entire legal process. Generally speaking, the key drivers of sustainable governance include new technologies, demographics and robust institutions. And more so, the importance and relative significance of the three (3) identified theoretical pillars of governance and their respective competencies namely: power (leadership, building relations, empowerment); knowledge (adaptiveness, knowledge cooperation, knowledge sharing); norms and values (inclusiveness, pluralism) cannot be underestimated (Monkelbaan, 2019).

The study focused on several aspects of MGPs relevant to traditional and informal medicine markets including the acts and bills of parliament; policies and regulations; government plans; sessional papers; county laws and by-laws. As much as the dynamic power tussles exist between various traditional medicine stakeholders, the power of modern institutions lie in the application of western knowledge discourses that are sometimes considered hegemonic and occasionally advance marginalization of traditional practices (Shava, 2011).

Netzer *et al.* (2021) downplayed the differences between developed and developing countries with regard to TM regulatory frameworks. Japan, Germany, India and China demonstrate tougher TM regulations and resultant less safety concerns as opposed to countries like USA and South Africa which lacked stricter laws or had relaxed TM regulations. Equally, countries with less strict TM regulations showcase greater challenges in efficient registration of TM practitioners and products.

2.3.4.2 Existing legal and policy frameworks of TM in Kenya.

Witchcraft Act, 1925.

This imperial and retrogressive act outlawed any practices related to witchcraft, traditional or cultural acts considered averse to the colonization agenda and imperialism. The victimization of local healers and punishment attached drove many authentic TM practitioners away from practice. As a consequence, most legitimate practitioners lived in constant fear of being arrested, jailed or given hefty fines or even brutally and severely punished by the colonial administrators.

CITES, 1963.

The CITES convention is a globally and internationally acclaimed agreement ratified by many progressive nations of the world and was officially drafted and adopted in 1963. The convention and agreement pledged to tame the sale of endangered flora and fauna through well monitored customs, import and export avenues. Technically, all members of CITES are also party to the IUCN. Kenya ratified CITES convention in 1978. CITES categorizes species in two appendices namely appendix I and appendix II. Species listed in Appendix I category are not allowed to be traded or harvested from the wild, whereas species listed in Appendix II category are allowed to be traded after meeting set stringent biological and legal requirements before exporting any material (IUCN, 2001; Lange, 2002).

Alma-Ata Declaration, 1978.

The Alma-Ata declaration addressed gross inequalities in healthcare and tasked governments to create legal checks for sustainability of primary healthcare for all. Alma-Ata is the present day Almaty.

Development Plan, 1989 – 1993.

This ratified plan promoted traditional medicine practice and highly considered the social capital of local healers. The plan also advanced the need for professional vetting and registration of all legitimate practitioners.

CBD, 1992.

The ratified CBD convention or widely known as the Convention on Biological Diversity espouses similar ideals with the Nagoya protocol in transparent and procedural sharing of traditional knowledge, natural resources and benefits accrued from their sale or exploitation. It underscores professional botanical determination and recognition of accurately identified ecological indicator species. It also advocates for sustainable conservation and utilization of biological resources (Jasmine *et al*., 2016).

KNDP, 1994.

The KNDP policy advances cultural ideals and effective mainstreaming and successful integration of traditional medicine.

Certification and Recognition of TMPs.

The traditional medical and herbalists associations or groups advances the recognition and certification of her members to allow for uninterrupted practice and preclude any form of conflict with the regulating authorities, county and national governments. However, the reluctance to join herbal associations by some practitioners is fuelled by the desire to protect their TK and cultural medical knowledge (Enumah *et al*., 2016).

Professionalization of the industry fosters recognition and places traditional healers at a pole position to access and tap government support resources and services. In addition, Traditional Medicine and Herbalists Associations promote coordination and cohesion among the local healers to mitigate tensions and create a common understanding with which to achieve common goals and interests (Devenish, 2005).

Continued escalation of tension and polarized relationships between traditional healers and biomedical practitioners prevents access to quality healthcare services (Haugan & Eriksson, 2021). However, traditional values of respect, compassion and empathy tends to cut across both traditional and orthodox medicine (de Andrade, 2011).

WHO TM strategy, 2002 – 2005.

The 2002-2005 WHO strategy was passed to help low and middle income countries reduce mortality and morbidity. Its four (4) key objectives include the prioritization, ensuring unparalled quality, streamlining of TM and CAM in the universal healthcare, increased access to TM, effective integration, drug efficacy and safety standards and lastly promote safe drug administration (Mothibe & Sibanda, 2019). WHO guidelines on herbal products helps in streamlining the traditional medicine industry, put strict emphasis on quality, improve research methodology and evaluation, foster regulation, ensure high safety and monitoring standards and promote a healthy national policy.

Stringent EU council directive 65/65/EEC treats herbal products and allopathic medicines with respect to quality and the need for prior marketing approvals. These stringent regulations help rid the market of non-standardized medicinal products (Ajazuddin, 2012). With successful integration efforts and seamless cooperation between modern and traditional systems of healthcare, medical pluralism has been realized in China and India. Medical pluralism can be effectively demonstrated in the adoption and consequent integration of traditional medicine practice with conventional medicine (Oliver, 2013).

The route to attaining considerable integration can be assessed by the levels of education, regulation, finance and monitoring. This is geared to achieving efficiency, quality, sustainability, accountability and resilience. The faster TM is integrated into the the primary healthcare the easier the path to realizing the envious objective of the universal healthcare (Park & Canaway, 2019).

National policy on TM and Regulation of Herbal Medicines, 2005

This policy increased awareness on the cardinal requirements of drug safety, efficacy and quality. Apparently, few countries have established proper registration and recognition of traditional medicine products.

Sessional paper, 2009.

The 2009 Sessional Paper prioritizes the importance of traditional medicine and engenders the establishment of relevant research institutions, consider high safety and efficacy measures, promote effective regulation and espouses critical conservation approaches. The paper also advanced the key principles of fairness, the right to accessing good health, transparency and equity. The elimination of hiccups in the traditional medicine practice, sharing of information and governance was highly valued.

The Medicinal plants and TM Bill, 2010.

This bill intended to properly outline, segregate, refine and define traditional medicine products and clearly distinguish it from other categories of medicine. It proposed the creation of health councils and collaborative engagement with other partners in the TM industry. Due to dwindling natural plant sources, the bill was designed to sensitize practitioners and other actors to consider medicinal plants domestication and also further the formalization agenda, recognition and certification of local healers.

Health Bill, 2012.

The 2012 health bill properly defined and introduced the role of a certified health worker and further sets out what TM entails. It proposed the unveiling of coordinating authorities with its members drawn from key stakeholders and pushed for heightened regulatory measures.

The Traditional Health Practitioners Bill, 2014.

The 2014 traditional health practitioners' bill further advanced the formalization agenda by introducing proper licensing, effective training and registration processes for local healers.

The bill also clearly defined the traditional health practice and sets out the wide ranging expectations from the stakeholders. In addition, the bill revived the issue of councils drawing members from all actors in the industry and eliminate the feeling of under-representation.

WHO TM strategy, 2014 – 2023.

This decade long planned strategy promotes the utilization of TM in improving health, wellness and more focus on the people, promote relevant education, allow safe use of TM and continue sensitization programmes and training of TM/Complementary and Alternative Medicine practitioners.

Health Bill, 2015.

This progressive health bill of 2015 clearly outlined the roles and contribution of TM in the provision of healthcare. Quite conspicuous was the proposal to establish a competent referral mechanism that enables a local practitioner refer patients to biomedical and allopathic practitioners.

Protection of TK and Cultural Expressions Act, 2016.

This law protects TK, culture of the people and their natural resources, and acknowledges its oral or verbal transmission. A proper governance structure should protect the traditional or local knowledge and guarantees its perpetuation through generations and at the same time protect holders of traditional medicine knowledge (Lah *et al*., 2015).

Local knowledge is often influenced by socioeconomic factors and mostly varies with age and profession (da Silva *et al*., 2019).

Health Act, 2017.

This progressive health act of 2017 institutionalizes the vetting and certification of health practitioners and propels the need for referrals from local healers to conventional health practitioners. This referral vision and integration of TM into the general healthcare service is yet to be realized.

Health Laws (Amendment Bill), 2018.

These amended laws appreciated the role of local healers and redefined the place of natural drugs and medicines in the centre of a properly functioning health sector.

Traditional & Alternative Health Practitioners' bill, 2019.

The 2019 traditional and alternative bill clearly and resoundingly defined the need and contribution of councils, their balanced formation and equitable representation.

Amended Health Laws and Act, 2019.

These amendment laws sets out to clearly define TM products and distinguish it from other allopathic medicines.

Health amendment bill, 2021.

This revised parliamentary legistlation advocated for the establishment of regional cancer centres in the local administrative counties. The bill criminalizes the act of demanding payments from patients before treatment and strongly against detention of cadavers as a coercion for payment of outstanding medical bills. The bill further enforces the right of any person to receive top notch health service and care, unconditional and prompt emergency treatment. The levying of charges has been effectively regulated to preclude exploitation of patients by unscrupulous medical officers.

Health (Amendment) bill, 2022.

This health amendment bill was anchored on the Health Act no. 21 of 2017 and was designed to develop policy guidelines on patient referrals outside the country.

2.3.5 Traditional Governance Practices in Traditional Medicine

Traditional governance practices reflect the sociocultural characteristics of the people as demonstrated by traditional healers. These practices sharply correspond to the cultures of the people and attract confidence from their respective communities.

This is also mirrored in the diversity of TM and natural products sold in different formal and informal medicine markets (McMullin *et al*., 2012). The informal measures of traditional medicine are potent in forging institutional collaborative engagement and push the fight against the scourge of biopiracy. Furthermore, traditional healers prominently feature various specializations, for instance, bone setters, traditional birth attendants (TBAs) and snake bite treatment experts.

Classical scientific systems consists largely of *Ayurveda*, an all-inclusive therapy which involves the use of herbs accompanied with regular diet, exercise and prescribed behavior. India over time has earned huge reputation in traditional medicine and it is widely referred to as a country of herbs where its traditional treatment is strongly dependent on herbs (Bhardwaj *et al*., 2018).

Ayurveda is simply defined as a science of life and a system that cure, prevent, or effectively treat human diseases. The contribution of the Indian *Ayurveda* in the economy both for local use and exports cannot be underestimated **(**Kala, 2017). In an African context, with a case example of Ethiopia, where traditional medicine practices are not only about about treating patients but focus on serving important sociocultural functions.

Major traditional practices include securing mental, physical, spiritual and material wellbeing. Traditional medicine therefore take several forms including preventative, curative or spiritual functions (Kassaye *et al*., 2006; Goswami *et al*., 2020). It has been proven that education, age and economic status have a significant effect in the consumption of TM products whereas the size of the religion, income and size of family had no significant bearing on the utilization of TM products (Wassie *et al*., 2015).

2.3.6 Integration efforts in Traditional medicine

Integration is multidimensional and covers broader aspects ranging from organizational, policy implementation to community-led efforts (Bodeker & Kariippanon, 2020). Integration also takes other forms, for instance, through unification, subjugation or equalization whereas non-integration breeds unprecedented marginalization and neglect (Holliday, 2003). Successful integration of approved traditional medicine practices can be employed sequentially and compartmentally or concurrently with biomedical healthcare (Oliver, 2013). Therefore, successful integration stories have been documented from various jurisdictions including Ghana where TM products have been recognized and listed in their National Essential Medicine, positive developments acknowledged in Tanzania, Sierra Leone and South Africa in the overall marketing and selling of traditional medicine products (Innocent, 2016).

2.3.7 Intellectual Property Rights of TK.

Dutfield (2014) decried lack of an efficient intellectual tool on traditional knowledge but expressed optimism of good tidings in future. Effective IPR provide a water-tight guard against defilement of community and practitioners innovations, cultural inventions and plant uses. The South American nations of Panama and Peru successfully showcased these stringent measures in the preservation of TK. India which sits atop in traditional medicine advancement demonstrates a properly revised traditional knowledge digital library (TKDL) which is regularly updated.

Enactment of efficacious *sui generis* regulations enable protection of TM makes it difficult for multinational companies to biopirate natural resources belonging to local communities. Measures laid to protect medicinal plants are sometimes curtailed by resource crunch and low levels of awareness at grassroot levels (Pati, 2017). Sensitization and awareness campaigns positively impacts the level of adoption of TM in the treatment of diseases. For instance, the traditional practitioners of Indonesia have revolutionized the dissemination of information on herbal remedies through the use of social media channels to reduce dependency on conventional medicine. Leading popular advertisement channels for traditional medicine (mostly processed and packaged herbal products) include brochures, radio, pamphlets, posters and even newspapers (Ndhlala *et al*., 2011; Suharti *et al*., 2021).

To prevent any loss of traditional medical information, traditional knowledge digital library systems helps in the conservation of authentic traditional medical knowledge, for instance, formulations via organized cultural documentations that include scans of texts, databases, organized texts, photographs, archives and inventories as governed by international standards of registries.

However, digital libraries are delicate, fragile and vulnerable to degradation (Reddy, 2006; Vadi, 2007). In established countries like China and India, the traditional knowledge digital library in industry clinically and efficiently processes their herbal products, package, label, advertise and even facilitate export to other countries (Enumah *et al*., 2016).

2.3.8 Enhancement of TM standardization

To ensure effective standardization of TKDL products, key quality indices for complete standardization include the macroscopic and microscopic examination (checking for potential adulterants), appropriate moisture content, ash value, organic matter, crude fibre, chemical evaluation, chromatographic and toxicological examinations (Folashade *et al*., 2012).

Japan and China have managed to stage a major crackdown on toxic herbal products and formulations and successfully removing them from the medicine market. Herbal medicine products that register adverse drug reactions or qualify as toxic substances are removed from circulation (Teng *et al*., 2016).

Standardization of TM dosages and determination of efficacy should also be extended to medicinal vegetables (Nakaziba *et al*., 2021). Notable challenges in the administration of traditional medicine must be confronted at all levels ranging from preparation, administration, to determination of potency and adverse effects (Isola, 2013). Standardization should also be applied to bioactive extracts in the determination of active compounds or ingredients, their efficacy and safety (Samy & Gopalakrishnakone, 2007; Singh *et al*., 2020).

Several factors that influence the quality of traditional medicine raw materials include levels of hygiene, the plant's habitat, harnessed plant parts and the collection period. Standardization should also be extended to techniques employed and regulation of data touching on safety, efficacy and quality (Saggar *et al*., 2022).

TCM leads the way in the enforcement of globally accepted standardization measures. This impressive development of TCM is hugely attributed to the level of government support in traditional medicine as opposed to meddling (Gromek *et al*., 2015; Wang *et al*., 2016; Zhou *et al*., 2019). Even in the established nations like India, standardization and quality control is still a major challenge in the controlled regulation of authentic raw materials, drug formulations and natural products. This challenge grows in stature courtesy of insufficient regulations that guides the manufacturing processes and successful realization and actualization of the 1940 Drugs and Cosmetics Act (Sahoo & Manchikanti, 2013). Scientific standardization and validation should also be clinically applied to enable accurate disease diagnosis and recipe preparations (Singh *et al*., 2020).

2.3.9 Traditional medicine market leadership

Traditional medicine markets are often underrated due to lack of a clear leadership framework. This notion is supported by the absence of measurable leadership parameters, for instance, specific traditional medicine policies, standards, safeguards, codes of ethics and practice. Traditional medicine stakeholders believe that authentic practitioners do what is right devoid of spurious medical claims and demonstrate Kant's idea of Good Will.

The demonstration of an intrinsically driven good help combat unethical practices drug alteration, irresponsible practices and total disregard of approved processes and guidelines. Kant's idea of Good Will simply translates to exercising the right thing for the right reason and not being conflicted in any way by selfish interests (Ariche & Tamunosiki, 2019).

Adulteration of traditional medicine products can be explained as an addition of extraneous ingredients into a pure mixture with the fraudulent intention of enhancing its quality or quantity (Zhang *et al*., 2012). Adulteration in the form of substitution calls for robust national or international checks through stringent regulatory systems (Santhosh Kumar *et al*., 2018).

The major fear that traditional medical practitioners and to some extent enlightened consumers have is the infiltration of counterfeit and 'contraband' medicine products into the medicine markets. The same headache is true for allopathic medicines where cheap generics are frequently sought by consumers who cannot afford original biomedical health products (Howland, 2021). Creation of a comprehensive herbal product authentication system starting from a unique identifier to a robust trade policy help stem species adulteration and irresponsible drug substitution. This can be stepped up further by developing multiple crude drug repositories that are used as reference materials for standardizing approved botanicals (Srirama *et al*., 2017).

2.3.10 Traditional medicine hiccups

Some authors have elaborately documented the challenges afflicting the traditional medicine industry as demonstrated in Table 1. Interactions may occur between different consumed herbs or in the case of integration it may occur between herbs and biomedical therapies (Job, 2016). Apparently, these documented herbal-drug interactions may be wrongly viewed by most traditional healers as positive drug action or 'drug is working' lay assumption (Enioutina *et al*., 2016; Sen & Chakraborty, 2017).

Therefore, in traditional medicine practice, it is not easy to distinguish between actual drug action and clinical toxicity. Over the years, indigenous health systems have faltered due to the absence of equitable administrative structures and inadequate policies (MacIntosh, 2017). Regionally, skepticism dominates the integration debate as local healers' continue to demonstrate stubborn reluctance to share their medical knowledge with biomedical practitioners (Boateng *et al*., 2016).

Table 1. TM hiccups and challenges as summarized by Job *et al.* (2016) and Sen & Chakraborty (2017).

Aspect	**Hiccup**
Processing & Harvesting	Good harvesting practices and processing steps.
Clinical trials	Drug action and toxicity tests
Administrative challenges	Regulatory and monitoring checks
Pharmacovigilance	Identify and evaluate drug side effects, Drug safety.
Quality & purity	Accurate folk ethno-taxonomy and scientific plant determination, quality checks, stringent drug processing.
IP	Preservation of TK and folk medical knowledge.
Quality control & integrity of products	Strict and careful drug manufacturing processes.
Infrastructure	Quality enhancement
R & D	Drug action and movement

Correct determination of plants or plant parts precludes toxicity emanating from self-medication. Poisoning has been reported in cases where plant mis-identification occurred or where wrong plant parts are prescribed to clients, wrong formulations or preparations, faulty administration channels and/or blunders mostly committed by inexperienced or inept practitioners (Fennell *et al*., 2004). Inconsistencies in herbal regulations or lack of it provides lacunae for quacks and exposes the markets to the sale of toxic medicinal plant materials and products by some unscrupulous traders (Kim *et al*., 2013). Demeke *et al*. (2020) asserts that Ethiopia has not yet fully adopted complete herbal medicine regulations to attain an autonomous herbal regulatory mechanism.

Fidelity to both traditional and modern medicine ethical requirements and not compromising personal and business interests is a sure way of maintaining impeccable traditional medicine standards, trust and bond (Jamal, 2006). Traditional medicine consumers easily relate and identify with the local healers' language and their distinct medication, and only seek alternative treatment when traditional medicine fails, and the converse is also true particularly when conventional medicine fails (Lampiao *et al*., 2019).

Animal Toxicity tests have revealed cases of hepatotoxicity or cardiotoxicity and therefore clinical tests are highly recommended before approval for human treatment (Gromek *et al*., 2015; Karimi *et al*., 2015; Moshabela *et al*., 2016). Regarding trade in traditional medicine, the exact volume can only be estimated due to the nature and complexity of traditional medicine markets (McMullin *et al*., 2012). The increased demand for folk medicines aids in the reduction of dependency on biosynthetic medicines (Hassan, 2020). Other challenges in traditional medicine can be linked to modern pressures and disproportionate extraction of timber and non-timber products from useful tree species (McMullin *et al*., 2012; Kewassa *et al*., 2015).

Regarding the proper trade in TM, the challenge sellers face include weak business acumen and little knowledge in contaminant proof packaging, poor marketing and pricing skills, challenges in banking and lack of good record keeping for TM stocks (Hilonga *et al*., 2019; Ndawonde, 2021; Abisoye *et al*., 2022). Even developed nations experience difficulty in keeping good records of sales data and purchases and therefore not easy to determine the exact market value, trade volume and distribution networks of invaluable NTFPs. In many areas, lack of a comprehensive market tracking programmes becomes more apparent and the growing need for unveiling profitable/productive and relevant market-centric programmes becomes a reality (Kruger *et al*., 2020).

The traditional medicine industry generally should direct efforts to refine identification of pharmacologically active constituents and even escalate these efforts to clinical and non-clinical trials. In addition, other key practices that should be followed include good sourcing practices (GSPs), good manufacturing practices (GMPs) and observation of strict regulatory requirements (Ahmad *et al*., 2006).

Other standard operating procedures (SOPs) that emphasizes on quality and safety of medicinal plant products include good agricultural practices (GAPs), good laboratory practices (GLPs) and good supply practices (Kumar & Kumar, 2009). Traditional medicine or herbal products quality issues are categorized into external and internal issues. External quality issues are demonstrated by contamination, adulteration and wrong plant identification or determination, whereas internal quality issues include the complexity and lack of uniformity of traditional medicine products (Zhang *et al*., 2012). Leading contaminants and adulterants include but not limited to pollen grains, dusts, rodents, insects, microbes, toxins, pesticides, heavy metals, orthodox drugs and fungi.

These contaminants have been linked to some diseases, for example, agranulocytosis, organ failure, meningitis, malignancies, liver failure, intracerebral haemorrhage, cerebral edema, metabolic acidosis and in extreme cases, the development of coma. Herbal medicine contamination have also been linked to arsenic, lead and mercury poisoning (Posadzki *et al*., 2013). Product assessment and listing helps in the detection and elimination of irregularities for instance, toxic products, contaminants, exaggerated claims, irresponsible adverts, misidentified and adulterated or substituted elements (Yee *et al*., 2005; Woerdenbag *et al*., 2012). Whereas assessment of herbal medicines should be guided by WHO guidelines and governed by intellectual property (IP) rights established by WIPO or the renowned World Intellectual Property Organization.

The dictates of WIPO engenders innovation and creativity with its development of trademarks, industrial designs, patents and IP (WHO, 1991; WIPO, 2003; Kim, 2005). World Trade Organization member states enjoy the flexibility to constitute their *sui generis* systems of protecting their local or traditional knowledge. This is in line with uniform standards developed and set the consensus on matters relating to trade and IP that is designed to protect intellectual property (Wekundah, 2012). Therefore robust policies should enable a patenting system that provide exclusive rights to local communities on their traditional medical knowledge and realize favourable benefit sharing (Mposhi *et al*., 2013).

2.4 Sociocultural aspects that promote conservation of medicinal plant species

2.4.1 Sociocultural factors influencing the practice of TM

The reported ethnomedicinal diverse plant uses are intertwined culturally and vary among local communities. However, plant uses are influenced by various factors including dynamic lifestyles, social transformations, changing perceptions and progressive assimilation (Giday *et al*., 2009; Kunwar *et al.*, 2013).

In addition, taboos, cultural norms and societal restrictions with time have led to the constitution of informal regulations of TM and effectively prevent overexploitation (Augustino & Gillah, 2005). Bodin & Crona (2009) underscored the contribution of local organizations in the governance of natural resources and resolution of natural resource problems. Therefore, governance of health systems is a multi-disciplinary concept borrowed heavily from the social sciences (Pyone *et al*., 2017). Culturally speaking, significant gender roles have been reported to have had an influence on TM sustainability in local communities.

Regarding mastery of traditional medical knowledge, female traditional healers have demonstrated vast knowledge as compared to the male practitioners and are more likely to pass the knowledge to their daughters (Augustino & Gillah, 2005; Kipkore *et al*., 2014; Torres-Avilez & Albuquerque, 2017). Over the years, sociocultural systems have also been found to be instrumental in the determination of key health decisions as influenced by diverse and often conflicting perceptions that sometimes warrant mediation (King, 2012).

2.4.2 Sociocultural bound illnesses or syndromes.

Fajinmi *et al*., (2017) documented the association and linkage of TM to autochthonous cultures of the African people with respect to their tribal, ethnic and cultural affiliation, social lifestyles, their daily activities and diverse cultural dynamics. Gruca *et al*., (2014) proposed a revision of disease classification to include cultural diseases and disorders and rather culture-bound syndromes, which are broadly categorized as folk illnesses. Therefore, the multidimensional characteristic of TM was unambiguously re-defined to reflect cultural specific knowledge and experiences invaluable in the management of mental, psychosocial and physical health and wellbeing (Gakuya *et al*., 2020). Traditional medicines, primarily constituted of medical plants are largely regulated by indigenous customs and cultures of local communities.

These cultures are prominently and conspicuously intertwined and are liable to cultural erosion due to an ever growing globalized cultural environments (Kunwar *et al*., 2013). In this regard, sustainable trade in TM and continual entrenchment in the stable value chain propagates a rich indigenous knowledge base with respect to diverse plant uses (Salim *et al*., 2019).

Furthermore, psychosocial and hallucinogenic drug substances for years have been verbally prescribed for traditional ceremonies and functions. Other substances are prescribed for cleansing operations that involve the use of flower bath, holy water or perfumes, charms, herbal amulets and protective wrist bangles. The Samburu, who are close cousins of the culturally-rich Maasai people of Kenya hold a common belief that sociocultural illnesses or syndromes are mainly caused by sorcery attacks.

Therefore, their treatment must be conducted by only gifted and locally recognized diviners who are trusted by the local community. The application of TM mixtures or solutions in rituals or ceremonies in order to purge or exorcise spirits and remove curses are mainly conducted through sprinkling or spraying (by mouth or aided by by a plant twig, leaves) onto one's body (Fajinmi *et al*., 2017). In essence, ritual practices are extremely diverse, and consumption of herbal remedies for protection against sexual transmitted diseases, prevent accidents among the Benin populations have immense sociocultural relevance (Quiroz *et al*., 2014).

Most people have attributed these cultural illnesses to mythical and mystical causes, for instance, culturally or societally inflicted curses by kinsmen. Traditional medicine knowledge is often threatened or influenced by religion, state formal operations, proliferation of urban settlements, overharvesting or extensive use of allopathic medicines (Fratkin, 1996; Bussmann & Sharon, 2006).

Furthermore, traditional medicines are widely believed to eliminate or reverse adverse effects of sorcery or witchcraft and tame spirits not to inflict grievous harm to an individual, a society, community or local populations (Tabuti *et al*., 2003). Traditional medicine dispensed by sorcerers is a double-edged sword where they use their acquired supernatural powers to treat and at the same time cause harm depending on the request from the customer, buyer or client (Haque *et al*., 2018).

2.4.3 Notable sociocultural syndromes among communities

People tend to seek medication or treatment from traditional healers based on their intrinsic needs and interests and not based on real test diagnosis and epidemiological approaches. For instance, when seeking good luck, favours or spiritual assistance commensurate with their sociocultural needs and varying perceptions of illness (King, 2012). Several communities attach sociocultural importance to some medicinal plant species.

In Kenya, the Akamba community of the Eastern Kenya region have rich ethnomedicinal knowledge and history, and have grown their traditional medical knowledge over the years and passed to multiple generations. Documented species that are perceived to carry significant sociocultural healing and individual wellness among the Akamba people include: *Pupalia lappacea, Acacia mellifera, Polygala sphenoptera, Combretum exalatum* and *Evolvulus alsinoides* among others. They are commonly prescribed to buyers for assurance of good luck, success in business, as love potion and assurance of victory in major life ventures. The Kamba traditional healers have also prescribed *Flueggea virosa, Tragia brevipes* and aromatic *Vitex strickeri* plant species for spiritual functions aimed at reversing and undoing witchcraft spells and promote success.

The Common Star grass (*Cynodon dactylon)* has been widely documented as a cleansing medicine and for restoration of mental, spiritual and physical purity (Wanzala *et al.*, 2016). The local Samburu local healers use a wide variety of medicinal plants in the treatment of sociocultural bound illnesses. These plants include the *Rhamnus staddo* and *Toddalia asiatica* for epileptic fits and seizures, madness, and *Ficus wakefieldii* was reported to be useful in the treatment of long term infertility in women (Fratkin, 1996). Their close relatives, the Maasai use the Olive oil extracted from *Olea europaea ssp. africana* in virtually all their ceremonies and cultural functions, mainly in the conferrement of blessings, execution of age rites, and disabling witchcraft for good luck and pleasant fortunes.

In addition, the Maasai utilize *Dryopteris concolor* and *Athyrium* sp. ferns to confer blessings to women (Bussmann *et al*., 2018). There is a thin line between the use of TM in the curing of diseases or sociocultural cultural illnesses and execution and performance of magical functions, for instance in the presentation of offerings and performance of rituals (Macía *et al*., 2005). Quite intriguing is the use of herbal remedies in the determination of sex among the Marakwet people of Sangurur. The traditional healers of Marakwet reported the use of boiled roots of the poisonous *Calotropis procera* and *Capparis tomentosa* in the overall sex determination process, and are preferably consumed before conception (Kigen *et al*., 2017).

In the Tharaka-Nithi region, the colourful pod legume, *Abrus precatorius* L. has been identified to be of extreme importance in male circumcision functions. Other documented species include *Senna didymobotrya, Solanum mauritianum, Ricinus communis* and the *Podocarpus latifolius*. Most of these plant uses are known to be gender specific and culturally sensitive, in most occasions, their deeper meaning may not be easily disclosed, divulged or revealed to all sexes (Kathambi *et al*., 2020).

Several palm species have been found key in the execution of rituals and cultural events particularly in the sub-Saharan Africa. Some of the culturally useful palm species include *Hyphaene petersiana, Elaeis guineensis, H. coriacea, H. petersiana, Raphia hookeri, R. farinifera* and *R. vinifera and Phoenix reclinata.* Palm seeds and leaves are used in oracles and in presentation of offerings respectively. The palm oil, just like some medicinal plant species, is instrumental as a blending medium for various healing mixtures (Gruca *et al*., 2014).

In Benin, a rare Convolvulaceae called *Ipomoea argentaurata* is considered central in the conduct of culturally sensitive and unspecified ritual practices (Quiroz *et al*., 2014). In the popular Congolese market hub of Matonge in Belgium, fragrant barks of the *Commiphora* sp. and the aromatic *Cyperus esculentus* L. rhizomes are commonly sold. These scented plant parts are normally burnt inside a house and is believed to get rid of bad and evil spirits.

The Congolese Baluba people serve fresh leaves of *Ocimum gratissimum* L. with chicken and palm, and are usually given to in-laws in fulfilment of marriage rites (van Andel & Fundiko, 2016). Cultural export in TM for use by immigrant populations is still an active venture. Immigrant communities in far flung geographic regions of the world utilize imported TM products coming from their ancestral home countries, and they get used to utilizing their somewhat familiar TEK and sustain connection with 'home'. However, slight distortions in the consumption of imported indigenous knowledge often occur due to integration, assimilation or cultural erosion and thus shape indigenous cultures of adopted home countries. Evidently, these indigenous cultures are somewhat gradually susceptible to erosion or modification (Bussmann & Sharon, 2006; Volpato *et al*., 2009).

This is exemplified by the ethnomedicine of the Korea-Australian immigrant populations showcasing change and restructuring of their very authentic cultures and adjusting to the host country way of life (Han & Ballis, 2007). In the process of cultural assimilation, immigrant populations change or alter their autochthonous cultures to fit and adapt to their new home culture (Barimah & van Teijlingen, 2008). Medicinal plant exports help in maintaining these relative cultural identities, adoption of preferential means of treating cultural-bound illnesses and provide a sense of belonging to new immigrants (van Andel & Fundiko, 2016).

2.4.4 Sociocultural regulation of the practice of Traditional Medicine

Prominent and outstanding cultural aspects that are invaluable in TM include a viable choice of language, delivering the exact meaning and representation of what herbal remedies entails and determination of established social networks that mirrors diverse plant uses (Menendez-Baceta *et al*., 2014). Due to low levels of education by most practitioners', ethno-taxa is frequently employed in the regular TM practice.

The major disadvantage of ethno-taxa lies in the absence of taxonomic universality and their non specificity as opposed to validated taxonomic nomeclature and biosystematics (Bussmann & Sharon, 2006). Culturally endowed TM knowledge and informal practices are formally controlled through enforcement of sound formal and informal checks. This is exemplified by the issuance of certificate of practice to successful traditional medicine traders by the Department of Culture after thorough formal and informal vetting processes. The local governments institute daily levies payable by all trading TMPs. Some practitioners may possess licenses which may collectively be regarded as a true validation of authentic TM practice but this is subject to debate.

Scientific validation of age-old herbal remedies and indigenous knowledge enhances confidence among the consumers of traditional medicine in the traditional healthcare system (Ramawat & Goyat, 2008; Chinsamy & Koitsiwe, 2016). Licensing and stringent regulations should be extended to other key traditional medicine practitioners, for instance, importers, manufacturers, packers/re-packers and prior assessment before being allowed for sale (Yee *et al*., 2005).

Urban and peri-urban consumers interact with the traditional medical practitioners in the designated market spaces, open air markets, on streets and avenues, or even marked town squares. However, TM traders experience unwarranted discrimination and spite accompanied by the derogatory classification as witchdoctors or sorcerers. This spiteful categorization derails progressive advancement of the TM practice in third world countries. In the sub Saharan Africa, the strides made in the TM industry has been derailed for many years with the brutal enforcement of the imperial Witchcraft Act as witnessed in Kenya and South Africa, therefore calling for the creation and implementation of new and progressive TM regulations (Moshabela *et al*., 2016).

2.4.5 Governance from the sociocultural perspective.

TM leadership circles favours the male practitoners as opposed to female practitioners and this is normally evident in the election or selection of male leaders in various registered traditional medicine practitioners and herbalists associations. Cultural norms and traditional health beliefs with respect to individual philosophies influence the utility of TM in the restoration of individual good health, illness perceptions and attainment of a holistic healing approach (Peprah *et al*., 2019). The administration of TM is culturally guided by the silent and yet powerful informal TGPs. Some typical Kenyan indigenous cultural etiquettes do not allow women undergoing menstruation or actively breastfeeding to administer TM products as they are considered impure.

Other gendered perceptions involve the prescription of gendered blending drugs where some drugs are blended for male and female clients. To fulfil strict societal considerations, some local communities bar traditional healers from engaging in conjugal activities before and during the course of treatment as a sign of purity (Chebii *et al*., 2020). Cultural acceptability of TM particularly with the use of herbal remedies has been associated with folk healing beliefs (Agrawal & Danai, 2017; Bizuayehu & Assefa, 2017). The authentic TIK of the local medical practitioners influences the utilization of traditional medicine as directly prescribed by the traditional medicine traders for self-medication.

These talented and gifted local healers are entrusted with the major responsibility of preserving TM knowledge (Mathibela *et al*., 2015). This responsibility mainly lies in older practitioners who carefully select apprentices to train and mentor for a sustainable practice (Plieninger *et al*., 2020). Good governance measures should stem biopiracy and non-inclusive bioprospecting particularly those that take advantage of community's local resources.

Unscrupulous organizations that bio-pirate for selfish profit gains and exploitation of local community resources are a threat to traditional knowledge systems and cultural innovations (Ens *et al*., 2016; Ageh & Lall, 2019). Therefore, indigenous communities have adaptive and innovative traditions that promote conservation of their natural resources, cushion their environment from exploitation, and execrcise clearly defined socio-religious and socio-cultural practices (Onyekwelu, 2021). Ideally, the attitudes of local community members are dictated by their ecosystem needs and cultural-religious beliefs that guide local conservation approaches (Talukdar & Gupta, 2018). Sociocultural bound illnesses are better addressed using traditional medicine and more particularly the medicinal plants used. This is due to a wider believe that psychological and spiritual needs cannot be addressed using biomedical drugs or allopathic medicine.

CHAPTER 3

MATERIALS AND METHODS

3.1 General methodology

3.1.1 Study area

The study area was purposively selected following invaluable advice from the Cultural Officers and traditional herbal leadership prioritizing traditional medicine markets that have registered traditional healers. The seven (7) selected administrative counties and nine (9) markets that included Trans Nzoia (Moi's Bridge & Kitale), Vihiga County (Luanda), West Pokot (Makutano), Uasin Gishu County (Eldoret), Siaya County (Yala), Elgeyo Marakwet County (Kaptabuk & Arror) and the Kakamega (Kakamega market) were surveyed. The surveyed area coordinates were recorded and used to produce the study area map with the aid of a Quantum Geographical Information System (Q GIS) 3.6.4 (Figure 2, Appendix 1**)**. The population and demographics, soils and edaphic traits, agriculture and forestry of the surveyed locations were also covered (Chebii *et al*., 2020).

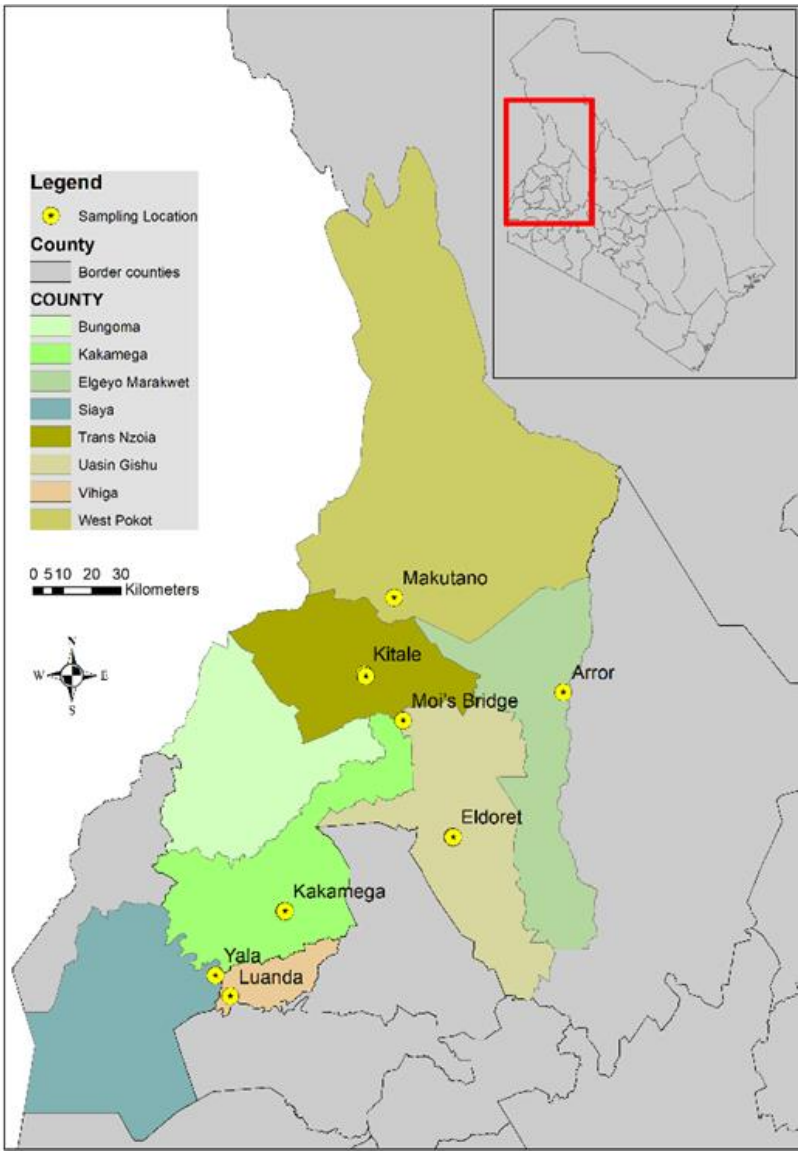

Figure 2. Sampled markets of Western Kenya.

The selected study areas met two key requirements namely: the availability and unlimited access to actively practicing traditional healers and the existence of a functioning TM market. The selected local healers introduced other respondents into the survey through a competent snowball sampling method. In addition, the lead professional experts who had direct contact with practicing traditional healers were interviewed at their Nairobi offices. Snowball sampling techniques aid in the identification of key persons or respondents in the study based on recommendations, experience and peer approval (Elfrida *et al*., 2021).

The most outstanding informant qualification considered included social legitimization and unbiased peer recognition as an authority in the research study, in this case, traditional medical knowledge (Albuquerque *et al*., 2014). The Kitale market is found in an agricultural hub in Kenya with good arable and fertile soils. The area has an altitude of about 1800m asl and records an annual rainfall of 1000 mm to 1200 mm, it also represents a highland equatorial climatic pattern. The area was previously categorized as White Highlands, and as the name suggests, a preserve of colonial White settlers or farmers. It later attracted an influx of migrants from all parts of Kenya for agricultural and entrepreneurial opportunities. The county is dubbed 'the food basket of Kenya' because its fertile arable soils and have the capacity to support many cash crops with many farmers also embracing livestock rearing. The county is predominantly inhabited by the Bukusu people of the Luhya community then the Nandi, Keiyo and Marakwet sub tribes and the Kikuyu ethnic community (Foeken & Tellegen, 1992; Foeken & Tellegen, 1994; Medvecky *et al*., 2007; Kagai, 2011).

The Eldoret market is the administration centre for Uasin Gishu County which is as high as 1,800 m asl. and receiving rainfall amounts of 900 mm – 1200 mm annually (Huss-Ashmore, 1996; Osundwa *et al*., 2013). The county is a rich agricultural hub, particularly for her milk and wheat production. In addition, the county has a stable textile industry, maize and pyrethrum farming. Just like Trans Nzoia County, Uasin Gishu County was also part of the White Highlands and a preferred habitat for White settlers (Youe', 1988; Braitstein *et al*., 2013; Gabriel *et al*., 2014; Kibiego *et al*., 2015; Akenga *et al*., 2017). Moi's Bridge is a cosmopolitan and a transboundary market and it is easily accessed by inhabitants of Uasin Gishu, Trans Nzoia and Kakamega counties. Kaptabuk and Arror surveyed markets have predominantly Marakwet speaking populations of the Kalenjin. The challenge of land adjudication and small land parcels is a common feature in the county highly characterized by mixed farming.

Elgeyo Marakwet has a considerable number of local healers practicing in the neighbouring counties, for instance, in the Uasin Gishu County (Gabriel *et al*., 2014). The medicine market in West Pokot is located in the business location of Makutano in the Kapenguria town. This county borders the Elgeyo Marakwet, Trans Nzoia, Baringo and Turkana counties. Majority of the inhabitants are the Pokot people of North Rift which is a Kalenjin affiliate. It records a biennial mode of rainfall in the range of 700 mm to 1600 mm in a year (Huho, 2012; Nyberg *et al*., 2015).

The Kakamega market is the principal administrative location of Kakamega County and a home to the dominant Luhya speaking ethnicities. The county is as high as 1580 m asl and has the iconic Kakamega forest which is widely perceived as a relic of the Guineo-Congolian and an afromontane forest (Fashing, 2001; Kasina *et al*., 2009; Fischer *et al*., 2010; Mukungu *et al*., 2016). It is also the most populous county with farmers owning relatively small land parcels (an average of 0.7 ha/household). The rich agricultural soils of Kakamega County support many crops including maize, sugarcane, vegetables and livestock keeping. The county also records high rainfall amounts that is more than 1500 mm a year (Kasina *et al*., 2009).

Luanda is a largely organized medicine market in Vihiga County and is mainly occupied by a Luhya speaking population. Vihiga County is as high as 2000 m asl but with relatively poor soils and decreased water retention capacity. It has a high population per sq. km and smaller farm plots, these very small land parcels support mixed crop and livestock farming (Soule & Shepherd, 2000). The population pressure in Vihiga County contribute to increased soil degradation and threatens food security (Tittonell *et al*., 2009). The Yala study area in Siaya is located on the Northern side of L. Victoria where the majority of her population showcase Luo culture, language and heritage. The elevation of the Yala is as high as 1400 metres above sea level and rainfall amounts vary from 800mm to 2000mm in a year. Yala has good agricultural soils that support mixed farming (Johns *et al*., 1990; Etyang *et al*., 2014).

Generally speaking, in all the surveyed counties of W. Kenya, West Pokot County is the most expansive region measuring upto 9123 square kilometres. Kakamega has the highest human population with Elgeyo Marakwet recording the least population (Kenya National Bureau of Statistics, 2019). The population and demographic data from the Volume 1 of the 2019 Kenya Population Census reports is tabulated in Table 2.

Table 2. Population and location data of the surveyed markets of Western Kenya.

SN	County	Human population	No. of Males	No. of females	Intersex persons	Land area (km^2)	Household number	Density Persons/km^2
1	Kakamega	1,867,579	897,133	970,406	40	3,017	433,207	619
2	Vihiga	590,013	283,678	306,323	12	564	143,365	1,047
3	Uasin Gishu	1,163,186	580,269	582,889	28	3,399	304,943	342
4	West Pokot	621,241	307,013	314,213	15	9,123	116,182	68
5	Siaya	993,183	471,669	521,496	18	2,530	250,698	393
6	Trans Nzoia	990,341	489,107	501,206	28	2,495	223,808	397
7	Elgeyo Marakwet	454,480	227,317	227,151	12	3,032	99,861	150

3.1.2 Forest ecosystems

Western Kenya is endowed with rich forest biodiversity and they include the Kakamega National Forest Reserve, Cherang'ani Hills forest ecosystem, Mau forest ecosystem and Mt. Elgon forest ecosystem. The Kakamega forest is a rich biodiversity hotspot that stretches beyond Kakamega County to the Vihiga County comprised of indigenous, mixed indigenous and exotic plantation vegetation. Among the listed flora of the Kakamega forests (Kakamega Forest Reserve, Kisere National Reserve, Buyangu National Reserve, Kakamega National Reserve, Isecheno and Yala Nature Reserves, Malava and Kaimosi forests) include the *Alangium chinense, Vepris nobilis, Trema orientalis, Trichilia emetica, Sapium ellipticum, Trichilia dregeana, Manilkara butugi, Spathodea campanulata, Kigelia africana, Rothmannia longiflora, Vangueria apiculata* and *Zanthoxylum gilletii.* Other documented species in the Kakamega forests include the *Croton sylvaticus, Trilepisium madagascariensis, Premna angolensis, Heinsenia diervilleoides, Albizia grandibracteata, Turraea holstii, Cordia*

abyssinica, Cussonia holstii, Piliostigma thonningii, Prunus africana, Dovyalis macrocalyx, Polyscias fulva, Strombosia scheffleri, Maesopsis eminii, Casearia battiscombei, Diospyros abyssinica, Erythrococca atrovirens, Gambeya albida, Aningeria altissima, Fagaropsis angolensis, Bridelia micrantha, Olea capensis, Croton megalocarpus, Alchornea laxiflora and *Bersama abyssinica.* In addition, *Ficus spp., Harungana madagascariensis, Markhamia lutea, Funtumia africana, Macaranga kilimandscharica, Maesa lanceolata, Clausena anisata, Blighia unijugata, Celtis gomphophylla, Chaectame aristata, Cassipourea ruwensorensis, Antiaris toxicaria, Sedum oblanceolatum* and *Zanthoxylum mildbraedii* were also documented (Fischer *et al*., 2010; Nyongesah *et al*., 2021; Osewe *et al*., 2022).

Other outstanding flora of the Kakamega forest national reserve include the *Chrysophyllum viridifolium, Argomuellera macrophylla, Tetrapleura tetraptera, Dissotis cryptantha, Turraea abyssinica* and *Strychnos usambarensis.* Kakamega forest is also a host to several endemic species in Kenya that include *Croton alienus, Commelina albiflora, Isoglossa membranacea, Tiliacora keniensis* and *Polyscias kikuyuensis* (Fischer *et al*., 2010). Oduor *et al*. (2022) documented species of sociocultural importance among the people of Ugenya, Siaya County that included *Milicia excelsa, Markhamia lutea, Ficus sur, Euphorbia tirucalli* and *Albizia coriaria.*

Uasin Gishu forests are basically an extension of the Mau forest block and it of comprised of patches of forests in Timboroa, Lorenge and Ainabkoi among others occupying about 6100 hectares (Chabeda-Barthe & Haller, 2018). Elgeyo Marakwet County has the rich Cherang'ani Hills forest ecosystem consisting of several forest blocks. The Kessup forest reserve located in the Keiyo area has both the indigenous natural forest and an exotic plantation. The notable species include the *Olea europaea, Podocarpus falcatus, Podocarpus latifolius, Juniperus procera* and the distinctive tree fern *Cyathea manniana* (Rotich, 2018).

Chebii (2016) explored the five forest blocks of the Cherang'ani Hills forest ecosystem namely Kipteber, Toropket, Tenden, Kerrer and the Koisungur forests that were uniquely characterized by the endemic *Senecio johnstonii ssp. battiscombei*. These forests were threatened by overgrazing and the invasive undergrowth of *Cestrum aurantiacum* and the herbaceous layer of thorny *Acanthus eminens*.

The dominant flora of the Cherang'ani Hills forest ecosystem consist of *Allophyllus abyssinica, Hagenia abyssinica, Neouboutonia macrocalyx, Juniperus procera, Podocarpus latifolius, Prunus africana, Rapanea melanophloes, Maytenus undata, Olea africana, Scutia myrtina, Dovyalis abyssinica* and the woody climbers of *Urera hypselodendron* and *Simirestis goetzei.* Other forest blocks of the Cherang'ani Hills include the Kapolet, Lelan, Sogotio, Chemurkoi, Cheboyit, Embobut and the Kipkunur forests which spread across the Elgeyo Marakwet and the West Pokot counties. The transboundary Mt. Elgon Forest ecosystem covers Kenya and Uganda countries and locally covers Bungoma and Trans Nzoia counties (Wekesa, 2017).

3.1.3 Dominant medicinal flora

A recent check of IUCN status of the Red listed plant species of the Nzoia River basin (covering Uasin Gishu, Elgeyo Marakwet, Kakamega, Siaya and Trans Nzoia counties) revealed that the vulnerable species (VU) include the *Entandrophragma angolense*, *Prunus africana*, *Vitex keniensis* and *Craterispermum longipedunculata*, whereas *Croton alienus* was recorded as endangered (Nasirwa *et al*., 2021). A survey of the Swampy vegetation of Uasin Gishu recorded distinct medicinal plant species that included *Carissa spinarum, Zehneria scabra, Acmella caulirhiza, Bidens pilosa, Baccharoides lasiopus, Cyphostemma adenocaule, Rubus apetalus, Leonotis nepetifolia*, *Sesbania sesban*, *Ocimum kilimandscharicum*, *Solanum incanum, Ajuga integrifolia*, *Pycreus nitidus*, *Cynoglossum coeruleum* and *Senna didymobotrya* (Mulei *et al*., 2015).

Medicinal plant species recorded in the larger Cherang'ani Hills forest ecosystem that covers Elgeyo Marakwet, Trans Nzoia and West Pokot counties include *Carissa spinarum* (antimalarial), *Sclerocarya birrea* (spleen and liver enlargement), *Mondia whitei* (an aphrodisiac), *Clerodendrum myricoides* (chest complications and pain), *Toddalia asiatica* (colds, coughs), *Erythrina abyssinica* (indigestive problems), *Syzygium guineense* (stomach pains) and *Aloe volkensii* (pneumonia).

Other medicinal species documented include *Ricinus communis* (against diarrhoea), *Basella alba* (menstrual problems), *Asparagus racemosus* (kidney ailments), *Clausena anisata* (heart infections), *Withania somnifera* (suppress labour pains), *Prunus africana* (against prostate cancer), *Periploca linearifolia* (Gonorrhoea and Syphyllis), *Warburgia ugandensis* (for respiratory illnesses), *Tragia brevipes* (treating rheumatism) and *Urtica massaica* against ulcers (Mbuni *et al*., 2020).

Kipkore *et al*., 2014 comprehensively listed the medicinal flora of the Marakwet of the Elgeyo Marakwet County, the outstanding species in the list include *Acacia brevispica, Coccinia grandis, Clerodendrum myricoides, Berchemia discolor, Clutia abyssinica, Croton dichogamus, Diospyros scabra, Maesa lanceolata, Portulaca oleracea, Sclerocarya birrea, Ximenia americana, Tragia brevipes, Kalanchoe germanense, Nuxia congesta, Lippia javanica, Calotropis procera, Boscia coriacea, Fuerstia africana, Hoslundia opposita, Ehretia cymosa, Caralluma acutangula, Leptadenia hastata, Lannea fulva, Euclea divinorum* and *Olea africana.* Most of the Marakwet TM were used in the treatment of cancer, heartburns, abdominal pains, amoebiasis and hypertension. On the other hand, their Keiyo counterparts have relatively similar list of flora where majority are used against gastrointestinal diseases.

Keiyo medicinal plant species include the *Acacia seyal, Sansevieria suffruticosa, Trichilia emetica, Capparis tomentosa, Maerua subcordata, Cissus rotundifolia, Terminalia brownii, Vepris nobilis* and *Balanites aegyptiaca*. (Cheruiyot *et al*., 2013).

The medicinal plants of the West Pokot have a striking resemblance to those of the neighbouring county of West Pokot where households favoured the domestication of many species that include *Lannea fulva, Azadirachta indica, Croton megalocarpus, Croton macrostachyus, Myrsine africana, Delonix elata, Teclea villosa, Ficus thonningii, Aloe graminicola, Vernonia amygdalina, Dalbergia vacciniifolia, Flacourtia indica, Commiphora edulis, Commiphora africana, Combretum molle, Schrebera alata, Cadaba farinosa, Syzygium cordatum, Pittosporum viridiflorum, Ziziphus abyssinica, Ochna insculpta, Tamarindus indica* and *Euclea divinorum (*Maina & Mandila, 2019).

The medicinal plants of the Kakamega biodiversity hotspot include the *Albizia grandibracteata* (against gonorrhoea), *Albizia gummifera* (STIs, Stomachache), *Clerodendrum pygmaceum* (flu), *Azadirachata indica* (skin conditions, malaria, aches and fever), *Clematopsis scabiosifolia* (Respiratory and opening up stuffed noses) and *Bequartiadendron oblanceolata* (digestive disorders and boils). Other recorded species in Kakamega include the *Trichilia emetica*, *Mondia whitei*, *Prunus africana, Diospyros abyssinica*, *Sapium ellipticum*, *Dovyalis macrocalyx*, *Entada abyssinica* and *Zanthoxylum gilleti* (Otieno & Analo, 2012).

Odongo *et al*., (2018) tabulated a comprehensive list of the medicinal plants of Kakamega that included *Harungana madagascariensis, Dicliptera laxata, Cyphostemma sp., Bridelia micrantha, Melia azedarach, Microglossa pyrifolia, Markhamia lutea, Rumex spp., Rubia coedifolia, Vepris nobilis* and *Solanecio manii*. The most sought TM were used against stomachache, malaria, backache and skin problems. The ethnobotanical survey of Emuhaya in the neighbouring Vihiga County recorded several medicinal plant species that include *Maesopsis eminii, Dicliptera laxata, Lippia grandiflora, Laportes ovalifolia, Antiaris toxicaria, Centella asiatica, Maesa lanceolata, Macaranga capensis* and *Fuerstia africana*. And like many other parts of Kenya, the herbal remedies were sought for stomachache and stem diarrhoea, and some were used against ulcers and mouth sores (Omale *et al*., 2020).

Siaya's medical flora include *Carissa spinarum, Acacia brevispica, Tamarindus indica, Grewia trichocarpa, Senna occidentalis, Tinnea aethiopica, Ximenia caffra, Vernonia amygdalina, Gomphocarpus physocarpus and Maytenus senegalensis* (Geissler *et al*., 2002). Most of the herbal remedies (*Lepisanthes senegalensis, Cassia spp., Harrisonia abyssinica, Ocimum spp., Schkuria pinnata*) were also used to treat gastrointestinal disorders, skin diseases (*Albizia coriaria, Ageratum conyzoides*) and respiratory (*Abrus precatorius, Lantana spp*.) ailments (Johns *et al*., 1990).

3.1.4 Study Research design

The survey employed a non-probability judgemental, deliberate or purposive sampling where the selected respondents were knowledgeable in traditional medical knowledge and are actively practicing in the surveyed markets. Judgemental sampling has an advantage of engaging a quality sampling frame and a representative sample. Non-probability sampling was selected for this study since there was no clear parameters of the target population at the start of the survey and relied more on peer approvals and recommendations from identified contacts and referrals. Judgemental sampling also allows the researcher to use his expertise or experience in the selection of an appropriate, relevant and fitting sample from a target population (Ross, 1978; Bhardwaj, 2019).

This sampling method is robust in the production of desired real time results from direct interaction with target respondents who have sheer mastery in their area of study (Bhardwaj, 2019). The selected respondents were taken through the semi-structured questionnaire and the study objectives. This exercise served as an assurance to the respondents that the study was mainly for education purposes and not for commercial exploitation of the enterprise. The medicinal plant names were captured mostly using the local vernacular langauges of the Kalenjin, Maasai, Luo, Swahili and Luhya. The selected respondents were allowed to introduce other experts into the survey through a competent snowball sampling process.

Snowball sampling method provides an opportunity for achieving a targeted, desired and quality data from professional experts (Espinosa *et al*., 2012). The advantage of a purposive or judgemental sampling lies in the selection of the best and knowledgeable respondents with the sole purpose of generating a quality and reliable data. It also works better in a research constrained by time and resources (Etikan *et al*., 2016). The unwilling respondents' and their reluctance to participate in the survey was largely blamed on high mistrust levels among different players in the TM industry. Among communities, TM knowledge is revered and considered sacred and treated with some level of cultural consciousness, reverence and sensitivity (Oliver, 2013). Therefore, interviewers must approach conservative respondents with extreme caution and cultural respect.

3.1.5 Sampling frame

Traditional medicine traders or medicine market practitioners, scientists and relevant ministry officials were the key study respondents (Table 3). The respondents were broadly classified into professional and traditional medicine experts. Thirteen (13) professional and 27 traditional healers were purposively selected and interviewed face-to-face. The professional experts were drawn from ministries, government institutions and departments, recognized universities, herbalists associations, research and regulatory institutions in Kenya and served to pretest the semi-structured questionnaires and played an invaluable role as key informants.

Table 3. Categories of professional experts and TMPs interviewed.

Informants	Institution/Ministry	No. of informants
Pharmacists	Ministry of Health & University of Nairobi	2
Conservationist	Kenya Forest Service (KFS)	1
Environmentalist	Kenya Bureau of Standards (KEBS)	1
Scientists	Department of Culture & Kenya Medical Research Institute (KEMRI)	2
Herbalist association representative	Kenyatta University	1
Branding specialist	National Environmental Management Authority (NEMA)	1
Botanist	University of Nairobi	1
Quality assurance	Ministry of Culture, Sports & Arts (MOCSA)	1
Phytochemists	Kenya Forestry Research Institute (KEFRI) & Kenya Industrial Property Institute (KIPI)	3
Traditional medical experts	Local medicine markets	27

3.1.6 Data collection

Generally, the data was collected through a mixed methodology approach that include oral interviews with the aid of a prested questionnnaire, herbarium techniques, direct observations, consented voice recordings (using a portable battery powered SONY ICD-PX470 voice recorder) and photography (with the help of a battery powered SX280HS Canon camera) (Kunwar *et al*., 2013; Muthee, 2013; Kaigongi & Musila, 2015; Shilabukha, 2015; Bussmann *et al*., 2016). An oral interview was the method of choice since it is hugely flexible and the interviewer had a formal guide with which to focus the interview.

This method is ideal particularly in cases where the respondents are interviewed only once. Interviews are superior in the generation of a meaningful data as compared to the ordinary free listing methodology that doesn't factor respondents' knowledge, attitudes and perceptions (Tongco, 2007; Albuquerque *et al*., 2014**)**

3.1.7 Herbarium techniques

Floral and vegetative characters were invaluable in the taxonomic identification and accurate determination of voucher plant specimens right at the market locations. Those specimens that lacked clearly expressed taxonomic characters were gathered, pressed and delivered to the herbarium of the University of Nairobi coded as NAI. Determination of medicinal plants in a market setting is an arduous and complex task since most of the specimens reveal few taxonomic traits and therefore categorized as incomplete specimens. Fresh specimens are mostly complete and reveal more taxonomic characteristics (roots, flowers, barks, stem, leaves, buds, fruits and seeds). Bulky specimens were also collected as carpological materials for herbarium determination.

Field data notes captured the date of collection, name of collectors, name of the medicinal market, growth habit and habitat, description of the visible taxonomic characters, and the photographic image of the specimen. Photographic plant images are invaluable for automation in modern day herbaria (Singh, 2018). Herbaria collections are principally established for taxonomic and biosystematics purpose but are also considered important repositories (seed bank and DNA plant sources) that offer critical data for conservation, molecular genetics and biotechnology (Albani Rocchetti *et al*., 2020). A comprehensive botanical checklist was generated, coded and referenced at the NAI herbarium. The herbaria collections were used to compare and validate the collections from the medicinal markets. Standard flora literature sources were used for confirmatory and verification purposes of recorded taxonomic characters.

Herbaria are important for referencing voucher materials and making comparisons of the generated field notes and the published literature sources. In addition, the herbaria collections are usually site or location specific and thus expresses critical historical and geographical references (Souza & Hawkins, 2017). The correct binomial nomenclature and biosystematics from the generated ethnobotanical checklists were further authenticated using the following taxonomic references: Lindsay, 1978; Beentje, 1994; Maundu *et al*., 1999, Mann & Buteyo, 2001; Dharani, 2006; Kokwaro, 2009; Dalitz *et al*., 2011 and Agnew, 2013. Local ethno-taxa and their corresponding ethnic affiliation or language were also recorded to reflect diverse market cultures.

3.1.8 Data analysis

The collected data was keyed in MS Excel and quantitatively and descriptively processed (N, f, %, averages). The analysed data was presented using tables, pie charts, column graphs and bar graphs. Content analyses using the ATLAS software were conducted to isolate thematic TM responses categories and sub-categories as laid out on excel spreadsheets and overall deductions qualitatively reported (Kuckartz, 2019; Lindgren *et al*., 2020).

3.2 Specific methodology

3.2.1 Objective I: To assess the use and trade of herbal remedies in traditional medicine in Western Kenya.

3.2.1.1 Data collection

As earlier stated, the study employed an expert-based purposive sampling and primarily targeted practitioners plying their trade at selected local medicine markets. A set of expert oral interviews combined with a comprehensive set of methodologies were employed (Klar & Leeper, 2019; van Audenhove & Donders, 2019).

These expert based interviews were marginally combined with snowball sampling methods and it relied heavily on referrals and recommendations from the willing respondents and introduce more competent and suitable informants into the market survey. Other than the advantage of social networking, competent referral mechanism, flexibility and relying on the willingness to be interviewed, Snowball sampling technique enable penetration of a hard-to-reach geographically dispersed populations. It is also employed in situations where the participants are sensitive, vulnerable and desire unlimited form of trust and anonymity. Snowball method is best combined with purposive sampling and emphasizes in the selection of quality and reliable respondents (Parker *et al*., 2019).

The interviews targeted traditional medical and ethnobotanical knowledge alongside the socioeconomic and demographic survey that was conducted between February 2019 and September 2019. Purposive sampling rely more on expertise information and generation of quality data rather than the number of respondents (Etikan *et al*. 2016). The three (3) key steps of purposive sampling technique (Tongco, 2007; Albuquerque *et al*., 2014) as follows;

i. State the research problem.
ii. Identify the target or desired information.
iii. Determine the qualities of the respondent.

Oral interviews with thirty (30) selected respondents was conducted using a pre-tested semi-structured questionnaire. This was done after providing assurance to the respondents that the data collected will be strictly used for research and academic purposes (Bussmann *et al*., 2016). Since the study only involved oral interviews, all the necessary inclusion and exclusion criteria were evaluated (Table 4). Inclusion and exclusion criteria enabled external validation of studies based on outline research questions (Tilburt & Kaptchuk, 2008).

Table 4. Criteria that aided the selection of the market respondents (Patino & Ferreira, 2018; Chebii *et al*., 2022).

Inclusion criteria	Exclusion criteria
Actively practicing traditional healers	No corruption or bribery, No conditional tokenism
Experts and well informed respondents	Apprenticeship
Express willingness to participate in the oral interviews	Coercion
Prior oral informed consents	Unwillingness to freely participate
Cultural knowledge and awareness	Irresponsible and unqualified practitioners

The questionnaire pretests allowed for simplification of the scientific questions into local languages for ease of comprehension. The purposively selected and recruited traditional medicine traders were asked to provide accounts of the common traditional medicine used, common diseases and sociocultural ills treated, plant parts used, ethnic or tribal affiliation, vernacular plant names, plant habits and growth forms (Mesfin *et al*., 2013; Bussmann *et al*., 2016; Ijaz *et al*., 2016; Kamau *et al*., 2016; Kebebew 2017; Meke *et al*., 2017; Alalwan *et al*., 2019 Rasethe *et al*. 2019; Chebii *et al*., 2022).

Medicinal plants were correctly determined with the help of observed and comparative anatomical, morphological, vegetative and/or floral characters in addition to careful examination and determination of the collected carpological materials and accordingly preserved and stored at the UoN Herbarium (NAI). Preliminary identification of complete specimens was done right at the medicine market locations.

In addition, recorded medicinal flora were cross-checked using two (2) verified nomenclature plant databases http://www.theplantlist.org/ and https://www.tropicos.org/ selected to accommodate all the identified medicinal plant species. Direct observations, consented voice recordings, herbarium voucher referencing and photography methodologies were also used in the study (Bussmann *et al*., 2016).

IUCN statuses were checked, and as a rule of thumb, no fresh specimens were collected for all species listed as rare, vulnerable or endangered species in accordance with the established IUCN expectations. The IUCN statuses of the listed medicinal plants were verified and validated using the Red List Criteria (version 3:1) and placed in their rightful categories (IUCN, 2001; PP-003-En.pdf (iucn.org)). IUCN Red List is an important conservation tool that guides planning and decision making processes of saving identified and threatened species from possible extinction (Rodrigues *et al*., 2002). The number of medicinal species consumed in a particular locality correlates with the threats facing their sources, most of which are collected from the wild, and are also linked to the declining traditional medical knowledge (Lee *et al*., 2008).

3.2.1.2 Standard disease classification systems

The three (3) prominent disease classification categories include: Economic Botany Data Collection Standard (EBDCS), International Classification of Primary Care (ICPC) and the Classification of Diseases (ICD). The study employed EBDCS to allow for broader categorization of diseases that encompasses the sub-categories cited by the traditional healers (Cook 1995; Gruca *et al*., 2014; Staub *et al*., 2015). EBDCS is an efficient ethnobotanical tool, only that it lacks a clear biomedical criteria. It is somewhat similar to the ICD but also lacks modern disease diagnostics. EBDCS system also allows for the elucidation of plant uses facilitated by standard descriptors and terminologies.

The ICD standard mainly focuses on conventional clinical medicine examinations and thus not ideal for field work purposes. ICD has gained immense popularity in epidemiological, clinical studies and healthcare management. Furthermore, ICD is disease centred and perfectly fits a conventional healthcare service where accurate disease diagnostics are carried out. ICPC disease categories follow patients' perceptions and not clinical medicine diagnostics.

ICPC system therefore classifies diseases following three important aspects of healthcare encounters namely: actual diagnosis, care and cause for encounter (Staub *et al*., 2015).

3.2.1.3 Data analysis

The significant cultural importance and value of TM was evaluated by the number of recorded citations, mentions or counts by the traders. The number of citations was based on frequency of use (Alalwan *et al*., 2019). Quantitatively, the species, plant families, habit, plant parts utilized, and disease(s) treated were assessed. The collated data was quantitatively and descriptively processed and laid out on column graphs, bar graphs, pie charts and tables. FC and RFC that carries cultural, quantitative and ethnobotanical indices were computed as follows:

$$\mathbf{RFC} = \mathbf{FC/N}$$

where FC is the Frequency of Citations on the utilization of a particular medicinal species and N denotes the total number of respondents who fully took part in the oral interview. RFC validates the FC reported for various diseases and can be converted into a percentage for ease of interpretation by multiplying it by 100.

$$\mathbf{RFC\ \%} = \mathbf{FC/N} \times \mathbf{100}$$

RFC is mostly used to determine the consensus among all the respondents on all the cited taxa. RFC is also critical in the creation of harmony between informants on medicinal plant uses in a particular area (Tardío & Pardo-de-Santayana, 2008; Vitalini *et al*., 2013; Umair *et al*., 2017; Uzun & Koca, 2020). Alternatively, frequency of citation percentages can be used to determine the most important medicine species from the study and it is quantitatively computed as follows:

$$\mathbf{FC}\ (\%) = \mathbf{N/T} \times \mathbf{100}$$

where N represents the number of traditional medicine traders who cited the medicinal plant uses and T is the sum total of traditional medicine traders interviewed.

Species with the highest frequency of citation have proven to be perfect candidates for further pharmacological tests and validation. FC also strongly correlates with the cultural importance index. RFC computated values vary between zero and one and it increases with FC and corresponds to the local importance of each reported taxon. In essence, **0** implies that no practitioner or medicine trader considers the cited as useful whereas **1** denotes that all cited plant species are useful to all respondents **(**Tardío & Pardo-de-Santayana, 2008; Hilonga *et al*., 2019; Salim *et al*., 2019; Suwardi *et al.* 2020; Uzun & Koca, 2020).

Medicinal markets often carry important cultural values and a hub for medical knowledge exchange and heritage (Luo *et al*., 2018). RFC has been successfully used to qualify medicinal plant species for further pharmacological studies, phytochemical screening and possible drug discoveries (Bhatt *et al*., 2021). Furthermore, ethnobotanical indices is a sure form of validation of traditional medicine where high values communicates bioassay competence whereas low values presents the need to conduct bioactive analyses to prove the therapeutic claims (Nguyen *et al*., 2019).

3.2.2 Objective II: To assess the governance of the practice of traditional medicine in Western Kenya.

3.2.2.1 Survey Research design.

The survey employed a subjective or judgemental methodology where only informed professional and willing traditional medical experts were interviewed. Snowball sampling method was used in the identification and recruiting more informants into the survey (McMullin *et al*., 2012; van Rooyen *et al*., 2015; Harrington, 2018). The choice of judgemental non-probability sampling factors in circumstances where some respondents in the medicine markets may be hesitant or reluctant to participate in the oral interviews, and is also ideal in cases with time and resources constraints.

Other circumstances that inform the use of purposive sampling is where the data is held by a specific category of persons, or where the data collected require specific interpretation. Twenty seven (27) TMPs and thirteen (13) key informants representing various research institutions and government ministries were interviewed on various aspects of governance using a semi structured questionnaire (Table 3). The selection of key informants is completely dependent on the reliability and competency of the selected interview (Albuquerque *et al*., 2014). Desktop reviews were also conducted to reveal the current legal and policy framework that regulate the TM enterprise.The TMPs and Professional experts were asked questions to evaluate their understanding of the current laws, policies, sessional papers and strategic plans that regulate TM.

3.2.2.2 Target sample population

The selection of this sampling frame targeted a representative sample that reflects the legitimate actors of the TM industry. A professional expert introduced his/her peers and few TMPs who then recruited more competent respondents into the survey. Basically, all the willing respondents were interviewed. Those who declined to be interviewed were not coerced to participate in the survey but were allowed to follow the oral interview.

3.2.2.3 Data collection

Data was collected via a mixed methodology that include detailed field observations, photography, consented sound or voice recordings, and prior informed consents before subjecting the respondents to oral interviews (Bussmann, 2006; Muthee, 2013; Kewassa *et al*., 2015; Kaigongi & Musila 2015; Shilabukha, 2015; Monica *et al*., 2016). The face to face interviews were carried out from February to September of 2019.

3.2.3 Objective III: To assess sociocultural aspects that promote conservation of medicinal plant resources.

To realize this objective, twenty one (21) willing TM traders were asked to provide information and material knowledge on sociocultural conservation strategies of TM. The text data or market survey notes from responses were processed in excel spreadsheets, properly categorized and sub-categorized, coded and qualitatively analyzed using the ATLAS.ti (version 8) computer software (Soratto & Friese, 2020). Overall deductions and summaries were highlighted after the thematic analyzes and sub categories were conclusively contextualized. In addition to the purposive and snowball techniques, a host of mixed methodologies introduced in section 3.1 were employed.

A focused and specific desktop reviews on thematic topics of conservation, protection, propagation and preservation of medicinal species was also conducted. The desktop reviews were done on on carefully selected peer reviewed scientific papers published on Google scholar, Scopus, Scimago and Web of Science online databases. The systematic review used the following key words: sociocultural, conservation, sustainability, traditional medicine and medicinal plants. The thematic search was chosen since it is not location specific and provides a universal coverage of salient aspects covering sociocultural conservatiom of medicinal plants natural, and also to develop a universal theory applicable to the global conservation agenda for all threatened medicinal plants.

CHAPTER 4

RESULTS

The study findings from the survey as guided by the three (3) stated objectives in the introduction have been systematically captured in Sections 4.1 – 4.3. A comparative study from a thematic desktop review was also captured accordingly in Section 4.3.

4.1 Use and trade of herbal remedies in traditional medicine in Western Kenya.

4.1.1 Sociodemographic characteristics

From a total of thirty (30) respondents, 13 (43%) were males and 17 (57%) were females (Table 5). Women practitioners dominated the TM enterprise in the surveyed areas, where sex, gender and cultural differences were observed in all the sampled counties. For instance, the markets of Trans Nzoia County were dominated by male practitioners whereas the Makutano medicine market of West Pokot County was dominated by female practitioners. The mean age (in years) of traditional healers was 61 with over two decades of experience.

Table 5. Sociodemographic elements of the survey.

County	Medicine market (Number interviewed)	Sex representation	No. of practitioners that declined the interview	Ethnic composition
Trans Nzoia	Kitale (n = 5)	1 Male	-	Mijikenda
		1 Male		Turkana
		3 Males		Bukusu
	Moi's Bridge (n = 1)	1 Male		Maasai
Uasin Gishu	Eldoret (n = 6)	1 Male	1	Marakwet
		4 Females		Marakwet
		1 Female		Keiyo
Kakamega	Kakamega (n = 5)	1 Female	2	Luhya
		4 Males		Luhya
Siaya	Yala (n = 1)	1 Female	-	Luo
Vihiga	Luanda (n = 6)	5 Females	11	Luhya
		1 Male		Luhya
West Pokot	Makutano (n = 3)	3 Females	6	Pokot
Elgeyo Marakwet	Kaptabuk (n = 1)	1 Female	-	Marakwet
	Arror (n = 2)	1 Female		Marakwet
		1 Male		Marakwet

The individual ages (in years) recorded was from thirty to eighty five and experience ranging from two to forty eight years. Traditional healers with basic education were more knowledgeable in traditional medicine as compared to relatively educated practitioners. The medicine markets served as important cultural melting hub of various ethnic and sub-tribal categories as reflected in the vast array of traditional medicine traded.

4.1.2 Medicinal plants frequently traded

From the identified taxa, forty six (46) plant families and seventy nine (79) genera were frequently sold in the sampled markets (Figure 3 & 4, Appendix 5). Medicinal plant species frequently traded belonged to the Meliaceae family (12%) followed by the Asclepiadaceae (10%), leguminous Fabaceae (9%), aromatic Rutaceae (5%) and Euphorbiaceae (5%).

A total of ninety (90) medicinal species were recorded with *Trichilia emetica* being the most frequently traded species (RFC, 0.37) followed by the naturalized neem tree *Azadirachta indica* (RFC, 0.27), *Dregea schimperi* (RFC, 0.23) and *Carissa spinarum* (*C. edulis*) with RFC of 0.23.

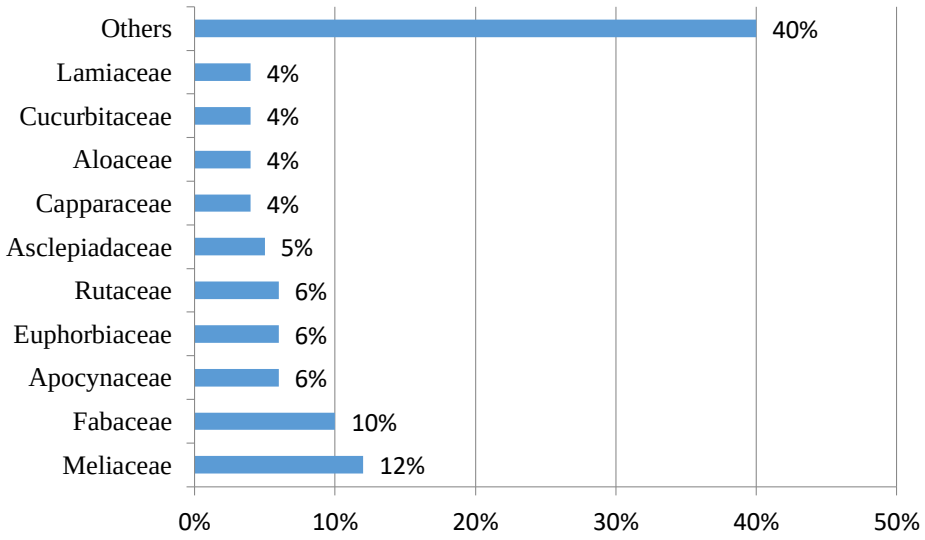

Figure 3. Frequently utilized medicine plant families.

The recorded medicinal plants reflected regional preferences, for instance, the robust *Trichilia emetica* locally known as *Mnyama* was commonly sold in Yala, Luanda and Kakamega whereas the liana *Dregea schimperi* locally termed *Chebelel* was prominent in the markets of Arror and Eldoret. Therefore, specific localities had few dominant plant species that characterizes a particular market location in line with the local cultures and medical heritage.

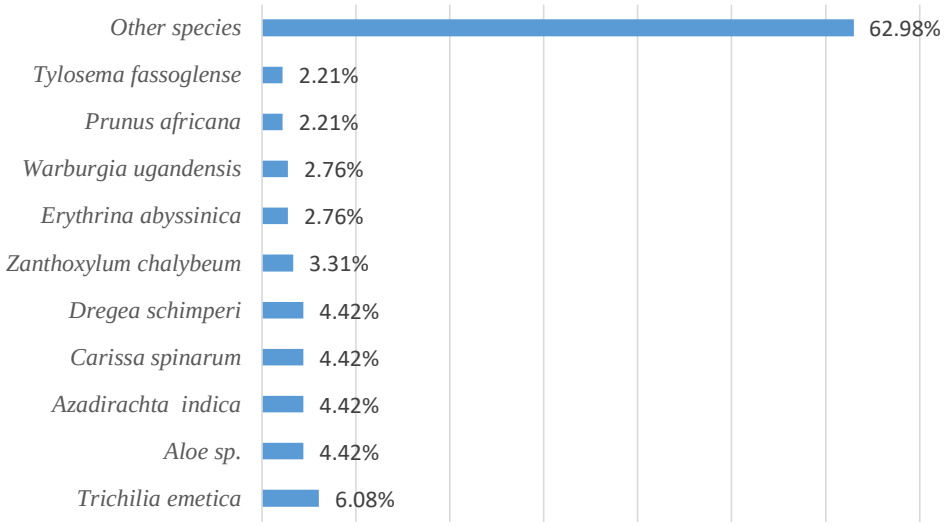

Figure 4. Frequently traded medicinal plant species.

The dominant growth life-form recorded was the tree (46%) followed by shrubs (22%) and climbers (16%). Lianas or woody climbers (1%) and the herbaceous species (12%) were least traded. Roots followed by barks and leaves were the most sought medicinal plant parts, with the fruits, seeds and rootstock swellings being least traded (Figure 5).

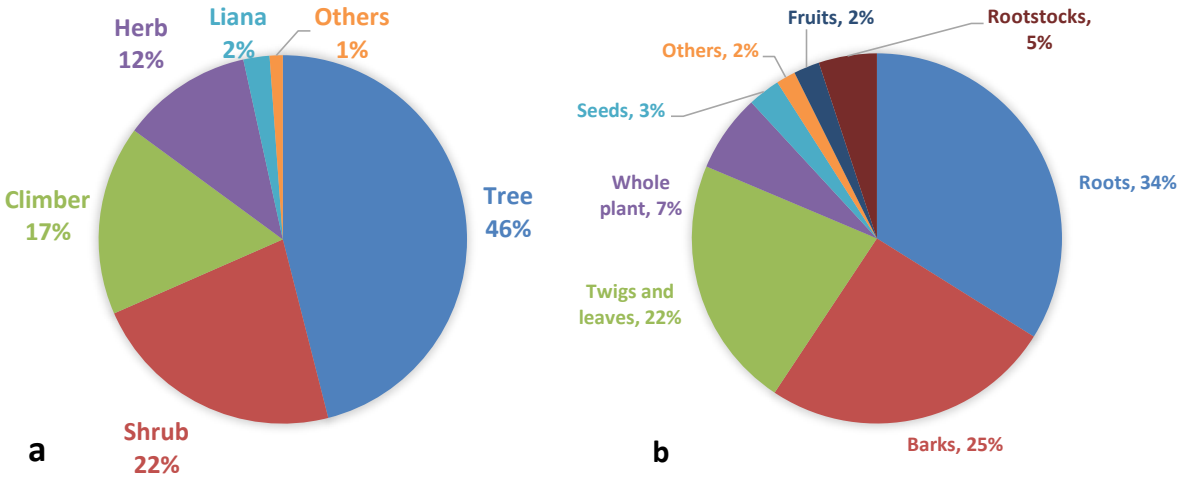

Figure 5. Medicinal plant species (**a**) Growth habits, (**b)** Plant parts utilized.

Medicinal plant species that attracted at least two mentions or citations were tabulated as summarized in Table 6.

Table 6. Frequency of mentions of most commonly sold medicinal plants.

Name of medicinal plant species	FC	RFC	RFC %
Trichilia emetica	11	0.37	37
Azadirachta indica	8	0.27	27
Dregea schimperi	8	0.27	27
Aloe spp.	7	0.23	23
Carissa spinarum	7	0.23	23
Erythrina abyssinica	5	0.17	17
Warburgia ugandensis	5	0.17	17
Zanthoxylum chalybeum	5	0.17	17
Prunus africana	4	0.13	13
Tylosema fassoglense	4	0.13	13
Bridelia micrantha	3	0.1	10
Capparis tomentosa	3	0.1	10
Clerodendrum myricoides	3	0.1	10
Ekebergia capensis	3	0.1	10
Maerua decumbens	3	0.1	10
Salvadora persica	3	0.1	10
Terminalia brownii	3	0.1	10
Ziziphus mauritiana	3	0.1	10
Cucumis aculeatus	3	0.1	10
Solanum incanum	2	0.07	7
Chasmanthera dependens	2	0.07	7
Cissus quadrangularis	2	0.07	7
Dalbergia melanoxylon	2	0.07	7
Harrisonia abyssinica	2	0.07	7
Hypoestes forskaolii	2	0.07	7
Kigelia africana	2	0.07	7
Leonotis nepetifolia	2	0.07	7
Maesa lanceolata	2	0.07	7
Moringa oleifera	2	0.07	7
Musa spp.	2	0.07	7
Podocarpus latifolius	2	0.07	7
Rawsonia lucida	2	0.07	7
Ricinus communis	2	0.07	7
Toddalia asiatica	2	0.07	7
Tragia brevipes	2	0.07	7
Urtica massaica	2	0.07	7
Uvaria scheffleri	2	0.07	7
Vachellia seyal	2	0.07	7
Ajuga integrifolia	2	0.07	7

The frequently traded traditional medicine were critical in the treatment of fifty two (52) common diseases including three (3) sociocultural illnesses. Diseases that attracted at least two (2) mentions or citations were tabled and summarized in Table 7.

Table 7. Perceptions of the Traditional Medicine Traders on frequently treated diseases and notable sociocultural syndromes* in the surveyed W. Kenya markets.

SN	Frequently cited diseases and sociocultural syndromes	Frequency of citations
1	Stomach pains and infections	18
2	Typhoid	15
3	Malaria	13
4	Ulcers	11
5	Blood pressure conditions	10
6	Infertility	10
7	Diabetes	9
8	Skin rashes	8
9	Libido	8
10	Gonorrhoea	8
11	Amoebiasis	6
12	Brucellosis	6
13	Chest pains and infections	6
14	HIV/AIDS management	5
15	Spinal cord pains and infections	5
16	Urethral tract infections (UTIs)	4
17	Arthritis	3
18	Blending drugs	3
19	Bone problems and infections	3
20	Dizziness and mental confusion	3
21	Fibroids	3
22	Headache	3
23	Hernia	3
24	Removing curses*	3
25	Syphilis	3
26	Skin itching and sensations	2
27	Cancer	2
28	Colds and coughs	2
29	Livestock eye infections	2
30	Maintenance of internal body organs	2
31	Pneumonia	2
32	Prostate problems	2

Quite notable was the local utilization of TM in the long term management of Human Immunodeficiency virus and Acquired immunodeficiency syndrome complications. Gastrointestinal diseases, malaria, hypertension and infertility problems were among the commonly treated infections using TM (Table 7 & 8). Traditional medicine were prescribed singly or in combination without any tangible explanation except in the administration of gender specific blending drugs; *Cadaba farinosa* for males, *Chasmanthera dependens* for females and non-gender specific *Salvadora persica* (Table 8).

Table 8. Commonly sold medicinal plant species.

Scientific name	Family	Diseases	Growth habit	Parts used	Ethnic composition
Albizia amara (Roxb.) B. Boivin.	Fabaceae	Spinal problems	Tree	Stem bark	Marakwet
		Digestion problems	Tree	Stem bark	Maasai
Azadirachta indica A.Juss.	Meliaceae	Malaria	Tree	Leafy twig	Luhya
		HIV/AIDS Management	Tree	Burnt ash	Marakwet
		Body rashes, Superficial fungal infection, Cancer (prostate, throat, breast), Nervous system breakdown, Amoebiasis	Tree	Leaves	Marakwet
		Infertility	Tree	Barks, Twigs & Leaves	Marakwet
		Malaria	Tree	Barks & Leaves	Bukusu
Ajuga integrifolia Buch. Ham ex D.Don	Lamiaceae	Stomachache & Typhoid, Pneumonia	Herb	Roots	Luhya
		Malaria	Herb	Whole plant	Luhya
Aloe sp.	Asphodelaceae	Typhoid	Herb	Roots	Pokot
		Typhoid	Herb	Roots	Luhya
		Syphilis	Herb	Barks	Luhya
		Boosts appetite	Herb	Leaves	Luhya
Basella alba L.	Basellaceae	UTIs	Climber	Twigs & Leaves	Marakwet
Bridelia micrantha (Hochst.) Baill.	Phyllanthaceae	Brucellosis	Tree	Leaves	Bukusu
		Ulcers	Tree	Barks	Luhya
Cucumis aculeatus Cogn.	Cucurbitaceae	Diabetes	Climber	Twigs, Leaves & Fruits	Marakwet
		Diabetes	Herb, Climber	Leaves	Luhya
Cordia africana Lam	Boraginaceae	Chest infections	Tree	Roots	Keiyo
Caesalpinia decapetala (Roth) Alston	Fabaceae	Stomachache	Climber	Roots	Marakwet
Chasmanthera dependens Hochst.	Menispermaceae	Stomachache and typhoid, Enhances libido, Erectile dysfunction	Woody climber	Roots	Marakwet
		Female gendered blending medicine	Liana	Roots	Marakwet
Cucumis dipsaceus Ehrenb. ex Spach	Cucurbitaceae	Diabetes	Climber	Fruits	Marakwet
Cadaba farinosa Forssk.	Capparaceae	A blending drug for males, , Seeds pocketed to deter enemies	Shrub	Roots & Seeds	Marakwet
Cleome gynandra L.	Cleomaceae	Colic	Herb	Roots	Marakwet
Combretum molle R.Br. ex G.Don	Combretaceae	Ulcers	Tree	Leaves	Bukusu
Clerondendrum myricoides (Hochst.) R.Br. ex Vatke	Lamiaceae	Blood Pressure conditions	Shrubs	Leaves	Bukusu
		Ulcers	Shrub	Roots	Marakwet
		Skin and body rashes, External fungal infection	Shrub	Leaves	Marakwet
Cissus quadrangularis L.	Vitaceae	Treats scorpion bites	Prostrate climber	Twigs & Leaves	Marakwet
		Chronic spinal cord problems, Nervous problems	Climber	Root	Marakwet
Cissus rotundifolia Lam.	Vitaceae	Body massage	Climber	Leaves	Marakwet

Cont'n

Scientific name	Family	Diseases	Growth habit	Parts used	Ethnic composition
Carissa spinarum L.	Apocynaceae	Typhoid	Shrub	Roots	Marakwet
		Arthritis	Shrub	Roots	Mijikenda
		Stomach pains	Shrub	Roots	Pokot
		Gonorrhoea	Shrub	Roots	Luhya
		Body rashes	Shrub	Roots	Luhya
		Stomachache	Shrub	Roots	Luhya
		Headache	Shrub	Barks	Luo
		Defecation challenges, Hernia, Urine production and release	Shrub	Roots	Luo
Capparis tomentosa Lam.	Capparaceae	Boosts male virity	Shrub	Roots	Marakwet
		Female fertility and Conception	Shrub	Roots	Marakwet
		Amoebiasis	Shrub	Roots	Marakwet
Curcubita sp.	Cucurbitaceae	Blood Pressure conditions	Climber	Leaves	Luhya
Cyperus rotundus L.	Cyperaceae	Nervous system challenges, Spinal cord problems	Herb	Root swellings	Marakwet
Cphostemma cyphopetalum (Fresen.) Desc. ex Wild & R.B. Drumm	Vitaceae	Ulcers	Climber	Roots	Turkana
Cyphostemma serpens (Hochst ex A.Rich.) Desc.	Vitaceae	Lymph node swellings	Climber	Leaves	Marakwet
Dovyalis abyssinica (A.Rich.)Warb.	Salicaceae	Sexually transmitted diseases with evidence of pus	Tree	Roots	Pokot
Dicliptera laxata C.B. Clarke	Acanthaceae	HIV/AIDS, Curses	Herb	Leaves	Luo
Dregea schimperi (Decne.)Bullock	Apocynaceae	Stomach pains, Dysentry, Typhoid, Infertility	Climber, Shrub	Roots	Keiyo
		Stomachache pains	Climber	Roots	Marakwet
		HIV/AIDS Management	Climber	Burnt ash	Marakwet
		Nervous system problems, Spinal cord pains, Typhoid, Infertility, Stomach pains	Climber	Roots	Marakwet
Erythrina abyssinica Lam. ex DC.	Fabaceae	Gonorrhoea	Tree	Roots	Bukusu
		Body rashes, Stomach pains and infections	Tree	Roots	Marakwet
		Fibroids	Tree	Roots	Luhya
		Gonorrhoea, Body rashes, Blood pressure conditions	Tree	Barks	Luhya
Ekebergia capensis Sparrm.	Meliaceae	Ulcers	Tree	Barks	Luo
		Syphilis	Tree	Barks	Luhya
Euclea divinorum Hiern	Ebenaceae	Diabetes	Tree	Leaves	Bukusu
Euphorbia sp. mixed with Sheep (*Ovis aries* L) oil	Euphorbiaceae	Dizziness & mental confusion	Herb	Twigs & Leaves	Pokot
Grewia trichocarpa Hochst. ex. A.Rich.	Malvaceae	Snake poison spray in the eyes	Shrub	Twigs & Leaves	Marakwet
Harrisonia abyssinica Oliv.	Rutaceae	Amoebiasis	Tree/Shrub	Roots	Marakwet
		Malaria	Shrub	Roots	Marakwet
Hypoestes sp.	Acanthaceae	Dispenses decoction against curses	Herb	Whole plant	Luhya
Kigelia africana (Lam.) Benth.	Bignoniaceae	Hernia	Tree	Fruits	Luhya
		Syphilis	Tree	Seeds	Luhya
Lannea schweinfurthii (Engl.) Engl.	Anacardiaceae	Stomachache, Typhoid	Tree	Barks	Marakwet
Leucas grandis Vatke	Lamiaceae	Colds, coughs and malaria	Shrub	Leaves	Luo

Cont'n

Scientific name	Family	Diseases	Growth habit	Parts used	Ethnic composition
Leonotis nepetifolia (L.) R.Br.	Lamiaceae	Ulcers,Stomach pains and infections	Shrub	Roots	Marakwet
Maerua decumbens (Brongn.) DeWolf	Capparaceae	Diabetes	Shrub	Tuber	Pokot
		Diabetes	Shrub	Tubers	Marakwet
		Infertility	Shrub	Rootstocks	Marakwet
Maesa lanceolata Forssk.	Primulaceae	Stomachache & Typhoid	Tree	Barks	Marakwet
Moringa oleifera Lam.	Moringaceae	Brucellosis	Tree	Whole plant	Bukusu
		Blood Pressure conditions	Tree	Leaves	Luhya
Microglossa pyrifolia (Lam.) Kuntze	Asteraceae	Boosts male virility	Woody herb/	Leaves	Luhya
Mondia whitei (Hook.f.) Skeels	Apocynaceae	Boosts male virility	Climber	Roots	Luhya
Manihot esculenta Crantz	Euphorbiaceae	Diabetes	Shrub	Whole plant	Bukusu
Momordica friesiorum (Harms) C. Jeffrey	Cucurbitaceae	Malaria	Climber	Tuberous rootstocks	Marakwet
Momordica sp.	Cucurbitaceae	Oral thrush, Psychosis	Climber	Leaves	Marakwet
Nuxia congesta R.Br. ex Fresen.	Stilbaceae	Chest pains & infections	Tree	Barks	Marakwet
Ocimum basilicum L.	Lamiaceae	Teeth problems	Herb	Twigs & Leaves	Marakwet
Prunus africana (Hook.f.) Kalkman	Rosaceae	Male virility, Prostate cancer	Tree	Barks	Marakwet
		Prostate cancer	Tree	Barks	Luhya
		Blood Pressure conditions	Tree	Barks	Bukusu
		Brucellosis	Tree	Barks	Mijikenda
Podocarpus latifolius (Thunb.) R.Br. Ex Mirb.	Podocarpaceae	Skin and body rashes	Tree	Barks	Marakwet
Pittosporum viridiflorum Sims	Pittosporaceae	Skin rashes	Tree	Root	Marakwet
Phytolacca dodecandra L 'Her.	Phytolaccaceae	Body rashes & Skin infection	Shrub	Leaves	Marakwet
Rubia cordifolia L.	Rubiaceae	HIV/AIDS, Cultural curses	Climber	Leaves	Luo
Senna didymobotrya (Fresen.) H.S. Irwin & Barneby	Fabaceae	Brucellosis, Malaria	Shrub	Barks	Maasai
Solanum incanum L.	Solanaceae	UTIs	Shrub	Whole plant	Marakwet
Senna occidentalis (L.) Link	Fabaceae	Stomach problems	Herb	Roots	Marakwet
Salvadora persica L.	Salvadoraceae	Oral and Teeth hygiene	Shrub	Twigs	Turkana
Sonchus sp.	Asteraceae	Stomachache	Herb	Roots and Leaves	Luo
Tragia brevipes Pax	Euphorbiaceae	Diabetes	Climber	Leaves	Bukusu
Terminalia brownii Fresen.	Combretaceae	Treats psychotic problems emanating from meningitis, malaria	Tree	Barks	Marakwet
		Infertility	Tree	Barks	Keiyo
Trichilia emetica Vahl	Meliaceae	Enhanced libido, Kidney problems	Tree	Leaves	Bukusu
		Headache	Tree	Barks	Luo
		Skin itching and pain	Tree	Roots	Luo
		Body rashes	Tree	Roots	Luhya
		Bone diseases, Gonorrhoea	Tree	Bark & Roots	Luhya
		Fibroids, Ulcers	Tree	Bark	Luhya

Cont'n

Scientific name	Family	Diseases	Growth habit	Parts used	Ethnic composition
Tylosema fassoglense (Kotschy ex Schweinf.) Torre & Hillc.	Fabaceae	Back pains	Herb	Swollen rootstocks	Luhya
	Fabaceae	Skin itching	Climber	Swollen rootstocks	Luo
		Ulcers	Climber	Rootstocks	Luo
Urtica massaica Mildbr.	Urticaceae	Hypertension	Herb	Leaves	Luhya
		Enhance libido	Herb	Leaves	English
Vernonia amygdalina Delile	Asteraceae	Ulcers	Shrub	Leaves	Luhya
Vitex doniana Sweet	Lamiaceae	Ulcers	Tree	Twigs, Flowers	Bukusu
Withania somnifera (L.) Dunal	Solanaceae	Pneumonia	Shrub	Roots	Keiyo
Warburgia ugandensis Sprague	Canellaceae	Chest infections	Tree	Barks & Roots	Keiyo
		Chest pains	Tree	Barks	Luo
		Bone problems	Tree	Roots	Luhya
		Gonorrhoea	Tree	Barks	Luhya
		Blood Pressure conditions	Tree	Twigs & Leaves	Bukusu
Zanthoxylum asiaticum (L.) Appelhans, Groppo & J.Wen.	Rutaceae	Urine production, Hernia & Defeacation challenges	Climber	Twigs & Leaves	Luo
	Rutaceae	Malaria	Climber	Roots, Fruits	Bukusu
Zanthoxylum chalybeum Engl.	Rutaceae	Diseases of the bone	Tree	Roots	Luhya
		Fibroids	Shrub	Barks	Luhya
		Body weakness, fever, Malaria, Colds and coughs	Tree	Seeds	Pokot
		Typhoid	Tree	Seeds	Marakwet
		Brucellosis	Tree	Seeds	Mijikenda
		Cough and Colds	Tree	Seeds	Maasai
Zanthoxylum gilletii (De Wild.) P.G. Waterman	Rutaceae	Stomachache	Tree	Bark	Luo
Ziziphus mauritiana Lam.	Rhamnaceae	Stomach pains	Tree	Barks	Keiyo
		Arthritis	Tree	Barks	Mijikenda
Zanthoxylum sp.	Rutaceae	Pneumonia	Tree	Seeds	Keiyo

4.2 Governance of the practice of traditional medicine in Western Kenya

4.2.1 Socioeconomic traits of the traditional medicine traders

Few traditional medical healers (27%) were conversant with the existing TM regulations in Kenya and virtually all practitioners had absolute compliance on the county by-laws, as exemplified by complete payment of daily market levies. Only 15% of the traditional healers had acquired certificate of practice. The mean age for Traditional Medicine traders' was 64 years with the average experience of at least 25 years. The oldest practitioner was 85 years old with 48 years of experience whereas the youngest practitioner was 30 years old with at least five (5) years of experience. Most of the TM traders (65%) had no additional income sources and solely depended on traditional medicine trade for income, sustenance and livelihood (Table 9).

Table 9. Socioeconomic and demographic characteristics of the Traditional Medicine Traders.

Variables	**Survey Response**
Total number of respondents	40
Dominant category of buyers	Reproductive age
Average age	64 years
Mean experience	25 years
% Willing respondents	54%
Gender:	
Men	46%
Women	54%
Awareness and knowledge of existing TM regulations	27%
Average market levy/day in KES.	KES. 30.00
Monthly income	KES. 14, 269.00
TMPs with certification and recognition	15%
TM traders with additional income sources (Through sale of calabash, candy, snuff tobacco, soda, juice) and engaging in small scale farming	35%

4.2.2 Traditional medicine market leadership

Traditional medicine traders elect their market leaders to represent them at both local and national levels. The criteria of selection of a market leader depended on various factors, for instance, the education level, traditional medical knowledge, negotiation and networking skills, gender and professional uniqueness or distinctness. Male leadership was mostly preferred even in cases where male practitioners were in the minority as seen in the populous Luanda market. An all-female medicine market, for instance, the Makutano medicine market had no choice but to be represented by a female market leader. These market leaders serve as a bridge between the traditional medicine traders and government authorities (local, county and national levels) and ensure a functional medicine market.

4.2.3 Modern Governance Practices

The recorded modern governance practices as observed among the surveyed medicine markets showed similarity among the surveyed locations. This could be attributed to the fact that all traditional medical practitioners are governed by the same formal regulations (Table 10).

Table 10. Modern governance practices of the TM industry.

Modern Governance Practices	Nairobi	Eldoret	Kakamega	Makutano	Kitale	Luanda	Moi's Bridge	Yala	Arror	Frequency of Counts
Designated market locations	-	-	1	-	-	6	-	-	-	7
Regular Monitoring and Checks	13	3	5	3	5	6	1	1	2	39
Drug Analysis Reports	13	-	3	-	1	3	1	-	-	21
Market Trading Fee	13	3	5	3	5	6	1	1	-	37
Practicing Rooms	-	-	2	-	-	6	-	-	-	8
Certificate of Recognition	13	-	3	-	1	3	1	-	-	21
County By Laws	13	3	5	3	5	6	1	1	-	37
Total counts	65	9	24	9	17	36	5	3	2	170

All actively practicing TMPs completely adhered to the set county-by-laws and national regulations to avoid the associated penalties in the case of an unfortunate default. Most informants (88%) supported the idea of regular monitoring checks, standardization and validation. Absence of market selling points (23%) and herbal clinic rooms (4%) were conspicuous market hiccups (Figure 6 & 7).

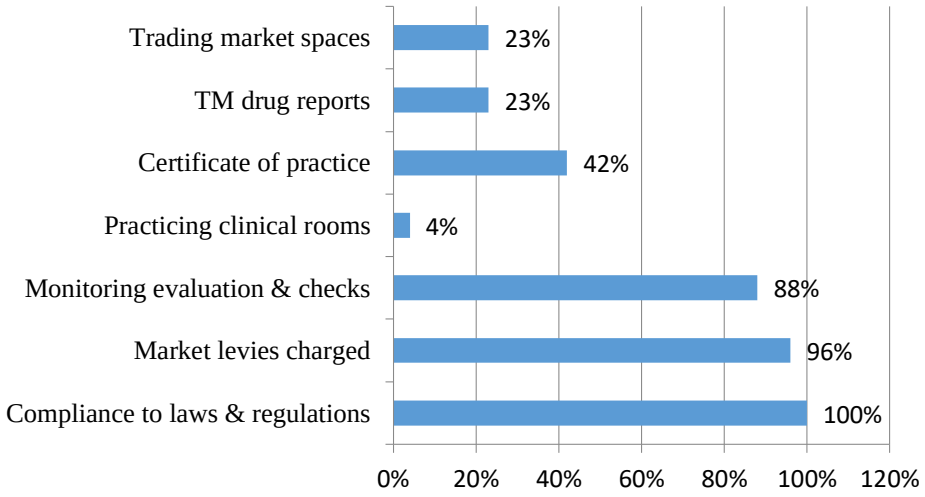

Figure 6. Observation of modern governance practices.

4.2.4 Traditional governance practices

TGPs showcased in the medicine markets is a function of diverse ethnic or tribal cultures of the local population. Most of the traditional healers demonstrated good harvesting practices (92%) and observed secretive collection expeditions (85%). Few respondents (19%) backed the idea that lactating and breastfeeding nursing mothers should refrain from full-time practice, whereas 15% endorsed the perception that women undergoing menstrual bleeding are impure and should step aside from practice until she regains purity. The recorded traditional governance practices among the surveyed market locations demonstrated notable differences. This could be attributed to diverse and varying cultures among various ethnic compositions in the surveyed region (Table 11).

Table 11. Frequently cited TGPs.

Leading TGPs	Eldoret	Kakamega	Makutano	Kitale	Luanda	Moi's Bridge	Yala	Arror	Frequency of Counts
Bars menstruating women	3	1	3	1	3	-	1	2	13
Transfer of TM knowledge	3	5	3	5	4	-	1	2	23
Bars breastfeeding mothers	3	1	3	-	3	-	-	2	12
Care for main roots	3	4	3	2	4	1	1	2	20
No or limited treatment charges	3	2	2	1	5	1	1	2	17
Sex is prohibited before	3	2	3	4	2	-	-	2	16
Closed diary	2	2	3	1	3	1	1	2	15
No fixed treatment charges	3	2	3	-	1	1	1	2	13
Bars uprooting of solitary medicinal plants	3	3	3	4	3	1	1	2	20
TMPs should be free from crime or curse	3	2	3	-	3	-	1	2	14
Cover exposed roots	3	4	3	2	4	1	1	2	20
No repeated harvesting	1	1	2	-	3	1	1	2	11
Total	33	29	34	19	38	7	10	24	194

Traditional medical practitioners are not encouraged to uproot a whole solitary medicinal plant (35%), maintain integrity of major plant roots and rootlets (62%). Most cited TGPs emphasized fidelity to sociocultural norms, purity and high moral standing by the traditional healers. This included prohibiting carnal activities (50%), not having fixed treatment charges (58%) and a demonstration of good will or abundant blessings, bars culturally cursed traditional healers from practice (69%) and encourages traditional medical practitioners not to disclose their healing activities or rather adopt a closed diary (69%) approach (Figure 7).

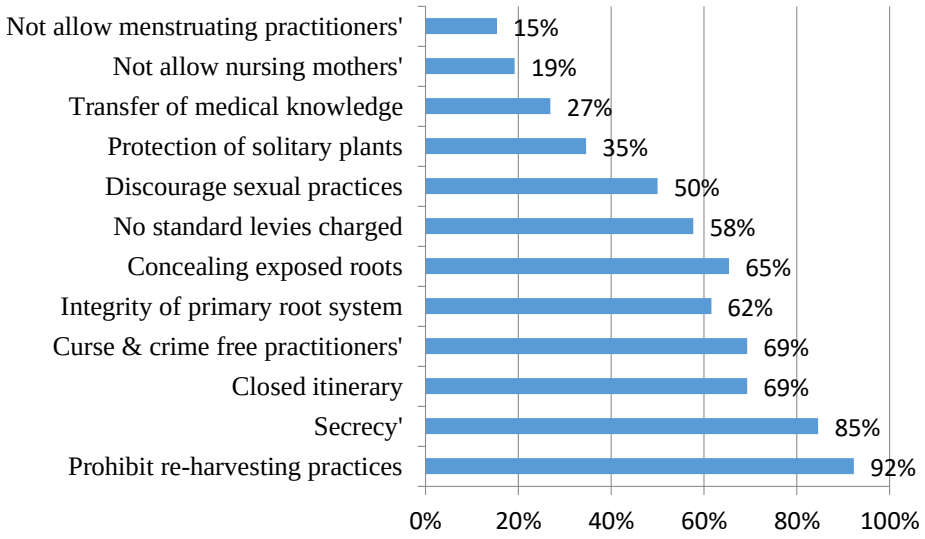

Figure 7. Frequently observed TGPs in the surveyed areas.

4.2.5 Secrecy or limited disclosure of TM knowledge?

Traditional medicine market display demonstrated that few traditional healers (15%) fully reveal invaluable and critical local medical knowledge. However, the oral interview was characterized by measured or limited disclosure of critical traditional medicine information. Easy-to-disclose disclosed data include: general herbal uses, plant growth habit, plant parts, drug action and diseases or sociocultural syndromes. Hard-to-disclose data include actual folk or ethnotaxonomic identity of the medicinal plant species or traditional medicine, exact site of collection, actual habitat and the mode of administration. To enforce limited disclosure of information, most traditional medicine traders showcased scanty morphological and floral taxonomic characters that may not be useful in actual plant determination at a single glance (Figure 8).

Figure 8. (a) Display of herbal remedies in the open air markets, streets and avenues of Kitale town (b) Packets of herbal remedies displayed on the streets of Kakamega by a traditional medicine trader.

4.2.6 Traditional medicine formalization trajectory

The path to the constitution of robust and efficacious regulations is critically important alongside the un-hindered access to primary healthcare (69%), mitigation of suspicion among the legitimate stakeholders (69%), local and modern conservation approaches and fast-tracking of proper vetting and registration process (62%) and retention of local patents or IPR (Figure 9).

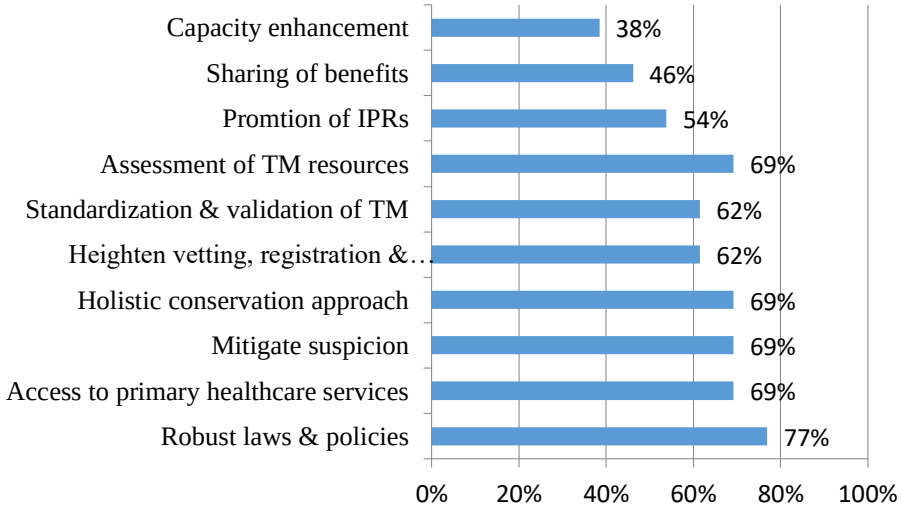

Figure 9. Professional Experts views on the importance of TM formalization.

4.2.7 Formal and Informal TM practices.

The surveyed medicine demonstrated a heterogeneous market that allowed perfect interaction in the recorded formal and informal practices (Table 12). From the market survey, most traders lacked practicing license and some had clearance from the Department of Culture and in possession of the Certificate of Recognition/Practice.

Table 12. Formal and Informal traditional medicine market practices.

Formal practices	Market centre	Informal practices
Simple dosage prescriptions, Partial labelling on paper packets or envelopes	Kakamega & Kitale	Oral or verbal dosage prescriptions
Certificate of drug analysis on analysed medicinal plant samples issued by relevant research/training institution; scientific taxa	Kakamega, Kitale & Moi's Bridge	Use of vernacular/local languages or ethnotaxa
Packaged medicine (plastic bottles, paper envelopes or polythene bags)	Luanda, Kakamega, Moi's Bridge, Eldoret, and Kitale	Modest display of herbal remedies.
Certification and Recognition from the Department of Culture	Kakamega, Kitale & Moi's Bridge	Governance through sociocultural protocols: social taboos, beliefs, norms and customs
Sale of processed TM products; Receipts issued on payment of charges, fines and market levies	All TM markets	Dispensing raw medicinal plant materials; No receipts issued.
Market issues channeled through Traditional Medicine Herbalists and Practitioners Associations; membership guidelines/fee is normally charged	Luanda & Kitale	Patriarchy.
Portable microphones or sound systems to advertise the TM products on sale	Kakamega	Face to face medium of communication; Limited or no Pharmacovigilance of traded traditional medicine. More often than not, actual adverse effects may be misconstrued for drug action.
Products diversification including trade on other non-medicinal products: beads, calabashes, sweets/candy's, snuff tobacco and processed imported herbal products	Eldoret, Kakamega & Kitale	Strict specialization and apprenticeship
Sourcing of TM supplies from known vendors, collectors, and peers	Makutano, Kakamega, Yala & Eldoret	More practitioner led collections; sourced through trusted vendors
TM trade governed by county by-laws, national laws and policies	All TM markets	Governance through laid down sociocultural protocols.
Environmental consciousness and protection	All TM markets	Community based conservation strategies

The open air medicine markets only provide spaces for offering oral prescriptions or disseminate information regarding home-based drug administration or self-medication (Figure 10).

Figure 10. (a) Sale of packaged traditional medicine products on a Kakamega street; (b) A traditional medicine trader advertising his medicine products in the Muliro Gardens in Kakamega County.

4.2.8 Potential areas for training TMPs.

The interviewed professional experts perceived that properly vetted TMPs should be trained on TM drug safety and quality (85%), sustainable harvesting practices (77%) and prioritization of environmental conservation and governance (77%). Patient referral within and outside the country (69%) was regarded important in order to save lives whenever traditional medicine fails or in cases of life threatening adverse TM effects, drug interactions or toxicity. Some professional experts also perceived that it was important that traditional healers should be trained on good record keeping (Figure 11).

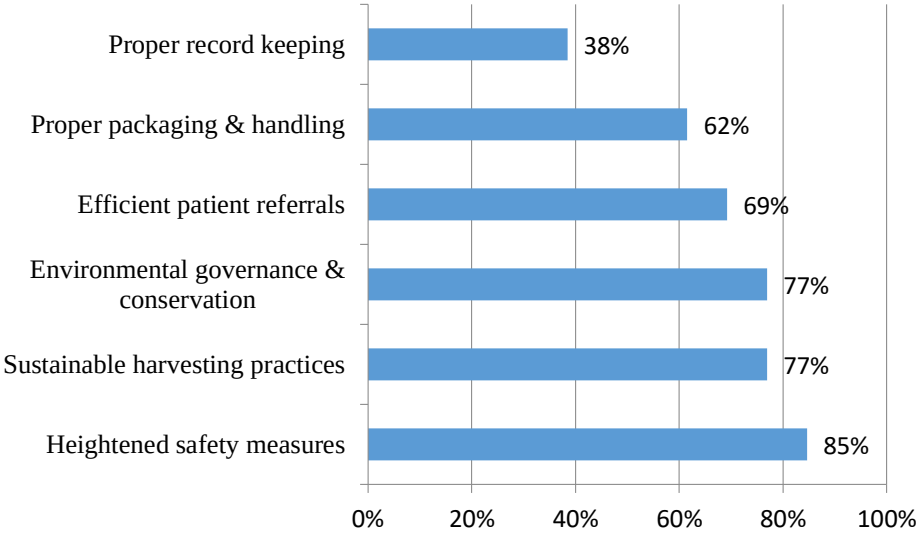

Figure 11. Professional experts' perceptions on the prioritization of thematic areas for TM training.

4.2.9 Traditional Medicine and Herbalists' Associations

Most TMPs strongly believe that Traditional Medicine and Herbalists' Associations are important and serve as gateway to technical and financial assistance (81%), cultivate and promote cooperation among traditional medicine stakeholders through organization of workshops and seminars (73%) and bolster research and collaboration in the sector (Figure 12).

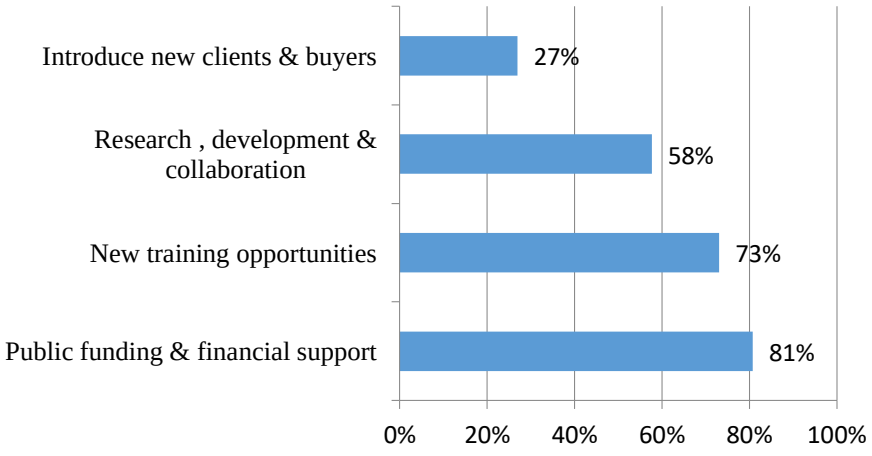

Figure 12. Traditional Medicine Practitioners perceptions on the benefits derived from organized Traditional Medicine and Herbalists' associations.

4.2.10 Sources of Traditional Medicine knowledge

Most TMPs (57%) acquired their TM knowledge from their grandmothers, and few (13%) tapped medical knowledge from their fathers, aunts (8%), mothers (11%), and some learnt on their own (3%) while others learnt from TM researchers or published TM information (Figure 13).

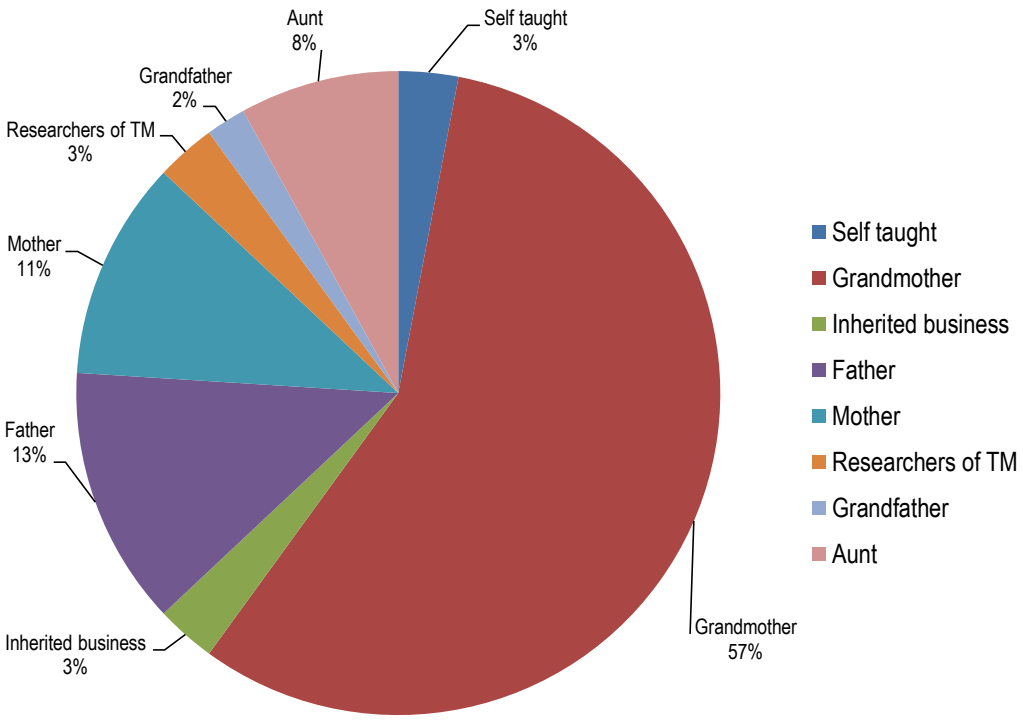

Figure 13. Sources of Traditional Medicine knowledge.

4.3 Sociocultural practices that promote the conservation of medicine plant resources.

4.3.1 Market perceptions of sociocultural practices in conservation.

Qualitatively, the thematic content analyses demonstrated various means that are locally employed to conserve and protect TM (Figure 14). Overall, conservation measures and growing indigenous traditional knowledge can help conserve important plant species and prevent their declining populations.

Theme 1: Exclusion and Restriction

Sub categories: Women barred from practice during menstruation; Practitioners with cultural curses or criminal record restricted from practice.

Theme 2: Secrecy and protection of Intellectual property rights.

Sub categories: Ethical harvesting and sustainability practices; Community and traditional guidelines on harvesting (Not uprooting, covering exposed roots); Discouraging sexual activities during the treatment period; Transmission of TM knowledge to the next generation.

Figure 14. The thematic responses from the TMPs on sociocultural conservation strategies.

4.3.2 Sociocultural aspects important in conservation of TM

Majority of the traditional market traders were esoteric and largely shared their TM knowledge strictly within their groups, peers and circles. These esoteric elements of medical information are usually passed to close relatives or dependants, and this was widely observed as a form of community regulation of the TM practice. The practice was characterised by limited disclosure of information within the known TM circles (90%) and was viewed as a safe measure to conserving or preserving the TM medical knowledge from opportunistic stakeholders.

Most TM traders also could not reveal their operations or working diary either in practice or collection of the medicinal plant resources (86%). This closely guarded practice was extended in many areas including and not limited to lack of labelling, selling TM products with scanty taxonomic characters, not revealing growing habitats and collection points.

Secrecy for posterity principle was largely favoured by the TM traders and widely regarded as the only free and affordable local patent mechanism. Most TM traders also locally promoted the conservation and preservation of indigenous medical systems and sanctity of the natural environment (86%). Sociocultural conservation strategies showcased by the traders included the promotion of good harvesting practices that discourages uprooting of solitary species (76%), maintaining integrity of primary roots (81%) and frown upon destructive and wanton debarking (67%).(Table 13).

Table 13. The observed sociocultural conservation strategies.

Socio-conservation strategy	Frequency of mentions/citations	Survey market response %
Discourages multiple collections of plant parts from same plant in a day	15	71
Highly safeguarded collection expeditions (At dusk, dawn or in the night)	19	90
Protection of solitary plant species	16	76
Cultivation and domestication of medicinal plants	10	48
Protection of exposed roots.	17	81
Maintenance of root integrity during harvesting	15	71
Preclude reckless debarking	14	67
Enhanced secrecy	18	86
Preservation of local patents	17	81
Conservation of indigenous medical and health systems	18	86

4.3.3. Sociocultural aspects of medicinal plants conservation

Sensitized rural communities lay emphasis on monitoring and evaluation (M&E) aspects of management, governance, ecological and social considerations. This emphasis serves to bolster adaptive management and redirect efforts towards evidence-based conservation. Locally, particularly in rural communities, conservation efforts are more inclined to community perceptions rather than evidence-based conservation.

An advantage attached to conservation based on community perceptions is the inclusion and understanding of deep seated sociological beliefs, ecological outcomes and improved conservation policies, actions and outcomes (Bennett, 2016). For decades, local communities have survived on their cultural innovations, traditions and practices that dictated the type of medicine used in the treatment of various diseases (Ageh & Lall, 2019).

Despite lacking the conventional grasp of modern species concept, there exists a wealth of indigenous knowledge on species use and diversity, although the sustainable utilization of medicinal plants was largely dependent on sociocultural protocols. Cultural-rich societies have demonstrated an intricate and dependent relationship with nature, conservation and preservation of traditional medicine (both medicinal flora and fauna) and other natural resources. Therefore, protection of traditional medicine markets help in the preservation of this invaluable medical plant knowledge crucial in the maintenance of local social history and natural environment (Luo *et al*., 2018).

Notable sociocultural protocols important in conservation include but not limited to taboos, customs, traditions, rituals, ceremonies and organized festivals with a deep emotional attachment and veneration of ancestors. This places the traditional healers at the centre of rural conservation approach serving as the principal custodians of the rich indigenous knowledge systems (Chinsamy & Koitsiwe, 2016; Ssozi *et al*., 2016; Singh *et al*., 2017). Community's social rituals, customs, myths and taboos constitute the Traditional Ecological Knowledge (TEK) and are passed by word of mouth from generation to generations (Sinthumule & Mashau, 2020). Local communities often conduct prudent governance of their natural resources and biodiversity through set norms and practices as dictated by strong traditional and largely informal community-based institutions. Sociocultural norms help in the harmonious reconciliation of human needs and conservation (Janaki *et al*., 2021).

Harnessing of medicinal plants locally are mainly controlled by management procedures that include taboos, seasonal and social constraints. Furthermore, these social taboos have been summarized into five main categories namely: species specific taboos (designed to protect a particular species), life history taboos (designed to protect species at particular growth stages), method taboos (dictates the method used to harness or exploit the species), temporal taboos (defines access of resources based on time) and habitat taboos (governs access of resources in time and space).

Social taboos normally control who is allowed to harvest or utilize medicinal plants and at what time or location (Sen & Bhakat, 2020; Janaki *et al*., 2021). The needs, worries, social relations, ethical and spiritual values of local communities further help shape the conservation management strategies and decisions. These conservation management strategies basically respond to uncertainty and enables realization of customs, emotions and curiosity that are part and parcel of management decisions (Rangel-Landa *et al*., 2017). The conservation of herbal remedies may take place consciously or intentionally on available spaces in the local communities. Conscious based conservation can be exercised directly by effecting conservation measures from the grassroots to the national level (Doffana, 2017; Abisoye *et al*., 2022).

Some models (tested for faunal conservation but presumed to be applicable to modern and advanced conservation of flora) have demonstrated changing social context of wildlife conservation where higher levels of education, income/wealth, and urbanization have been linked to a corresponding high number of mutualists (wildlife being part of a social network and deserving care) and low number of traditionalists harboring domination (wildlife being used to benefit humans) values (Manfredo *et al*., 2020). These models may be applicable to floral conservation and particularly help boost our natural biodiversity.

Conservation of medicinal plants revolves around protection, maintenance, extraction and sustainable utilization of natural resources (Rajasekharan & Wani, 2020). In a holistic conservation approach, the traditional ethno-ecological knowledge should be promoted in the silvicultural management that should be applied mostly to over-exploited medicinal plant species. A shift from a pure ecological and sociological fashion to an ideal environment that integrates societal values into conservation enjoys prioritization in the global conservation approach (Beltrán-Rodríguez *et al*., 2017).

In addition, an effective collaborative engagement or partnership should integrate management strategies with the development needs of the local communities and fully embrace bottom-up collaborative approaches (Lake *et al*., 2018). Equally, traditional healing practices have been assessed to be society-specific and reflects the location, beliefs, sociocultural, socioeconomic and political organizational ideals of the people. In most instances, restorative healthcare for healing or health rituals have always been carried out using herbal remedies.

In most instances, a growing educated urban population do not believe in conservative traditional healing practices including the traditional medicine knowledge. Conservative traditional practices combined with cultural and seasonal restrictions particularly in the harvesting of medicinal plants have contributed immensely to conservation and protection of TM resources (Khan *et al*., 2018). Ironically, most dominant players in the traditional medicine trade have less formal education and not illiterate as widely perceived.

But in essence, they draw or imbibe most of their knowledge and wealth of experience from other less formal but gifted pool of traditional healers. The major hiccup in the conservation agenda of traditional medicine is absence of a convincing and successful transmission of TIK to the younger generation in its authentic and original form (Isiko 2019; Susanti & Zuhud, 2019). Regarding consumption and utility of traditional medicine, the less educated tend to consume more traditional medicine than the educated lot (Aabdousse *et al*., 2020).

Sociocultural factors that have been reported to cause a decline in TIK and practices include the distance to traditional medicine sources, age, ill health, access to modern medicine and agricultural intensification (Atreya *et al.,* 2018). However, the traditional knowledge should factor in the most important facets of a vibrant community structurewhich include the natural, cultural, usefulness or/and even religious or spiritual aspects, customary laws and traditions critical for biodiversity conservation (Duguma & Mesele, 2019; Susanti & Zuhud, 2019).

Susanti & Zuhud (2019) documented the role played by three pro-conservation stimuli significant in TEK namely: natural stimuli, usefulness stimuli and religious stimuli. Natural stimuli is inclined more to sustainable agriculture, usefulness stimuli touches on the uses of the individual plant species in meeting basic human needs, whereas the religious stimuli appreciates the role of customary laws by communities for sustainable extraction of plant species products and their conservation.

In the Indian state of Odisha, it was reported that some trees and their plant parts (branches, twigs and leaves) represent some deities and are revered by local communities and therefore enjoy some level of cultural conservation and protection. However, this form of conservation is threatened by progressive erosion of sociocultural taboos and community rules leading to destruction of some Indian sacred groves (Rath & Ormsby, 2020). An earlier study revealed that the implementation of sociocultural laws by upholding traditions and beliefs positively aided the conservation of sacred groves including natural forests. Awareness campaigns or educating local communities in the general understanding on the wide range of ecosystem services from natural resources (Mohapatra *et al*., 2017). To prevent the destruction of sacred forests or groves, there should be a symbiotic relationship between the cultural belief system and the natural resources (Negi *et al*., 2018). The ascription of totems to natural resources and creation of forbidden limits further serves to protect the environment from destruction.

It is also believed that whoever destroys the sacred environment will attract the wrath of the supernatural forces (Aniah *et al*., 2014). Significant gender roles have been also been reported to influence the sustainability of traditional medicine use in urban and peri-urban communities. Male clients' demonstrated preference to utilizing root plant parts for medication whereas female clients preferred barks. Female traditional medical practitioners also showcased more knowledge in traditional medicine as compared to the male practitioners (Torres-Avilez & Albuquerque, 2017). Women were also perceived to be motivated to do more environmental activities than men because of the benefits (ecosystem services) they draw from it. Women also get more attached to cultural and religious elements, particularly to some medicinal plants, and are therefore huge proponents of stricter conservation approaches (Ondiba & Matsui, 2020).

4.3.4 Traditional conservation strategies

Incorporation of strong and validated indigenous sociocultural practices and beliefs of the local communities into the modern conservation strategies has become increasingly important. Sustainable harvesting and cultivation methods are still ranked as leading conservation strategies applied by most conservationists (Muriuki *et al*., 2012). With ubiquitous cultivation practices, the debate shifts to revolutionary organic farming which is often valued because of heightened quality, retention of natural attributes, increased production, genetic boost, enhanced biosynthesis of bioactive compounds and active ingredients, hastened growth rates and increased biomass.

Economically, organic farming positively affects prevailing market prices, boosts overall economic growth and attainment of social stability among traditional healers, collectors, farmers and suppliers (Shahrajabian *et al*., 2019). Major cultural and traditional practices in traditional medicine conservation include; totemism, conservation of sacred and protected areas like shrines, evil forests, sacred groves and burial grounds for the conservation of TM (Xego *et al*., 2016; Eneji *et al*., 2019).

Using local conservation knowledge in combination with customary rules and regulations, customs and rituals, taboos and totems, with the application of folklore metaphors and proverbs promote local conservation efforts (Mavhura & Mushure, 2019).

4.3.5 Totemism and deities in conservation

Totemism is defined as a belief system where humans have a mystical, mythical or spiritual relationship with plants or animals (Eneji *et al*., 2019). In addition, totemism can be further explained as a practice where some tribes or communities believe that certain animals, plants or physical features carry ancestral significance or mythical relevance and hence cannot be harmed or destroyed. Other than totemic veneration, totems are also invaluable in the performance of rituals or sacred ceremonies (Singhal *et al.*, 2020).

Totemism and deity worship in many traditional communities help conserve both the revered plants and animals, whether it is by default or design is another story since it is not supported by any environmental consciousness or pragmatism. The baobab (*Adansonia digitata* L.) tree is revered in most parts of the African continent, whereas *Euphorbia ingens* E. Mey ex Boiss enjoy protection due to traditional beliefs, emotions and ethical societal controls designed to serve as a traditional lightning arrester (Benson, 2021; Reniko *et al*., 2018). Other totemic plant species include: *Croton oblongifolius* Roxb., *Ficus benghalensis* L., *Tamarindus indica* L. and *Ficus religiosa* L. (Singhal *et al*., 2020).

Other notable protected plant species in the Indian sub-continent due to cultural-religious reasons include *Butea monosperma* (Lam.) Taub. and *Mangifera indica* L. where these two species are prominently valued as good cremation zones (Talukdar & Gupta, 2018). Reverence to supreme deities, ancestors, spirits and strong beliefs in animism, sorcery and witchcraft has contributed immensely to conservation of forests and plant resources.

This conservation is in tandem with the calling to preserve natural resources and biodiversity, and at the same time please the supernatural beings and also not to attract a curse, wrath and punishment from the spirit world (Adom, 2018). Other than the religious undertones associated with totemism, it has helped conserve plants by assigning some spiritual importance and are therefore immune to exploitation (Marumo, 2019).

Animism has been distinguished from totemism in the sense that it attributes life into inanimate things and natural elements, for instance, trees personified as home of ancestors and shrine, whereas totemism is where plants or animals are regarded as symbols of ritual importance and are hugely revered and celebrated by those who believe in them (Insoll, 2011). Religious beliefs and worshipping of some identified and revered god trees is reported to have positively contributed to conservation and regeneration of valuable plants. In the Gairsain region of Chamoli, Uttarakhand state of India, *Quercus leucotrichophora* A. Camus., *Prunus cerasoides* D.Don, *Celtis australis* L. and *Myrica esculenta* Buch.-Ham. ex D.Don. among others are revered by the villagers and are protected by locals from wanton destruction (Khasim *et al*., 2020).

4.3.6 Social taboos and conservation

Traditionally, access to natural resources was controlled by stringent traditional beliefs, taboos and customs and monitored by community leadership structure. It is believed that complete devolution of natural resources to the community level enhances the conservation agenda by instilling some cherished ownership values (Chigonda, 2018). Therefore, social taboos have succeeded in stemming deforestation on prohibited spaces and fidelity to local conservation regulations and approaches (Maru *et al*., 2020).

As a product of culture, some of the regulatory norms and societal taboos that constitute traditional conservation strategies include preventing re-harvesting of already harvested medicinal plant, limited disclosure of traditional medicine knowledge and sources, avoiding uprooting stand-alone plants, covering of exposed roots with soil mounds, and discouraging the harnessing of primary roots (Chebii *et al*., 2020).

Other documented and sustainable harvesting practices include avoiding girdling, discouraging ring-barking, encouraging collection of minimal number of roots and restrained debarking (Cunningham, 1989; Mbinile *et al*., 2020). Ring de-barking has been identified as the major cause of tree die-off and therefore exposing tree canopies, structure and species community composition to colonization by invasive species (Cunningham, 1989).

4.3.7 Modern conservation strategies

The modern conservation strategies for medicinal plant species are mainly classified into four (4) main areas: *ex situ* and *in situ* conservation, and enhanced by research and education. The two leading conservation strategies being *ex situ* and *in situ* which are considered reliable when it comes to the conservation and protection of prioritized and highly ranked medicinal species. *In situ* habitats simply refer to where plant species are found naturally and they include: biosphere reserves, sacred groves and natural forests, whereas *ex situ* habitats are areas found outside the species natural habitats and they include: field gene banks: botanical or herbal gardens, kitchen gardens, arboreta and seed banks (*in vitro* seed and gene banks, DNA banks, cryobanks) that enable storage and preservation of seeds and propagules of marked plant species. New and modern cultivation strategies (hydroponics and organ/tissue cultures) and domestication of the MAPs are considered improved methods for biodiversity conservation, and their adoption is highly encouraged.

These modern progressive cultivation strategies are aimed at growing prioritized medicinal plants, hastening growth rates, increase the concentration of active ingredients and bioactive compounds or even increased plant part quantities to meet the growing market demands (Phondani *et al*., 2016; Xego *et al*., 2016).

The fast growing and multipurpose medicinal plant species should always be prioritized for cultivation and domestication (Ibrahim *et al*., 2016). Species prioritized for conservation should have a lower environmental availability and a higher exploitation rate (da Silva *et al*., 2019). Agroforestry offers a viable system with which multipurpose medicinal plants (food and medicine) can be grown and conserved (Khalid *et al*., 2017). With increasing human population, cultivation is mostly constrained by decreasing land sizes, competing land uses, uncontrolled harvesting, slow growing or long maturation species, low value monetary value species and practitioners lacking adequate knowledge on modern silvicultural practices (Ebifa-Othieno *et al*., 2017). Ultra-modern conservation strategies should be assigned to endangered plant species that has the potential to cure or treat many of diseases (Dadjo *et al*., 2020).

From an ethnobotanical viewpoint, few documented species that include *Asystasia schimperi, Carissa spinarum* and *Toddalia asiatica* medicinal species were categorized as endangered with proposals given on the need for a progressive hormonal aided propagation using stem cuttings (Ruth *et al*., 2010). However, modern conservation strategies are beyond the grasp of most traditional healers but can be implemented alongside traditional conservation strategies. Traditional medical practitioners should progressively employ new technologies that would realize an increase in TM quantities and quality to satisfy the growing market needs. The new technologies should be fashionably designed to influence sustainable extraction, quality development of the herbal products, exquisite packaging and preclude contamination of medicinal products (Cahyandito & Oktasari, 2019).

In some unfortunate cases, most adverse effects have been blamed on accidental contamination and intentional adulteration (Mosihuzzaman, 2012). Properly updated species inventory, checklists and ethnobotanical databases serve as key decision making tools that scientifically guide the conservation of threatened medicinal plants (Rajasekharan & Wani, 2020; Ayalew *et al*., 2022). Prudent keeping of historical records backed by good and reliable data is invaluable in the protection, preservation and conservation of medicinal plants (Jamshidi-Kia *et al*., 2018).

4.3.8 Conservation and protection of medicinal plant species.

Conservation measures are crafted to guarantee a sustainable and uninterrupted supply of TM for present and future generations, and at the same time facilitate perpetuation of threatened species (Barata *et al*., 2016). Less known but efficacius traditional methods of harvesting are subjected to cultural controls and social taboos and not strict conventional regulations. Fundamentally, most of the local TM and herbal practitioners adhere to strict and cultural guided gathering restrictions (Monica *et al*., 2016). Harvesting restrictions for some plant species or plant parts can be imposed directly by local communities as a management method. These restrictions can be extended to cover seasons or rather impose periodic harvesting with clear emphasis on multi-purpose species. *In situ* management strategies calls for harvesting of plant parts (roots, bark, stem, leaves, fruits, bulb *et cetera*) right in their natural habitat (Rankoana, 2016).

Local communities are at the centre of these in situ harvesting management strategies. In addition, most *ex situ* conservation measures have gained huge popularity among communities, for instance, in the management of easy-to-do and low cost home gardens, farm-backs and front-yards which are cheaply and adequately maintained through cultivation. However, medicinal species that are not easy to domesticate or manage are most often conserved *in situ*.

Medicinal plants conserved *in situ* are often vulnerable to overharvesting or over-exploitation and must be protected well to preclude prevent in wild populations (Xego *et al*., 2016; Bizuayehu & Assefa, 2017; Doffana, 2017; Pati, 2017). The major bottleneck in the establishment of home gardens among the rural-based medical practitioners is relatively higher costs of production as compared to those practitioners who simply collect cheaply from the wild (van Wyk & Prinsloo, 2018).

Agronomically tested management practices for a well-groomed mixed home garden include the cultural methods of intercropping and crop rotation practices. Intercropping is a simple management practice that has been easily adopted by local populations, particularly those practitioners having small farm sizes or small spaces found in farm yards and kitchen gardens. Diversity can therefore be attained through organized cultivation and domestication of more valuable annual/perennial herbs and shrubs (Jaya *et al*., 2019). The urge and need to exploit unregulated common plant resources for individual gain or profit overrides the need to conserve the resource. Recapitulation of the Hardin's tragedy of commons, Game Theory Logic and the Prisoner's Dilemma theories strongly asserts that private incentive and individual drive to exploit a common resource is way stronger than the collective sustainable utilization and conservation benefits (Rath & Ormsby, 2020).

The Game theory determines the interactions between two or multiple players to understand actions under specified conditions. The specific games are developed to determine scenarios that help maximize both environment and overall sustainability (Collins & Kumral, 2020). The Restorative Commons theory underscores the benefits of environmental stewardship and allows for expansion of the environmental land ethic to a revamped global health ethic (Gurevich, 2020).

The creation and realization of a little known indigenous conservation policy serves as a boost in the quest for a competent cultural and biodiversity conservation that effectively matches the benefits derived from harnessing medicinal plant species (Ens *et al*., 2016). Therefore the significance of indigenous, tribal and cultural practices cannot be overlooked in the conservation agenda. Notable pressures of a viable conservation programme include pressure from industrialization, over-exploitation and the expansion of agricultural activities (Rath & Ormsby, 2020).

4.3.9 Sociocultural governance and management of Traditional Medicine

Public policies should be potent enough to completely regulate and check traditional medicine industry so as to safeguard the health of consumers. The constituted policies should enhance the traditional community conservation practices that are effective in the conservation of medicinal plants. Generally speaking, efficacious regulations should promote good harvesting and ensure sustainability of the TM economy (Beltrán-Rodríguez *et al*., 2017). The formulated regulations should cover overall governance of the market operations, legalization of the major processes and the distribution of final TM medicine products (Cahyandito & Oktasari, 2019). Four criteria and several indicators (as indicated in brackets) have been developed to achieve long term economic and environmental sustainability of medicinal plants formal and informal trade and they include: governance (aiding environment and policy making, strengthening institutions and improving infrastructure); sociocultural (traditional knowledge system, community acceptability); environmental/ecological (resource status, regularization of collection from the wild, conservation and provision of ecosystem services); and lastly, a holistic economic criteria that considers cultivation, marketing, industry, research and development (Negi *et al*., 2018).

Sustainability hiccups emanates from a host of biological factors which include slow growth, endemism and sensitivity to climate change. These hiccups can be addressed by substituting endangered plants, replacement of plant parts with same pharmacological activity, and adopting artificial or synthetic alternatives. On a national scale, governments can impose trade and consumption restrictions on endangered medicinal plant species (Cheung *et al*., 2021). The efficiency of governments in the enforcement of trade bans is still widely contested since illicit trade of vulnerable species are still carried out albeit informally. Regulatory institutions usually effect trade bans on threatened plant species or ban the trade of listed plant species.

The effectiveness of a top down conservation approach remains a debatable issue, it is therefore imperative to cushion marked plant species from wanton destruction or harvesting by devolving management rights to the local communities (Pyakurel *et al*., 2019). The efficacy of the customary laws as enforced by local communities is seen in the relationship between the people and nature. Conventionally, local users may be asked to obtain a permit first in order to extract forest resources or face a fine for any breach committed. Regardless of its informal nature, customary laws impose restrictions to preclude over-exploitation of forest resources (Susanti & Zuhud, 2019).

4.3.10 Medicinal plant diversity and conservation

Some plant families have a disproportionately high number of medicinal plant species and some have more threatened species. Based on a scientific determination of commonly used or traded taxa, more attention can be directed in the conservation and protection of the highly ranked or prioritized taxa (Chen *et al.,* 2016; Bizuayehu & Assefa, 2017). Frequently cited or highly ranked medicinal plant species are therefore perfect candidates for phytochemical screening, drug research and development (Kassa *et al*., 2020). The multipurpose medicinal species are more threatened than the single use plant species, this applies mostly in commonly used taxa or those used in drug combinations or drug synergies (Bizuayehu & Assefa, 2017).

Species diversity and abundance are always affected by over-exploitation, uncontrolled deforestation, poor harvesting practices and general habitat destruction (Chen *et al*., 2016). Forest degradation in the past influenced the supply of medicinal plant materials and their market prices as well as the desecration of sacred groves (Anyinam, 1995). The evaluation of the state of conservation for most frequently used medicinal plant species and constant revisions on their IUCN status based on field evidence helps conserve threatened, rare, vulnerable and endangered plant species (Dapar *et al*., 2020).

This underscores the importance of accurate botanical identification of these frequently traded medicinal plants (Lima *et al*., 2016). Proactive conservation measures therefore starts with plant inventories or botanical checklists and mapping of geographic hotspots for conservation. Local communities should be educated via a series of awareness campaigns in the creation of robust legislations, development of seed banks and the importance of modern germplasm repositories (Ouedraogo *et al*., 2020). Some governments, for instance, India, has enforced measures to promote conservation of *in situ* habitats through creation of special MPCDAs or Special Medicinal Conservation Development Areas. MPCDAs allow for conservation of endemic germplasm, with priority assigned to the red listed medicinal species and associated flora (Biswas *et al*., 2017).

In situ conservation primarily allows for protection of threatened plant species right in their actual habitats and help reduce pressure on our forest ecosystems (Sanwal *et al*., 2017). Other than cultivation or sustainable agriculture, substitution of root plant parts with other parts that have same biochemical and pharmacological activity aids in the conservation and protection of bioresources. This is exemplified by substituting roots or root barks with leaves as seen in the use of *Premna latifolia* Roxb. (Jena *et al*. 2017). The protection of natural plant resources enhances discoveries of new pharmaceautical drugs (Singh *et al*., 2020).

Other than the use of locally available wild vegetables for medicinal purposes, the utilization of common weed species (some are rather undesirable and obnoxious) in farms, gardens, yards, compounds, office premises *et cetera* serve as traditional medicine repositories. This maximization of little environmental spaces help reduce pressure on forests ecosystems. At the same time, removal of useful weeds is also beneficial in crop production and enhanced crop yields (Abiodun & Tunji, 2019). Finally, gender specific roles in conservation is still widely considered a conscious effort. Men are favoured as architects of more diverse medicinal plant gardens whereas women were identified as leading broadcasters of TEK to the younger generation (Caballero-Serrano *et al*., 2019).

4.3.11 Sustainability of Traditional Medicine resources

Sustainability is still a much broader concept where aspects of socioeconomic, environmental paradigms or pillars on sustainability have been widely documented. Economic gains positively influences the changes realized socially, ecologically and environmentally (Purvis *et al*., 2019). Harvesting of plant parts like roots or sometimes harvesting the whole plant impose devastating effects on the sustainability of threatened plant species as opposed to extracting other plant part or parts like leaves, flowers and buds (Chen *et al*., 2016).

Sustainability can also be achieved through propagation of new and desirable plant traits with a corresponding increase in functional benefits and value addition (Ebifa-Othieno *et al*., 2017). In most instances, collection of nearby plants with redundant utilities help lower plant use pressure on local indigenous plant populations and consequent conservation of the larger indigenous biota (Kunwar *et al*., 2016). Lack of sustainable harvesting and propagation methods negatively affects recruitment of new members into the exploited plant population. As previously indicated, special emphasis must always be focused on multipurpose and slow growing medicinal plant species.

Sustainability challenges are often compounded by sustained climate changes, irregular land use plans, low and erratic rainfall pattern, agriculture intensification, encroachment and expansion of human settlements (Mbinile *et al*., 2020). The sustainability of TM of knowledge, local cultural heritage and successful transmission to the next generation are exceedingly important if TM should be vibrant venture now and in future (Nankaya *et al*., 2019).

4.3.12 Crafting a holistic conservation vision

Traditional systems of conservation have a role to play in the modern conservation approach. Blending the existing myths, rituals and perceptions with modern conservation measures by involving traditional healers and local communities in the conservation of their natural resources (Abugiche *et al*., 2017). An effective conservation approach for medicinal plant sources should adequately follow both the conservation strategies (*ex situ* and *in situ* conservation approaches, cultivation, domestication, research and development) and prudent resource conservation strategies (sustainable use solutions, good agricultural practices).

The most prominent *in situ* conservation domains include wild nurseries and natural refuge sites whereas the leading *ex situ* habitat conservation strategies include seed banks and botanical gardens. Modern biotechnological approaches that include micropropagation methods, tissue culture (TC), micropropagation and synthetic seed and molecular technologies must be observed in the quest to improve the production and quality of medicinal plants (Chen *et al*., 2016). DNA banking is an ultra-modern conservation method of the plant species by preserving their genome at low temperatures (Agrawal & Danai, 2017). The development of medicinal germplasm and gene banks are invaluable in the multiplication, sustenance and propagation of rare and endangered medicinal plants (Pati, 2017). Educational awareness campaigns on efficacious conservation strategies of medicinal plants should be placed on those species that are in high demand, slow growing, threatened or those growing in delicate and vulnerable habitats.

Basic and simplified training modules for traditional healers bolsters conservation measures of highly valued or exploited species and can be blended with folk knowledge. The trained or sensitized traditional healers in turn will train their apprentices in key processes like collection, administration of rituals, and in the inspiration of young and educated members of society to embrace traditional medicine (Mathibela *et al*., 2015; Tilahun, 2018).

Adopting an integrated ecological (endemism, threat status) and socioeconomic (use value, harvesting practices) approach help minimize loss of species, bolster sustainable utility of biodiversity, prioritized conservation approaches and high regard for urgent research attention (Tali *et al*, 2019). Society or community awareness on the importance of traditional herbal and medicine products, positive sensitization weeds out negative publicity and increases the trade, utilization and practice of TM (Cahyandito & Oktasari, 2019).

There is need to advance learning and educate local traditional medical practitioners on the importance of integrative conservation strategies (Aabdousse *et al*., 2020). Observation of Standard Operation Procedures (SOPs) like Good Agricultural Practices (GAPs) and Good Sustainability Practices (GSPs) are invaluable in checking environmental, toxic and contamination sources like pesticides, heavy metals and biological toxins to ensure heightened quality and safety of TM products (Ahmad *et al*., 2006).

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 DISCUSSION

5.1.1 Traditional medicine trade and uses

The TM industry was dominated by older practitioners or traders with an average of over two decades and showcasing a great mastery of traditional medical knowledge. A vibrant traditional medicine trade, growing demand of several medicinal plant species and increased quantities traded corresponds to the quantities harvested or extracted from the wild but rarely from cultivation or domestication (Ghosh, 2017). The medicine markets demonstrate different cultures of the local inhabitants which are reflected in the general floral compositions and varying plant uses (Gakuya *et al*., 2020).

TMPs demonstrate clear gendered medicine roles and activities with evidence of some blended herbal medicine exclusively designed for male or female clients use (Chebii *et al*., 2022). Women and experienced practitioners have also exhibited massive knowledgeable, skills and experience in the practice of TM as compared to men and younger practitioners (Umair *et al*., 2019; Bussmann *et al*., 2020). This gendered pattern has been documented by several authors, for instance, by the TM market sellers of the Abeokuta markets of Nigeria (Idu *et al*., 2010). In the Georgian Caucasus survey, resultant ordination analyses revealed distinct gender roles. The gender aspect lacked significance on plant-space ordination but showed importance in use-space ordination (Bussmann *et al*., 2020). Similar research findings pointed out that most traditional healers with basic education express unrivalled indigenous medical knowledge in as compared to the educated practitioners (Miara *et al*., 2019). Folk ethno-taxonomy is prominent in most TM markets, this form of identification works in the TM markets but lack universality. This is because most common or vernacular names refer to different plant species, and that folk ethnotaxonomy and local systematics lack taxonomic rigour (Otieno *et al*., 2015).

The dominance of ethno-taxonomy is linked to the fact that vernacular names unlike binomial nomenclature are derived from authentic cultural, ecological, experiential and societal elements of the dominant tribes, cultures or languages in the medicine markets (Chebii *et al*., 2022). Just like in the conventional binomial nomenclature and biosystematics, folk names are coined from direct visual observations of the conspicuous morphological characters.

To solve this ethno-taxonomic conundrum in the TM trade, only validated binomial nomenclature should be adopted as the most reliable form of taxonomic determination. Ethnotaxonomy recognizes the identification of medicinal plants using local knowledge and expertise. It also significant in the documentation of botanical diversity and their respective conservation (Jaya et al., 2019; Aparicio *et al*., 2021).

Traditional medicine industry has grown over the years, with practitioners trading both indigenous and naturalized plant species. For example, the increased use of the Neem tree, *Azadirachta indica* (a naturalized species that has attracted huge attention among users due to a perception of its numerous health benefits) in the treatment of many diseases. *Aloe* spp. have also attracted huge market interest and medical uses. From the survey, the frequently traded plant families include the Meliaceae, Apocynaceae, Asclepiadaceae, Fabaceae, Euphorbiaceae, Rutaceae and Capparidaceae (Capparaceae).

The dominance of Apocynaceae was broken by the taxonomic revisions that commuted some species to the Asclepiadaceae family. Other studies similarly reveal that Capparidaceae and Rutaceae were frequently traded by the Keiyo people of Elgeyo Marakwet County (Cheruiyot *et al*., 2013). Among the Marakwet people, the popularity of *Rotala tenella*, *Dovyalis abyssinica* and *Euclea divinorum* has also been documented. It was also reported that *Basella alba* was a dominant medicinal vegetable (Kigen *et al*., 2017).

The study also identified *Trichilia emetica*, *Aloe* sp., *Dregea schimperi*, *Carissa spinarum*, *Erythrina abyssinica*, *Warburgia ugandensis* and *Zanthoxylum chalybeum* as commonly traded medicinal plant species. The therapeutic uses of these dominant medicinal species were summarized and tabulated in Table 14. Commonly used medicinal plants listed in an ethnobotany survey may slightly differ from the frequently traded medicinal plant species. This difference can be attributed to different research approaches and methodological uniqueness of household and market surveys. Apparently, frequently traded species register high FC, RFC and RFC % values and are therefore perfect candidates for further pharmacological and phytochemical analyses (Yaseen *et al*., 2015; Chebii *et al*., 2022).

The study findings agree with other authors that stomachache and respiratory problems are the most treated diseases using traditional medicines (Wanjohi *et al*., 2020). Similar findings have been corroborated by high Informant Consensus Factor (ICF) for gastrointestinal (GIT) disorders (Cheruiyot *et al*., 2013; Miara *et al*., 2019; Amjad *et al*., 2020; Mutai *et al*., 2021). Medicine markets therefore provide opportunity for treatment of diseases difficult to treat using allopathic medicines, for instance, in the case of cancer, diabetes and blood pressure. Gastrointestinal disorders and malaria have also been reported as commonly treated diseases by the herbal clinics of Gucha districts in the Kisii region (Ondicho *et al*., 2016). Other commonly diseases treated include colds, hypertension, UTIs, fever and headaches/migraines (van Andel & Carvalheiro, 2013).

Table 14. Traditional medicine uses of the most traded species as documented by other authors as indicated in brackets.

Medicinal plant species	Diseases treated (Reference cited)	Plant parts used
Azadirachta indica A.Juss.	Skin or body rashes, Malaria (Maina *et al*., 2013); Asthenia, Rheumatism, Boils,Kidney stones, Pelvic pain, Hepatitis, Constipation, Burns, High cholesterol (Randriamiharisoa *et al*., 2015); Fever, Thirst, Cough, Bad mouth taste (Rahman & Keya, 2015); Eye and Ear infections, Typhoid, Skin-fungal infections, Ring worms, Genital thrush, Herpes (Shiracko *et al*., 2016); Arthritis, Stick from twig used for brushing teeth (Pandey *et al.*, 2016); Bactericidal, Fungicidal (Sohel *et al*., 2016); Scabies (Faruque *et al*., 2019); Toothache, Viral infections (Ramya *et al*., 2019); Small pox, Rheumatism (Abassi *et al*., 2020); Mouth and Stomach ulcers, Heart diseases (Dar & Singh, 2019); Hepatitis, Vermicide (Shah *et al*., 2020).	Barks, Leaves, Seed, Seed oil, Twigs, Fruits & Whole plant
Carissa spinarum L.	Gastrointestinal disorders, Intestinal worms, Scabies (Kefalew *et al*., 2015); Tuberculosis, Cancer, Cough (Kewassa *et al*., 2015); Colds (Kimondo *et al.*, 2015) Reduces swelling and treats bruises, Management of HIV/AIDS, Pneumonia and Chest pains (Duncan *et al*., 2016); Rabies (Kassa *et al*., 2016); Women infertility, Abdominal pains (Kigen *et al*., 2016); Sickle cell anaemia, Fever, Epilepsy, Pain, Malaria (Mukungu *et al*., 2016); Snake poison (Chekole, 2017); Diarrhoea (Tefera & Kim, 2019); Breast cancer, Headache, Lowering BP, Rheumatism (Azeem *et al*., 2020); General malaise (Teka *et al*., 2020); Joints & muscle pains, Polio symptoms (Mwaura *et al*., 2020).	Roots, Barks, Fruits & Leaves
Dregea schimperi (Decne.)Bullock	Eczema (Kefalew *et al*., 2015); Rabies (Kassa *et al*., 2016); Asthma, Azurit (Teka *et al*., 2020)	Leaves & Seeds
Erythrina abyssinica Lam. ex DC.	Chicken pox, Abdominal pains, Colic pain in children, Men infertility (Kigen *et al*., 2016); Abortion, Cough, Malaria (Mukungu *et al*., 2016); Swollen lymph glands (Shiracko *et al*., 2016); Indigestion (Mbuni *et al*., 2020); Anaemia, Birth control, Brain disorder, Dehydration, Diabetes, Diarrhoea, Eye dryness, Fallopian tube blockage, Fibroids, Syphilis (Schultz *et al*., 2020)	Barks, Leaves & Flowers
Prunus africana (Hook.f.) Kalkman	Swelling (Kefalew *et al*., 2015); Sunken fontanel (Kewassa *et al*., 2015); Wound (Kassa *et al*., 2016); Stomachache (Mwaura *et al*., 2020).	Barks & Leaves
Trichilia emetica Vahl	Kidney disease, Skin rashes (Maina *et al*., 2013); Moisturizer (Kaigongi & Musila, 2015); Diabetes, Hypertension, Malaria (Mukungu *et al*. 2016)	Stem, Barks & Seeds
Tylosema fassoglense (Kotschy ex Schweinf.) Torre & Hillc.	Renal disorder, Infertility in women, Epilepsy, Arthritis, Cancer (Kigen et al., 2016)	Tuber
Zanthoxylum chalybeum Engl.	Sores and wounds (Kaigongi and Musila 2015) Toothache, Edema, Cough (Mutie et al., 2020); Liver cancer, Intestinal cancer, Skin cancer, Chasing away evil spirits, Epilepsy, Fallopian tube blockage, Psychosis, Syphilis (Schultz et al., 2020)	Barks, Roots, Root barks, Seeds & Leaves
Warburgia ugandensis Sprague	Diarrhoea, Respiratory problems (Kimondo et al., 2015); Clears blood and mucus from stool, Relieves pain among women who have just delivered (Duncan et al., 2016); Anemia, Aphrodisiac, Candidiasis, Fallopian tube blockage, Kidney failure, Influenza, HIV/AIDS management, Hypertension, Measles, Miscarriage, Nose bleeding and Nasal congestion (Schultz et al., 2020); Pneumonia, Stomachache (Mwaura et al., 2020)	Barks & Leaves

Species traded in the W. Kenyan markets that should be protected from decline in the wild include the critically endangered *Warburgia ugandensis,* the endangered *Carissa spinarum*, the vulnerable *Prunus africana, Warburgia ugandensis* and the woody *Dregea schimperi*. However, the frequently traded species of *Azadirachta indica*, *Zanthoxylum chalybeum*, *Erythrina abyssinica* and *Trichilia emetica* were categorized to be of 'least concern' by the updated IUCN Red list data (Chebii *et al*., 2022). The dominant growth forms or habits from the survey comprised of trees followed by shrubs, lianas/woody climbers and the herbaceous species. Roots were commonly traded followed by barks and twigs/leaves.

Similarly, in a recent ethnobotanical survey of the Marakwet people living near the Cherang'ani Forest Blocks, the tree habit was also the most cited plant habit followed by herbs and shrubs, and a combination of roots, barks and leaves were mostly sought by TM consumers. The most cited species from the Cherang'ani forest community include the *Zehneria scabra* climber, *Croton macrostachyus* tree and the *Cyperus esculentus* sedge (Mutai *et al*., 2021). Similar findings have been reported in the market surveys of the Northern frontier townships of Moyale and Marsabit where *Carissa spinarum* was also highly exploited and frequently traded (Delbanco *et al*., 2017). Recent ethnobotanical surveys in Nairobi, Narok and Kajiado revealed over-extraction of stems, barks and roots. The overharvesting of these plant parts directly affects species community structure and overall conservation efforts (Mwaura *et al*., 2020). In the South African medicine market of Gauteng, roots followed by bulbs and barks were also mostly traded (Rasethe *et al*., 2019).

Not all frequently traded medicinal plants are listed or captured in CITES, and therefore there is need to provide up-to-date data from market surveys to guide in their present and future regulation. From the CITES records, the cycad *Encephalartos tegulaneus* faces a trade ban in Kenya. However, species facing trade ban sometimes find their way to regulated markets, border points and transit locations (Lange, 2002).

Documenting current medicine market status of plant species help raise awareness on species use and heighten respective conservation measures (Dar & Singh, 2019). Other than regulatory and enforcement challenges, declining traditional medicine and medicinal plant resources continue to pose a huge challenge in the development of the industry. In addition, the continued decline of traditional medical knowledge and lack of interest by the young members of local communities is a major cause for concern (Amjad *et al*., 2020; Gakuya *et al*., 2020). Rational consumption of medicinal plants for curative purposes help bolster conservation and maintenance of biodiversity (Ramawat & Goyal, 2008).

The bark extracts from the mostly traded *Trichilia emetica*, previously referred to as *Trichilia roka* and a widely sought TM drug has been found to contain trichirokin and steroid ergosta-5, 24(28)-diene-3S, 16S, 20S-triol plus nine (9) compounds namely: benzoic acid, rohituka-3, lignoceric acid, protocatechuic acid, rohituka-9, β-sitosterol-3-O-β-D-glucopyranoside scopoletin, β-sitosterol and stigmasterol. Limuloid's from *T. emetica* have been found to have antimicrobial, antiplasmodic, anti-leishmanial and also anti-inflammatory effects.

Substantial evidence have also demonstrated the use of *T. emetica* in the treatment of gastric ulcer, hernia, and haemorrhoids. In addition, *T. emetica's* bark extracts are also widely used as emetic, vermifuge, against liver diseases, laxative, febrifuge, antiparasitic, in the management of menstrual cycle complexities and also against stomach pains and infections (Tsopgni *et al*., 2019; Usman *et al*., 2019). In addition, the rich seed extracts of *T. emetica* contain flavoinoids, cardiac glycosides, alkaloids and terpenoids (Perumal *et al*., 2020). These whole seed extracts also contain a catechin-3-O-α-Lrhamnopyranosyl (1→4) β-D-glucopyranoside (Usman *et al*., 2019). The neem plant (*Azadirachta indica*) is known to have up to 300 active compounds and useful in the treatment of many diseases. These active compounds are broadly classified into isoprenoids and non-isoprenoids, where isoprenoids are comprised of azadirone, limonoids, protomeliacins, vlasinin and gedunin terpenoids.

The csecomeliacins include the popular azadirachtin, salanin and nimbin compounds whereas the isoprenoids include polysaccharides, coumarins, tannins, amino acids and polyphenolics. Other neem compounds include gedunin, nimbolide, and azadirachtin for antimalarial; nimbidin, sodium nimbidate and polysaccharides with anti-inflammatory effects; margolonone, isomargolonone and mahmoodin have anti-bacterial whereas cyclic trisulphide and cyclic tetrasulphate contain anti-fungal properties. Neem polysaccharides have also demonstrated antitumour functions and nimbin and nimbidin are potent spermicidal substances (Latif et al., 2020; Uzzaman *et al*., 2020).

The magnificent effects and therapeutic benefits of *Azadirachta indica* alongside *Vernonia amygdalina*, *Nigella sativa* and *Eurycoma longifolia* were explored in the treatment of COVID-19. These species were potentially good against the coronaviruses since they have anti-inflammatory, antiviral and immunomodulatory benefits with *A. indica* being extremely effective against the SARS-CoV-2 (Lim *et al*., 2021). The Morroccans used *Olea europaea*, *Allium sativum*, *Zingiber officinale*, *A. cepa*, *Eucalyptus globulus*, *Thymus maroccanus*, *Foeniculum vulgare*, *Phoenix dactylifera*, *Curcuma xanthorrhiza*, *T. satureioides*, *Pimpinella anisum*, *Mentha pulegium* and *Rosmarinus officinalis* in the prevention and management of COVID-19, although limited information was reported about their toxicity.

These medicinal plants contain essential oils that promote symptomatic relief of general respiratory problems (El Alami *et al*., 2020). In Kenya, the sensation to prevent or reduce symptoms of respiratory infections has led to massive interest in *Citrus limon*, *Z. officinale*, *Curcuma longa* and *A. sativum*. The root barks of *Carissa spinarum* contain phenolic compounds known to be anti-inflammatory, hepatoprotective and also serve antioxidant. The less documented *Dregea schimperi* contain anthraquinones (Liu *et al*., 2021; Tegen *et al*., 2021). *Prunus africana* was reported to contain docosanol and β-sitosterol active compounds whereas *Capparis tomentosa* are known to have stachydrine (Maina *et al*., 2013).

Few literature sources have cited toxicity in herbal remedies, particularly those sold in informal local medicine markets. *Maina et al*., 2013 reviewed toxicity of some of the herbal remedies, with *Trichilia emetica* showing genotoxicity; *Azadirachta indica* has been found to induce nausea and vomiting, tachypnea, drowsiness and cause diarrhoea; *Prunus africana* was reported as a potential genotoxic agent; *Capparis tomentosa* prescribed for abdominal pains and asthma has been lnked to some human fatalities, particularly from consumption of their root extracts; finally *Senna occidentalis* and *Senna didymobotrya* have been linked to causing or exacerbating liver/muscle degeneration and gastrointestinal irritation respectively.

5.1.2 Governance of the practice of traditional medicine

Older women and experienced practitioners have an upper edge in the practice of TM, and this advantage is seen where most of the TM medical knowledge is passed to the gender as opposed to the . This domination can also be explained by the stringent traditional governance practices as observed through cultural lens. The stringent traditional governance practices include barring young women in the reproductive age category from active practice. Inferentially, as demonstrated from the study findings, TGPs were statistically not similar among sampled market locations due to a display of different cultures and tribal affiliations. The dominance of older practitioners, particularly women, positively demonstrate a credible, knowledgeable and experienced category of practitioners that easily attract and inspire confidence among TM users (Othman & Farooqui, 2015; Peltzer & Pengpid, 2018; Mwaura *et al*., 2020).

Suspicion among traditional medicine actors and limited disclosure of vital traditional medical knowledge meets cultural and religious requirements. For instance, communities practicing the Islamic religion control public interaction between men and women. These strict requirements makes hard for researchers from interviewing women practitioners of Muslim faith (Hussain *et al*., 2018; Umair *et al*., 2019).

In this market survey, sex, gender and cultural influence was so evident in the markets, for instance, male domination in the Kitale and female domination in the Makutano market. In addition, the reluctance to share valuable information in the field emanates from a sad history of exploitation, lacking adequate recognition, respect and acceptance coupled with uncertainty in benefit sharing (Williams & Hardison, 2013).

Full compliance to modern governance practices was observed in all the surveyed counties whereas adherence to traditional governance practices varied with varying ethnic compositions. Documented modern governance practices points out that what really matters is effective enforcement of the regulatory measures of traditional medicine and not having excess regulations. Successful sensitization and education campaigns on efficacious laws, parliamentary bills and adopted policies should be considered a top priority among the TM regulators (Carie *et al*., 2015).

There is a continuous feeling that the process of constitutional and policy making alienates the traditional medical practitioners and blatantly ignores an important constitutional requirement of public participation. The presence of uncertified practitioners (58%) underscores the importance of strict monitoring exercise, enforcement of laws and implementation of policies. Normally poorly formulated laws alienates the traditional healers and therefore do not reflect their needs and aspirations (Louw & Duvenhage, 2016).

Despite the marginalization of traditional medicine sector courtesy of a non-inclusive regulatory framework, no medical system is considered perfect or complete but the overarching goal needs to be a well-integrated and functional system (Sheng-Ji *et al*., 2001). The stakeholder theory therefore help stem the proliferation of quacks in the traditional medicine industry by promoting the patient as the main centre of focus and not the ‘money minting’ ill objective.

Stakeholder theory engenders ethical leadership in traditional medicine industry that respects the rights of individuals and communities despite the changes brought about by emerging technologies and globalization (Mathooko, 2013). Regionally, the practice of trdaditional medicine is derailed by the presence of archaic imperial laws and policies, for instance, the pre-independent Witchcraft Act of 1925 that should be repealed. These punitive laws alongside negative stereotypes and prejudices completely scared the authentic practitioners from active and stalled progressive traditional medicine practice. In South Africa, little hope was restored by the realization of the Traditional Health Practitioners act of 2007 which acknowledged and recognized TM enterprise and the role played by local healers.

Furthermore, traditional healers continue to have undefined or marginal market roles and position as compared to other established healthcare professionals like naturopaths, homeopaths, osteopaths and conventional professions like doctors, pharmacists and nurses. The Republic of Tanzania also passed the Traditional and Alternative Medicine Act (No. 23 of 2002) and established a traditional and alternative council mandated to monitor, regulate, support and promote the advancement of traditional medicine and fosters the conservation and protection of medicinal plants.

The concept of formalization of a largely informal sector should embrace an inclusive but diverse sector that values input of all stakeholders (Wynberg *et al*., 2015). Informal traditional medicine markets on undesignated spots like roadsides, open air markets, streets and avenues often expose displayed traditional medicine products to dusts, damping conditions, contaminants and adulterants (Bhardwaj *et al*., 2018). Furthermore, a careful approach of legislating TM sector should prevent over-regulation or under-regulation (Janes, 1999). In addition, regulatory harmonization aid in the elimination of bottlenecks that affect commercialization of traditional medicine products within and across nations (Sahoo & Manchikanti, 2013).

The desire for a harmonious integration starts with recognition of the significant governance practices (both modern and traditional). The two most important aspects of governance with respect to integration efforts include transformation and assurance. The transformative governance help reconfigure current practices and consider community and/or clients aspirations and valued choices as key drivers of change. Assurance, as the name suggest, is mainly centred on the aspect of safety and quality of traditional medicine products (Wilkinson *et al*., 2004).

A collaborative engagement between the traditional healers and policy/law makers enables achievement of inclusion and equality, bolsters recognition and mitigates dissatisfaction between various stakeholders. Furthermore, an intercultural component enhances cooperation between stakeholders and cultivates peace, dignity, equity and understanding among the major players in the healthcare system (Bautista-Valarezo *et al*., 2021).

5.1.3 Conservation of prioritized medicinal plant species

From the survey, the highly ranked species for conservation based on frequency of citations include the *Carissa spinarum, Azadirachta indica, Trichilia emetica, Dregea schimperi, Erythrina abyssinica, Warburgia ugandensis, Zanthoxylum chalybeum, Prunus africana, Tylosema fassoglense, Bridelia micrantha* and *Aloe* spp. Other parts of Kenya have also recorded overharvesting of some of these medicinal plants and more sensitization efforts in the conservation of these species are needed. Normally, the frequency of use denotes the vulnerability of the traded species due to overextraction (Pyakurel *et al*., 2019).

In the Lower Eastern Kenya, four commonly harvested medicinal plant species in Mwingi area include the *Salvadora persica, Aloe secundiflora, Albizia amara* and *Acalypha fruticosa*. Similarly, *Salvadora persica*, a popular twig prescribed for oral health and as a local tooth brush was also noted in this survey among the frequently traded species (Njoroge *et al*., 2010).

Creation and mobilization of community conservation groups and being informed of threatened or mostly harvested medicinal plant species is good for conservation. Communities' efforts to conservation is bolstered by a sense of ownership and sharing of benefits (Kisangau *et al*., 2004; Ayalew *et al*., 2022). In the arid and semi-arid Samburu Central region, domestication is a nightmare due to harshness of weather compounded by poor and less fertile soils (Gafna *et al*., 2017). The problem of funding conservation efforts is not new, and therefore sustainable commercialization, trade and use of biological resources including medicinal plants provide an ample source for financing conservation (Lange, 2002).

5.2 CONCLUSIONS AND RECOMMENDATIONS

5.2.1 Conclusions

- TM trade is important in accurate identification of the commonly traded medicinal plant species, the commonly treated diseases and sociocultural illnesses.
- Folk ethno-taxonomy and folklore medical knowledge was a common practice in all sampled markets. This was largely fuelled by most practitioners having acquired little or no basic education. It was apparently clear that most of the medicinal plant uses recorded from the survey have not been previously documented.
- Medicinal plants used to treat gastrointestinal and genitourinary diseases were the commonly sold TM.
- Suspicion, limited disclosure of TM information or secrecy characterizes sharing of TM medical knowledge. The feeling of exclusion by TM practitioners in the constitution of new regulations widens the bridge between local healers and biomedical practitioners thus hampering mainstreaming and integration vision.
- National and county by-laws and regulations were completely adhered to by the traditional healers underscoring the role of governments in the improvement of the TM industry.

5.2.2 Recommendations

Therefore, for better traditional medicine governance, I recommend that:

- There is need to document the folklore medical knowledge and ethno-taxonomy, with a collaborative effort to incorporate conventional taxonomy and biosystematics into the practice.
- A collaborative engagement between traditional and conventional practitioners must be actualized to tackle gastrointestinal and genitourinary diseases.
- For a vibrant TM sector, all legitimate stakeholders must work together to avoid suspicions among them. This involves inclusion of traditional healers in the formulation of laws and policies, and resolve to remove the feeling of exclusion.
- Traditional medicine should be effectively mainstreamed and integrated into the primary healthcare. Qualified and competent experts should be looped in to progressively transform the industry.
- Effective mainstreaming and integration boosts commercialization and consumption of TM. This requires complete sensitization and awareness campaigns, capacity building and training of legitimate stakeholders.
- County and national governments should provide practicing spaces to promote TM trade, quality and preclude contamination.
- The use of medicinal plant species in the treatment of much neglected sociocultural illnesses should not be overlooked but improved.
- The frequently traded TM should be subjected to further scientific empirical and pharmacological tests to ascertain their mode of action, dosage, administration, toxicity and safety.
- More attention should be given to the much neglected traditional governance practices.

- There is need for efficient positive integration of local traditional medicine with modern medicine to ensure seamless mixing of both indigenous and introduced cultures.

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APPENDICES

Appendix 1. GPS Co-ordinates of surveyed medicine markets

County	Sampled medicinal market	GPS coordinates		Altitude (m asl)
Uasin Gishu		N 00° 31.010’	E 035° 16.364’	2080
	Eldoret	N 00° 30.886’	E 035° 16.480’	2068
		N 00° 30.970’	E 035° 16.550’	2094
	Moi’s Bridge	N 00° 52.610’	E 035° 07.236’	1819
Elgeyo Marakwet	Arror	N 00° 57.838’	E 035° 36.967’	1049
Trans Nzoia	Kitale	N 01° 01.206’	E 035° 00.087’	1898
		N 01° 01.179’	E 035° 00.119’	1897
		N 01° 00.806’	E 035° 00.352’	1893
West Pokot	Makutano	N 01° 15.425’	E 035° 05.549’	2060
Kakamega	Kakamega	N 00° 17.231’	E 034° 45.206’	1556
		N 00° 17.055’	E 034° 45.219’	1565
		N 00° 17.231’	E 034° 45.342’	1572
Vihiga	Luanda	N 00° 01.427’	E 034° 35.167’	1505
Siaya	Yala	N 00° 05.301’	E 034° 32.387’	1389

Appendix 2. Semi-structured questionnaire

Date of Interview: …….

A. Socio economic characteristics of the TMPs

Name of the respondent ……

Sex of respondent …….

Place of birth ……

County of residence ……

Phone number ……

1. Age (in years) of respondent

Below 21 [ ]

21-30 [ ]

31- 40 [ ]

41-50 [ ]

51-60 [ ]

61-70 [ ]

More than 70 years [ ]

2. Marital status of the respondent

Single [ ]

Married [ ]

Divorced [ ]

Widow/Widower [ ]

3. Highest formal education level of respondent

None [ ]

Primary [ ]

Secondary [ ]

Tertiary college [ ]

B. Governance and management of traditional medicine

1. How long have you practiced traditional medicine? ……
2. Who taught you traditional medicine?
3. What age category frequently visits for treatment?
4. How much are you charged by the county to trade/practice in the market centre?
5. Are you aware of the existing legal and policy frameworks?
6. Are you recognized or certified by the Department of Culture?
7. How much do you earn in a month from the traditional medicine practice?
8. Do you have any other source of income/livelihood?

   No [ ]

   Yes [ ]

   If YES, Mention these other sources of income
9. What challenges/concerns/threats do you face in your daily practice as a Traditional Medicine Practitioner?
10. What traditional governance practices governs the traditional medicine practice?
11. What modern governance practices regulate traditional medicine practice?
12. Are you a member of an active traditional medicine and herbal associations?

    No [ ]

    Yes [ ]

    If YES , what are their benefits?
13. Is there a conflict between traditional systems of governance and modern systems of governance? Can the two systems be harmonized for better governance and management of traditional medicine and trade in medicinal plants
14. Do you think the formalization of the TMP will improve the sector?

YES [ ]

NO [ ]

State a reason ……

15. What key areas are prioritized for training traditional medicine practitioners?

C. Traditional medicine trade and uses in the selected medicine markets of Western Kenya

1. Based on your knowledge on ethnomedicine and herbal practice, kindly fill in the table below:

S/N	**TM or Medicinal plant species**	**Source (s)**	**Growth habit/Plant life form**	**Use(s)**	**Plant part (s)**
1					
2					

2. Frequency of extraction of plant materials?
3. Other applications of traditional medicine and herbal remedies other than curing diseases/ailments?
4. What are the commonly treated diseases treated?
5. Provide 3 commonly used medicine plants and the diseases they treat
6. Kindly explain any preferential shift to traditional medicine or medicinal plants and the diseases involved?
7. How long have you practiced TM?
8. How did you learn TM?

Appendix 3. Sites and websites explored

http://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/HealthActNo.21of2017.pdf

http://kenyalaw.org/kl/fileadmin/pdfdownloads/AmendmentActs/2019/HealthLaws__AmendmentActNo.5of2019.pdf

http://kenyalaw.org/kl/fileadmin/pdfdownloads/bills/2015/HealthBill2015.pdf

http://kenyalaw.org/kl/fileadmin/pdfdownloads/bills/2018/HealthLaws_Amendment_Bill_2018.pdf

http://kenyalaw.org/kl/fileadmin/pdfdownloads/bills/2021/TheHealth_Amendment_Bill_2021.pdf

http://publications.universalhealth2030.org/uploads/health_bill_2012.pdf

http://publications.universalhealth2030.org/uploads/the_health__bill_2016.pdf

http://www.kenyalaw.org/

http://www.parliament.go.ke/sites/default/files/2021-06/

http://www.parliament.go.ke/sites/default/files/2022-11/Health%20%28Amendment%29%20Bill%2C%202

http://www.theplantlist.org/

http://www.westpokot.go.ke/

https://apps.who.int/iris/handle/10665/58865

https://checklist.cites.org/#/en

https://elgeyomarakwet.go.ke/

https://faolex.fao.org/docs/pdf/tan155105.pdf

https://siaya.go.ke/

https://www.cbd.int/abs/doc/protocol/nagoya-protocol-en.pdf

https://www.ema.europa.eu/en/human-regulatory/herbal-medicinal-products

https://www.ema.europa.eu/en/human-regulatory/herbal-medicinal-products

https://www.iucn.org/

https://www.knbs.or.ke/

https://www.pharmacyboardkenya.org/files/?file=herbal_guidelines.pdf

https://www.researchgate.net/publication/323267945_A_Critical_Overview_of_the_Health_Act_2017

https://www.transnzoia.go.ke/

https://www.tropicos.org/

https://www.uasingishu.go.ke/

https://www.un.org/en/academic-impact/sustainability#:~:text=In%201987%2C%20the%20United%20Nations,to%20meet%20their%20own%20needs.%E2%80%9D

https://www.vihiga.go.ke/

https://www.who.int/health-topics/traditional-complementary-and-integrative-medicine#tab=tab_1

https://www.who.int/publications/almaata_declaration_en.pdf

Appendix 4. Reports accessed

Constitution of Kenya (2010)

Development Plan, Kenya (1989-1993)

Sessional paper on Traditional Medicine in Kenya (2009)

The Traditional and Alternative Health Practitioners Bill (2019)

The Traditional Health Practitioners Bill (2014)

The Traditional Medicine and Medicinal Plants Bill (2010)

Appendix 5. List of commonly traded medicinal species traded in the selected medicinal markets of Western Kenya.

Botanical name	NAI Code
Acanthus eminens	CK1
Ajuga integrifolia	CK2
Aloe spp.	CK3
Azadirachta indica	CK4
Basella alba	CK5
Bridelia micrantha	CK6
Cadaba farinosa	CK7
Capparis tomentosa	CK8
Carissa spinarum	CK9
Cassia (Senna) didymobotrya	CK10
Cassia occidentalis	CK11
Chasmanthera dependens	CK12
Cissus quadrangularis	CK13
Cissus rotundifolia	CK14
Cleome gynandra	CK15
Clerodendrum myricoides	CK16
Combretum molle	CK17
Cucumis aculeatus	CK18
Cucumis dipsaceus	CK19
Cucurbita sp.	CK20
Cyperus rotundus	CK21
Cyphostemma cyphopetalum	CK22
Cyphostemma serpens	CK23
Dalbergia melanoxylon	CK24
Dichrostachys cinerea	CK25
Dicliptera laxata	CK26
Dovyalis abyssinica	CK27
Dregea schimperi	CK28
Dregea sp.	CK29
Ehretia cymosa	CK30
Ekebergia capensis	CK31
Erythrina abyssinica	CK32
Eucalyptus sp.	CK33
Euclea divinorum	CK34
Euphorbia sp.	CK35
Ficus sycomorus	CK36
Grewia trichocarpa	CK37
Harrisonia abyssinica	CK38
Hypoestes forskaolii	CK39
Kigelia africana	CK40

Cont'n

Botanical name	**NAI Code**
Lannea schweinfurthii	CK41
Leonotis nepetifolia	CK42
Leucas grandis	CK43
Maerua decumbens	CK44
Maesa lanceolata	CK45
Manihot esculenta	CK46
Microglossa pyrifolia	CK47
Momordica foetida	CK48
Momordica friesiorum	CK49
Mondia whitei	CK50
Moringa oleifera	CK51
Musa sp.	CK52
Nuxia congesta	CK53
Ocimum basilicum	CK54
Phytolacca dodecandra	CK55
Pittosporum viridiflorum	CK56
Plectranthus barbatus	CK57
Podocarpus latifolius	CK58
Prunus africana	CK59
Rawsonia lucida	CK60
Ricinus communis	CK61
Rubia cordifolia	CK62
Salvadora persica	CK63
Schefflera volkensii	CK64
Solanum incanum	CK65
Solanum nigrum	CK66
Sonchus sp.	CK67
Tabernaemontana stapfiana	CK68
Teclea nobilis	CK69
Terminalia brownii	CK70
Terminalia glaucescens	CK71
Tragia brevipes	CK73
Trichilia emetica	CK74
Tylosema fassoglense	CK75
Urtica massaica	CK76
Uvaria scheffleri	CK77
Vachellia seyal	CK78

Cont'n

Botanical name	**NAI Code**
Vepris glomerata	CK79
Vernonia amygdalina	CK80
Vitex doniana	CK81
Warburgia ugandensis	CK82
Withania somnifera	CK83
Ximenia americana	CK84
Zanthoxylum asiaticum	CK72
Zanthoxylum chalybeum	CK85
Zanthoxylum gilletii	CK86
Zehneria scabra	CK 87
Ziziphus mauritiana	CK88
Cordia africana	CK89
Albizia amara	CK90

Appendix 6. Plates

Ajuga remota

Senna didymobotrya

Harrisonia abyssinica

Dregea schimperi

Nuxia congesta

Maesa lanceolata

Momordica friesiorum

T. stapfiana