ECONOMIC BASIS FOR SUSTAINING TRADITIONAL BIO-INNOVATION IN DEVELOPING COUNTRIES:

THE CASE OF HEALTH CARE IN MADAGASCAR AND KENYA

By

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B. Sc. Forestry, 1988; M. Sc. Botany, 1996.

A THESIS SUBMITTED IN FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY (Ph.D.)

in

THE FACULTY OF SCIENCE

GRADUATE SCHOOL OF ENVIRONMENTAL STUDIES

THE UNIVERSITY OF STRATHCLYDE SCOTLAND UK

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ABSTRACT

This thesis presents analyses of inter-technology systems arrangements in health care, with a view to determine an appropriate system that increases the market share for products of traditional knowledge. Such a system would provide economic incentives for traditional innovators to sustain the productivity of their knowledge system and subsequently stimulate bio-innovation. Through comparative case studies on health care systems of Madagascar, China and Kenya, two contrasting arrangements were studied. They include:-

a) The integrated health care system, in which modern and traditional technology systems collaborate and contribute to health care in the same economic space, through a co-evolutionary model.

b) The non-integrated health care system in which the modern technology system dominates official health care, and subsequently the modern economic space. In this arrangement, the traditional technology system is marginalised and its products and services do not participate in the modern economy.

A synthesis of the case studies revealed that the co-evolutionary model of Madagascar and China was more effective at increasing the market share for traditional medicine products. Technological and economic analyses of traditional medicine products, used by the *Giriama* in Kenya, revealed their competence to co-evolve with products of modern medicine.

These rationale offer strong incentives for the Kenyan government to invest in developing the integrated health care system. The appropriate policy and institutional mechanisms for the artificial selection of products of traditional bio-innovation into the modern economy were determined and recommended for Kenya's health care.

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LIST OF ACRONYMS

ACTS	African Center for Technology Studies
ANGAP	Association Nationale por le Gestion des Aires Protegées
ARIPO	The African Regional Industrial Property Organization
BC	Before Christ
CBD	The Convention on Biological Diversity
CBS	Central Bureau of Statistics
CDC	Atlanta Center for Disease Control and Prevention
CNARP	*Centre Nationale d'Applique de Recherches Pharmatiques*
CT	Computed Tomography
DD	Diarrhoeal Diseases
DNA	Deoxyribonucleic acid
FAO	the Food and Agricultural Organisation
FOB	Free on Board
GDP	Gross Domestic Product
GNP	Gross National Product
GSES	Graduate School of Environmental Studies
HIS	Health Information System
HIV/AIDS	Human Immuno Virus/ Acquired Immune Deficiency Syndrome
IDRC	International Development Research Centre
IHC/S	Integrated Health Care/System
HIS	The Indian Health Service
ILO	The International Labor Organisation
IPBN	Indigenous Peoples Biodiversity- Network
IPF	Intergovernmental Panel on Forests
IPR	Intellectual Property Rights
IUCN	The World Conservation of Nature
KEFRI	Kenya Forestry Research Institute
KEMRI	Kenya Medical Research Institute
KENGO	Kenya Environmental Non Governmental Organisation
KIA	Kenya Institute of Administration
KIFCON	Kenya Indigenous Forest Conservation Project
KWS	Kenya Wildlife Services
M	Malaria
MM	Modern Medicine
MOH	Medical Officer of Health
NAPRECA	Natural Products Research in Eastern and Central Africa

NCI	National Cancer Institute
NCST	National Council for Science and Technology
NDP	National Drug Policy
NGO	Non Governmental Organisation
NHRDC	National Health Research Development Centre
NMK	National Museums of Kenya
OAPI	The African Intellectual Property Organization) for French speaking
countries	
OAU	The Organization of African Unity
OECD	Organisation for Economic Cooperation and Development
OTC	Over The Counter
PBR	Plant Breeders' Rights
R & D	Research and Development
RAFI	Rural Advancement Foundation International
RTI	Respiratory Tract Infections
SD	Skin Diseases
SSA	Sub Saharan Africa
STI	Sexually Transmitted Infections
TB	Tuberculosis
TK	Traditional Knowledge
TM	Traditional Medicine
TMP/s	Traditional Medicine Practitioner/s
TRIPS	Trade Related Aspects on Intellectual Property Rights
UNCED	The United Nations Convention on Environment and Development
UNDP	The United Nations Development Programme
UNEP	United Nations Environment Program
UNFPA	United Nations Fund for Population Activities
UNICEF	United Nations Children and Education Fund
UNIDO	United Nations Industrial Development Organisation
UON	University of Nairobi
UPOV	The Union for the Protection of New Varieties of Plants
USA/ US	the United States of America
UTI	Urinogenital tract Infections
WCED	The World Commission on Environment and Development
WCIP	The World Council of Indigenous People
WCMC	World Conservational Monitoring Centre
WHO	The World Health Organisation

WIPO	The World Intellectual Property Organisation WIPO
WTO	The World Trade Organisation
WWF	The World Wide Fund for Nature

DEDICATION

I dedicate this thesis to my mother, the late Mrs. Clemence Chao Mutta whose great courage continues to inspire me

ACKNOWLEDGEMENTS

I would like to thank all the people who contributed to the research leading to, and the development of this thesis. I am indebted to my supervisor Prof. Norman Clark, of the Graduate School of Environmental Studies (GSES), at the University of Strathclyde, United Kingdom, for his tireless intellectual advice and encouragement throughout the Ph. D. program. I also thank Dr. John Mugabe, the Executive Director, African Centre for Technology Studies (ACTS) in Nairobi, who was also my research supervisor, for his intellectual guidance and support. Thanks also to the Department of Pharmaceutical Sciences which through the intellectual guidance and support of Dr. Alexander Gray a major section of my research was accomplished.

I acknowledge the staff and personnel in the *Ministere de la Sante* (Ministry of Health (MOH)), *Centre Nationale d'Applique de Recherches Pharmatiques* (CNARP), (the National Centre for Applied Pharmaceutical Research), the Integrated Health Care Project, *Universite d'Antananarivo* (the University of Antananarivo), World Wide Fund for Nature (WWF) in Madagascar. In particular, I am greatly indebted to Dr. Nat Quansah and his wife Dr. Pat Quansah for their time and support during the field work in Madagascar. Results on the case study on Chinese medicine is information and knowledge acquired from practicing Chinese medical doctors in Nairobi, Kenya. Their contribution is also acknowledged. I also acknowledge the contribution of the staff and personnel in the Ministry of Health in Nairobi, Kilifi and Malindi districts, the Kenya Medical Research Institute (KEMRI), the Kenya Forestry Research Institute (KEFRI) at the Gede Regional Research Centre, the Forest Department in Gede, the Ministry of Culture and Social Services in Malindi and Kilifi Districts, the Central Bureau of Statistics (CBS) and the Ministry of Research Science and Technology.

A great part of my field research involved interactions with traditional medicine practitioners (TMPs) practicing around the Manongarivo Reserve in Madagascar and the Arabuko Sokoke Forest in Kenya. I thank them for the valuable information on traditional medicine they shared with me. I also thank my field research assistants Ms Rose Chiteva, Mr. Geoffrey Mashauri and Mr. Fred Olum all of KEFRI and Mr. Kazungu Masha of the Forest Department for their commitment and hard work during the Kenya case study.

I thank colleagues and friends: Ms Jayne Andrews at the Graduate School pf Environmental Studies (GSES); Dr. Patriciah Kameri-Mbote at the African Center for Technology Studies (ACTS); Dr. Solomom. Shibairo and Dr. Joyce Maina both at the University of Nairobi (UoN); Dr. Mbae Muchiri at ~~the Kenya Forestry Research Institute (KEFRI)~~; and Mr. Bosire at the Kenya Institute of Administration (KIA), who at various stages of the development of the thesis provided valuable comments. I thank

Mr. Walker Nyaluoga a copy editor of the Standard Newspapers Limited for editing the dissertation.

I greatly appreciate the financial support provided by the Darwin Initiative for the Survival of Species through the Graduate School of Environmental Studies at the University of Strathclyde, the African Centre for Technology Studies (ACTS) and the Churches Commission for Overseas Students. I am greatly indebted to the KEFRI Directorate for the institutional and logistical support that facilitated both the research and thesis writing components. I also thank the directorate at the Muguga Regional Research Center for the logistical support during the final stage of thesis writing.

I deeply thank my family — my daughter Noelle; sisters Winnie and Stella; and brother Dale and friends — Ebby, Susan, Elaine, Rosemary, Delwyn, and Getrude for their support, prayers and great encouragement throughout the Ph. D. Program. Above all, I thank the almighty God for being with me and seeing me through all the difficult and challenging times of the study period. Blessed be His name.

PART ONE

LITERATURE REVIEW, THEORY AND METHODS

"Fruit trees of all kinds will grow on both banks of the river. Their fruit will serve as food and their leaves for healing"

Ezekiel 47: 12

CHAPTER ONE: INTRODUCTION

Over countless generations of human history, the traditional knowledge system has sustained human livelihoods both directly and indirectly. Through the generation of traditional technologies, the productivity of this knowledge system has sustained the supply of products to meet, *inter alia*, nutrition and health care needs of particularly rural populations around the world. Here, products refer to goods as well as services generated by production systems.

Traditional farming systems, characterised by high species diverse and resilient agro-ecosystems, have been particularly important to subsistence farmers for the food and nutrition security that they offer (Altieri 1987; UNDP, 1992; Brookfield and Padoch 1994; Shand, 1997; Thrupp, 1997; 1998). Traditional health systems, developed over generations of clinical experience, offer accessible and effective disease management regimes for communities that don't have adequate access to official health care. In the late twentieth century, the World Health Organisation (WHO) estimated that over 80 per cent of rural communities in developing countries, were major direct beneficiaries of traditional medicine (WHO, 1993). Indirectly, these technologies also contribute to the productivity of modern science particularly, as leads for research and development of new nutritional, pharmaceutical and industrial products (Principe, 1991; Farnsworth, 1994; Prance et al.,1994; ten Kate and Laird, 1999;). To sustain the productivity of these production systems, it is paramount to maintain the supply of traditional bio-innovations. Hence, the imperative to sustain the productivity of the traditional knowledge system.

However, this is a difficult task because the productivity of the traditional knowledge system is currently threatened by processes related to modernisation that particularly undermine the integrity of traditional institutions and their products. As cultures evolve towards modernization, traditional technologies are gradually getting excluded from the mainstream of various economic sectors and eventually get discarded. Consequently, in Sub Saharan Africa (SSA), the knowledge has become marginalised and is gradually getting eroded (Okoth-Owiro and Juma, 1996; Mugabe, 1999).

Two factors related to market share for products of traditional knowledge have contributed to this state. The first one is the marginalisation of traditional institutions by colonial and post colonial institutions and; the consequent non-inclusion of products of traditional bio-innovation in development, by government policies. Subsequently, these products are excluded from the modern economy. For instance, traditional health systems in many developing countries have been excluded by government health care policies and kept out of mainstream health care (Bodekar, 1994; Okoth-Owiro, 1994; Bell, 1994). Consequently, their products don't participate in the modern economic space. Here, the term health system is used to reflect the organized pattern of thought and practice — diagnostic, clinical and pharmacological — that shapes and maintains most bodies of traditional health knowledge. In this study, discussions focus on *materia medica* in general and more specifically on plants used for therapeutic purposes, to enhance health and well being. Other constituents of *materia medica* include animals and minerals.

Current policies and markets for the health sector in this region promote mainly the development of modern medicine products (Okoth-Owiro, 1994; Amooti-Kyomya, 1994; Sofowora, 1982). As a result, these products dominate the modern economic space and derive economic benefits which provide incentives for modern scientists to innovate. Consequently, albeit playing a role in health care, traditional medicine products are often undervalued, thus providing little incentives for the traditional innovators to sustain the production of new technologies.

Secondly are market failures caused by improperly designed property rights systems (Perman, Ma and McGilvray, 1997). For example, traditional knowledge generally falls within the common property resources regime, a system in which the resources are owned in common rather than private. Common property resources are not exclusively controlled by a single agent or source and are therefore freely accessible. Entitlements to use common-property resources may be formal, protected by specific legal rules or may be informal, protected by tradition or custom (trade secrets). Common-property regime exhibit varying degrees of efficiency and sustainability, depending on rules which emerge from collective decision making. In traditional knowledge, this has been disrupted by poverty and the search for personal pursuits for survival.

A large part of traditional knowledge is commonly known in a community, making ownership communal rather than private, except for that which is owned by specialists. In the presence of sufficient demand, the absence of private property rights means that there is unrestricted access. This affects the supply curve for products of traditional knowledge, potentially leading to over-exploitation, thus promoting an inefficient market allocation. An example of such over-exploitation is of the rosy periwinkle *Catharanthus roseus* G. Don CV Little Delicata, which grows in Madagascar. Over 600 tons of this plant are harvested annually by western drug companies, for developing cancer treating drugs (Rajaonarivony, 1996). While these companies earn about $150 million per year, the people of Madagascar who have been the custodians and developers of such technologies are paid a pittance (Diringer, 1992). An imbalanced distribution of benefits in effect misleads the local innovators to rather invest in other activities such as monocultural agriculture which appear, and currently so, to have significant economic returns. They have no economic interest to preserve the traditional knowledge base. Thus compromising biodiversity and the associated traditional knowledge required for development of modern monocultural agricultural systems. This tendency is attributed to the fact that products of the monoculture system are privatized. They are also highly valued in the modern economy and attract market prices. On the other hand, products of traditional medicine that could also fetch favorable market prices are poorly valued and fetch low market prices.

The need to provide economic incentives to the local innovators of such products cannot be overemphasized. This essentially calls for government intervention to rearrange economic incentives similar to the modern science research and development reward system so that local groups have an economic interest to sustain traditional bio-innovation. To ensure this, governments have mandated contemporary Research and Development (R&D) institutions to recognise the importance of stimulating and sustaining innovations. The institutions have thus developed a reward system for novel inventions that have a commercial impact. In modern science and economy, innovators are allocated private property rights to their innovations, which guarantee the right of legal individuals to profit from their innovations. These include intellectual property rights (IPR) designed to exclude others from deriving direct economic benefits, from a particular innovation, for a fixed period. Among the rationale for protecting innovations are the exclusive role of IPRs as an inducement for innovators to make inventions. Because of the economic incentives, intellectual property protection regimes have contributed significantly to increased innovations in modern science and technology (Vaderaman 1971, Smith, 1992, Gollin, 1993, Alikhan, 2000). Unfortunately, these rights are not afforded to traditional innovators because of the design and exclusive definition of innovation and high associated administration costs of the facilities. As a result, traditional bio-innovations are excluded from the private property reward system.

Concurrent to the above reward system, there should be a parallel effort to provide similar economic incentives to traditional innovators. This is particularly crucial for the gene rich developing countries, including Sub Saharan Africa, whose traditional people are major contributors to the traditional knowledge base, particularly of biodiversity, of scientific and commercial importance. The sustained supply of traditional technologies for *inter alia* health care will greatly benefit their economies most of whose are poor and declining (UNDP 1999; 2000). As their populations continue to grow rapidly and the derived demand for the health care services subsequently increases (Collins et al., 1994), many of these countries are unable to fulfill health care needs of their populace. Since their population growths exceed economic growths, they experience major budgetary shortfalls, a problem that is further exacerbated by rising costs of modern health care (World Bank, 1993; Obbo, 1995; Kenya, 1997). Attributable to the shrinking budget, only a relatively small proportion of their population, about 15 to 20 per cent, have access to adequate official health care (Sindinga et al., 1995). The rest of the population has little access, if any, and or adequate drugs which are too costly for them. They, therefore, rely on traditional medicine for their health care needs.

The demand for alternative health care is further heightened by the incidence of problem diseases for which modern medicine has no effective remedy. Diseases such as high blood pressure, diabetes and cancer and; the resurgence of old diseases related to HIV/AIDS such as tuberculosis thus continue to affect people of all nations including the SSA region. While these conditions pose great technological challenges to modern medicine, ethnomedical literature (Ampofo, 1977, Sofowora, 1982, Farnsworth 1994; Kogozi, 1994; Cox, 1994, Chang, 2000, Orwa, 2002) indicates that traditional medicine could offer some effective remedies. Unless African nations mainstream the development of traditional medicine, their economies stand to forego not only the current benefits of the traditional medicine technologies, but also potential benefits that can be realised by combining them with other technologies. To harness these benefits, it is imperative that they address those factors that contribute to loss of traditional knowledge and biodiversity, for instance, the lack of incentives to conserve the same.

In general, the importance of ensuring fair and equitable benefits are shared with traditional innovators is widely recognised as crucial to reducing loss of traditional knowledge and associated biodiversity. In particular, the issue of protection of traditional knowledge, as an approach, has been the focus of debates in a wide range of international forums including the Convention on Biological Diversity (CBD), Food and Agriculture Organisation (FAO), the International Labor Organisation (ILO), World Trade Organisation (WTO) and the World Intellectual Property Organisation (WIPO) (Posey and Dutfield, 1996). The most explicit advocate for traditional knowledge has been the Convention on Biological Diversity (CBD), which recognised this concern and created a framework for ensuring that traditional people share benefits arising from use and appropriation of their knowledge. (See Articles 8 (j)[1], in (UNEP, 1992). Unless benefit sharing arrangements enhance benefits to traditional innovators, they (innovators) shall have no incentives to conserve traditional knowledge and biodiversity of which they are developers and custodians.

Subsequently, efforts to achieve these have focused mainly on legal mechanisms to protect traditional knowledge. Currently being explored, are various regimes of intellectual property protection to protect particularly, traditional knowledge of economic and commercial importance. These include patents, copyrights, trademarks, industrial designs, plant breeder's rights, geographic indications and appellations of origin. So far, these have proved inadequate and ineffective because of legal limitations posed by their design with respect to the nature of traditional knowledge. For example, companies may investigate some useful, but non-patentable, attributes of a biological substance known to a traditional community, and develop a product which then becomes patentable.

Efforts are in place to broaden intellectual property protection through recognition and inclusion of new rights and subjects of protection through a *sui generis* system. (TRIPS Article 27; Leskien and Flitner, 1997). Proposed systems of rights include those that conform to the nature of traditional knowledge and its collective ownership. These include traditional resource rights, community IPR and the African Model Legislation (Nijar, 1994; Posey and Dutfield, 1996).

Traditional Resource Rights refer to a bundle of rights based on human rights for the indigenous and local communities to development and conservation. They seek to protect knowledge relating to biological resources and assert the right of the people to

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1 *"... as far as possible and appropriate subject to national legislation respect, preserve, and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices."*

self-determination and the right to safeguard "culture" in its broadest sense. Community intellectual property rights enable farmers to assert their rights to seed by claiming that a corporation using traditional knowledge or resources without the permission of the local communities is engaging in intellectual piracy. The African model law for the protection of rights of local communities, farmers and breeders and; for the regulation of Access to Biological Resources seeks to establish a framework for national laws to regulate access to genetic resources. Community rights recognised by the model law include rights over biological resources and the right to collectively benefit from their use, rights to their practices, knowledge, technologies and innovations, and the right to collectively benefit from their utilisation. In practice, these rights allow communities the right to prohibit access to their resources and knowledge but only in cases where access would be detrimental to the integrity of their natural or cultural heritage. Further, the state is to ensure that at least fifty per cent of the benefits derived from the utilisation of their resources or knowledge is channeled back to the communities. For these models to be effective, they need to be entrenched in appropriate national legislation with reciprocal recognition in other countries.

Another mechanism for providing incentives to traditional innovators responds to the need to reduce market failure through marketing of the knowledge and its products. Marketing traditional knowledge products essentially offers the innovator the opportunity to reap benefits directly from the market. However, some natural resource economists, especially those of the preservation or non-use school of thought, argue that such an arrangement could lead to over-exploitation of the resource, thus threatening its own survival. But on the other hand, indigenous people and communities are part of the global process and are thereby seeking access to the market economy (Conklin and Graham, 1995). Therefore, if their products remain undervalued, the traditional knowledge system stands the risk of being exploited and marginalised by one that generates more marketable products.

Directly related to the need to market traditional knowledge products, is policy regarding national accounting for the products. Currently, many developing countries' accounting practices do not reflect the full economic values of traditional resources. Under such practices, a country could lose its traditional resources without affecting measured income in the process (Repetto et al; 1989; IUCN/UNEP/WWF 1991). As a result, the economic system offers no incentive to preserve those resources not reflected in national accounts (Swanson and Barbier, 1992). This can only change with wider acceptance of these resources as economic assets to which the same principles as for other capital assets apply.

HYPOTHESES

This thesis identified the mechanism referred to above, that brings products into the modern economy, as one that could enhance the market position for traditional products in a sustainable way. It is argued that market prices will provide incentives to the innovators to generate marketable products sustainably and hence ensure conservation of the same. This thesis argues that putting products of traditional knowledge, specifically those of traditional medicine, into the modern economic space will provide economic incentives and thus sustain the productivity of the traditional knowledge system.

To achieve this, an arrangement that offers opportunities to products of traditional knowledge system to participate in, interact and contribute to the modern economy is explored. In particular, an arrangement that could increase market share for traditional medicine technologies — products and processes — would provide incentives for sustaining traditional medicine bio-innovations that are beneficial to developing countries' economies. In health care, this means that modern and traditional medicine technologies are developed and applied in the context of a specific subsystem in use, in this case health care, but at the same time coordinated in relation to requirements of a certain market system. Based on principles of natural selection, integrating the two systems would enhance the diversity of technological products for management of various disease conditions (Nierenberg, 1995). The higher the diversity, the greater the probability of finding effective cure for disease problems and hence an improved health care system. Integrating modern and traditional medicine through a co-evolutionary model is the option that this thesis investigated.

A fundamental process in initiating the co-evolutionary process is the artificial selection of traditional technologies, products and processes into the modern economic space. Artificial selection is the selection of certain traits and propagating only units that possess the desired traits. This essentially creates a demand on the products to be fit enough to compete with others in the modern economy. Therefore, for co-evolution to take place, the traditional medicine system must be fit in the production of goods that can compete in the same environment as those of the modern medicine innovation system, as prescribed by Darwin's criteria for natural selection (Nierenberg, 1995). For co-evolution to be instituted, the products must meet certain practical criteria including technological and economic. It was, therefore, also hypothesised that traditional medicine technologies could have the capacity to co-evolve with modern medicine technologies. After demonstrating the fitness of the technology system, the appropriate policy, legal and institutional mechanisms for selecting the products into the modern economic space were identified.

OBJECTIVES

The broad objective of the study was, therefore, to determine the appropriate technology and market system, in Kenya, that will increase the market share for products of traditional medicine bio-innovation in the modern economic space.

The specific objectives were to:

i) Test effectiveness of the integrated health care (IHC) system at increasing benefits for the traditional medicine system. After the effectiveness was established, it was therefore necessary to;

ii) Determine the fitness of the traditional medicine knowledge system to co-evolve with the modern one through the determination of the technological attributes of Kenya traditional medicine products and subsequently;

iii) Identify the appropriate policy, legal and institutional mechanisms for artificial selection of traditional medicine into the modern economy and for sustaining the process of technological co-evolution in Kenya.

Three case studies were undertaken on health care and related technology systems, in developing countries. They focused on Madagascar, China and Kenya's health care systems. Using a multi method approach, each study responded to predetermined lines of inquiry, integral components of which were synthesised to test the hypotheses outlined above.

The first study was on Madagascar's health care system where an attempt has been made to integrate the modern and traditional medicine technology systems through an integrated health care system. The Malagasy government recognised the important economic role that traditional medicine plays, in particular among the poor, and invested in the process of integrating modern and traditional medicine. The policies, laws and institutions for the development of the integrated health care system were analysed. The analyses revealed the mechanisms for the artificial selection of the traditional technologies into the modern economic space at both policy and institutional levels. The impact of the evolving policy structure on traditional medicine was determined through field research on the Manongarivo Integrated Health Care Project,. Technological, including scientific and economic, dynamics in the evolution of health care among the *Tsimihety* of the Manongarivo Special Reserve were then analysed to test the effectiveness of the technological co-evolutionary model at increasing the market share for traditional medicine products.

The second study was done on China's health care system, a fully integrated health care system. An analysis was done on the health care policy structure and its impact on traditional medicine technological products which have diffused into other countries, in both developed and developing nations, Kenya included. The study was undertaken to firstly, define the co-evolutionary process. Secondly, it was designed to demonstrate the performance of its products in Kenya's modern economic space. In the context of Kenya's health economy, a survey was undertaken on Chinese medicine clinics, in Nairobi, to determine the market share for products of the Chinese medicine knowledge and innovation system. The survey was thus also designed to determine the capacity of Kenya's market to embrace and sustain the co-evolutionary health care model.

The third case study was done on Kenya's health care system which officially excludes traditional medicine from participating in mainstream health care. The study was undertaken in two parts. The introductory Part A examined the health care policy structure and its impact on economics of traditional medicine products *vis a vis* products of modern medicine. The health care system was analysed to determine the health care needs of its populace including the burden of disease and economic implications. The performance of the system at meeting its objectives was examined and opportunities and potential benefits of an alternative health care system discussed.

Part B focused on a local community at the coast. Through field research on health care services — including both modern and traditional — among the *Giriama* two major exercises were undertaken. First the impact of the policy structure on economics of traditional medicine were examined. This was aimed at testing the effectiveness of the health care arrangement to generate incentives for traditional medicine. Secondly, the scientific and economic capacities of traditional medicine were analysed This was aimed at establishing its competence to co-evolve with modern medicine. Technological attributes of the traditional medicine system were determined to define its technological robustness. Subsequently, through ethnobotanical, phytochemical and pharmacological studies on selected remedies, used by the *Giriama*, living around the Arabuko Sokoke Forest, the scientific evidence and why/how the traditional remedies are efficacious were established. The economic benefits were analysed through a comparative pharmacological analysis of the modern medicine remedies. These analyses were designed to determine the fitness of the traditional bio-innovation system at generating medicinal products that can effectively compete with those of the modern medicine innovation system.

A synthesis of the three case studies identified the policy, legal and institutional arrangements that offer more economic incentives for the traditional bio-innovation system. Subsequently, the rationale for adopting the appropriate health care system is discussed. Results of this study were designed to contribute towards the development of policy options for responding to requirements of Article 8 (j) of the Convention on Biological Diversity (CBD) to which Kenya is a Contracting Party. Finally, the appropriate policy, legal and institutional reforms required were determined and recommended for Kenya.

The thesis is presented in three parts. Part one has four chapters, and focuses on literature review, theoretical framework and research methodology. In Chapter two, global perspectives on health care are discussed with the view to present the various options available, how and why they have evolved and performed. The evolution of international policy and legal regimes for traditional medicine is outlined. Various traditional health systems, and their products, in various parts of the world — Asia, Africa, South America, are discussed with the view to illustrate the productivity of traditional knowledge systems in these regions and their contribution to health care.

Chapter three attempts to examine the divide between modern and traditional knowledge systems in the modern economy, with the view to present the technological and policy challenges of integrating the two. In particular, it shows that the capacity of current R&D systems to reward and stimulate technological change is limited to modern science only. A model for according equal opportunity for products of traditional knowledge to participate in the modern economy is proposed.

Chapter four outlines the research methods and materials used. The comparative case study is the main method. A comparison is made between Madagascar, China and Kenya health care systems whose arrangements differ in the level of integration of traditional medicine into mainstream health care. These studies are undertaken to test the hypotheses outlined above. This method was supported by field work including ethnobotany, where interviews and discussions with various target groups, in both health care systems, were designed to respond to the following research themes:

a) Health care framework and development of traditional medicine;
b) Impact of integrated health care on traditional bio-innovation;
c) Rationale for artificial selection of products of traditional bio-innovation into modern economic space including technological, scientific and economic and;
d) Legal, policy, institutional mechanism for technological co-evolution.

Selected data on traditional medicine were advanced through taxonomy and ethnopharmacology and phytochemistry databases.

Part two has four chapters and presents results of the case studies. Chapter five presents results of the study done on Madagascar's health care system. Chapter six presents results of the case study on Chinese medicine. Chapter seven outlines the background information on Kenya's health care. Chapter eight presents results of the second part of the Kenya case study on Arabuko Sokoke Forest.

Part three has two chapters and presents the synthesis of the case studies, recommendations and conclusions. Chapter nine presents a synthesis of the case studies. In response to the hypotheses, the chapter outlines the impact of the health care policy structure on traditional medicine and the technological competence of traditional medicine to co-evolve with modern medicine. The appropriate policy, legal and institutional mechanisms for the development of the more effective health care system in Kenya are determined. Chapter ten presents conclusions of the study and recommendations for the development of the appropriate health care system that will sustain traditional bio-innovation in Kenya.

CHAPTER TWO: HEALTH CARE AND PLANT GENETIC RESOURCES

2.0 INTRODUCTION

This chapter discusses the evolution of health care systems including both modern and traditional. The interactions between the two systems are presented to demonstrate the emerging role of traditional medicine in the modern economy. Related policy responses in various regions of the world are also discussed.

2.1 GLOBAL HEALTH CARE SYSTEMS

Health care systems of some sort have existed for as long as people have tried to protect their health and treat diseases. A health care system is defined by the WHO as comprising all the organisations, institutions and resources that are devoted to primarily improving health (WHO, 2000a).

There are various challenges that health care systems have had to confront. These include disease epidemics, persistent and recurrent diseases' resistance patterns and; steeply appreciating health care costs. In response to the various demands, organized health care systems, in the modern sense, emerged about 100 years ago. Ever since, efforts have been directed towards providing affordable universal health care coverage. To achieve this goal, health care structures have metamorphosised through first, the founding of national health systems, extension of social insurance schemes and later, in 1975, the promotion of primary health care systems (Akerele, 1987; Golladay and Liese, 1980).

The primary health care system, which was adopted at the Alma Atta Conference, was designed to include, among others, "treatment against major infectious diseases, prevention and control of locally endemic diseases, appropriate treatment of common diseases and injuries, and provision of essential drugs" (WHO, 1978). Fundamental principles guiding primary health care include: (1) the use of appropriate technology with a minimum of costly drugs and equipment; (2) a maximum use of village workers; (3) sensitivity to traditions of traditional medicine practitioners (TMPs) and midwives, with an active community role in both planning and developing the program; and (4) an intersectoral or holistic approach to the improvement of health in the community.

Later and currently widely accepted, in developing countries, has been the incorporation of the essential drugs concept within the primary health care system. The essential drugs concept first introduced in 1977, (WHO, 1977) was designed to provide the best-known, evidence-based, cost effective health care. Without excluding all other drugs, the concept focuses therapeutic decision, professional training, public information and financial resources on those drugs that best represent the best balance of safety, efficacy, quality and cost, for a given health care setting. The concept also incorporates the need to regularly update drug selection, review new therapeutic options and changing therapeutic needs; the need to ensure drug quality; and the need for continued development of better drugs for emerging diseases and to meet changing resistance patterns. Therapeutic and economic benefits of the concept have made it the pragmatic approach for providing the best of modern medicine health care.

Its forward looking principle is in cognisance of shortcomings of an inflexible system, particularly in an environment of dynamic changes in health care challenges and in technological advances in therapy. In grappling with various disease challenges, man has throughout the century, been engaged in intellectual inquiry, particularly scientific. The intellectual forces have included clinical science, technology and pharmaceutical innovation. Particularly during the three post war decades, intense scientific activity resulted in medical achievements that rank as one of the supreme epochs of human endeavor. Almost every day a new drug or treatment, or a further advance in medicine and health technology, is announced (Le Fanu, 1999). The scientific advancements have contributed enormously to better health for most of the global population. These include the decline of infectious diseases through the application of Sulphonamides introduced in 1935, Penicillin first used in 1941 and childhood immunization first used in 1955; the widening scope of surgery through the operating microscope, transplantation and hip replacements; major developments in the treatment of cancer, mental illness, heart disease and infertility; and improvements in diagnostic techniques including the endoscopes and the Computed Tomography (CT) scanner.

Despite these achievements, recent political and economic trends, in developing countries, have led to a reappraisal of current health care systems approaches. Impacts of the politico-economic changes, including the transformation from centrally planned to market-oriented economies, reduced state intervention in national economies, fewer government controls and more decentralization have contributed to *inter alia* spiraling costs of health care. These events have in effect undermined the ideal of universal and equitable medical care for all. For instance, in many low and middle-income countries, significant economic and political changes have, in the past decade, hindered their efforts to provide modern health care for to most of their populations. For low-income countries especially, reduced public sector health budgets have meant cutbacks in primary health care provision. At the same time, demand for official health care has increased due to burgeoning populations and the increased burden of disease due to emergence and spread of new diseases such as Human Immunodeficiency virus/ Acquired Immunodeficiency Syndrome (HIV/AIDS); re-emergence of old diseases such as Tuberculosis (TB) and sleeping sickness and; rapid development of drug resistant malaria. Consequently, primary health care, in the modern sense, is lacking or at best largely inadequate, for the majority of populations in these countries, a fact that has severe adverse effects on economic growth.

The correlation between health and economic performance is well established. A survey done by Hamoudi and Sachs (1999) revealed that health is a determinant of economic performance and vice versa. They identified, disease incidence and malnutrition as important factors contributing directly to reduced income per capita and labor productivity. Therefore for developing countries to improve their economic performance they ought to incorporate effective health interventions. The pertinence for a more cost-effective and appropriate health care system in developing countries cannot be overemphasized.

In response to these emerging demands, there has been a gradual shift of vision towards what WHO calls the "new universals". Included in the new order is an appropriate health care system that delivers to all, high quality essential care guided mostly by criteria of effectiveness, cost and social acceptability. It implies *inter alia* explicit choice of priorities among interventions. Today, many low and middle income countries are reconsidering how best to provide health care, particularly essential drugs for their populations, by exploring various options, for instance traditional medicine.

2.2 TRADITIONAL MEDICINE AND BIODIVERSITY

2.2.1 Traditional Medicine

The term "traditional medicine" refers to ways of protecting and restoring health that existed even before the arrival of modern medicine. It's the total combination of knowledge and practice, whether explicable or not, used in diagnosing, preventing or eliminating a physical, mental or social disease and which may rely exclusively on past experience and observation (Sofowora, 1982). As the term implies, these approaches to health belong to the traditions of each country. However, they have been surpassed by modern medicine in some countries Nonetheless the approaches continue to be handed down from generation to generation verbally or in writing. Each culture therefore, has its own traditional health system. Examples include African Ethnomedicine; Indian Ayuverda, Unani and Siddhu; and Chinese Kampoh. In North America where indigenous people have practiced traditional medicine for long, the systems are now treated as complementary or alternative medicine. In practice, the term "traditional medicine" refers to herbal medicine, acupuncture, traditional birth attendance, mental healing, bone-setting, homeopathy and naturopathy.

To date, a large proportion of the population in a number of developing countries still relies on traditional medicine which essentially forms an integral part of their primary health care systems. For example, WHO estimates that traditional birth attendants assist in up to 95 per cent of all rural births and 70 per cent of urban births in developing countries (WHO, 1996).

Through the practice of herbal medicine, medicinal plants play a major role in traditional medicine where they are used directly as therapeutic agents. As the oldest known health care products, they constitute the medicines used by up to 75 to 80 per cent (RAFI, 1994; ten Kate and Laird, 1999) of the population in developing countries, about 3.5 billion people (WHO, 1993). Notably, their use is not limited to developing countries. A resurgence of interest in alternative medicine in the west has been recorded. As a result, traditional medicine and medicinal plants, are assuming greater importance in their health care. The degree of practices varies depending on the ethnological, medical and historical background of each country.

In Africa, they started off with traditional medicine and later, upon colonisation, adopted modern medicine. Since this period, the nations' health systems' efforts have continued to devote all resources to development of modern medicine infrastructure. However, as outlined in this thesis, most of these nations have not had the economic capacity to develop and maintain modern medicine to cater for their people's health care needs. As a result of this drawback, modern medicine continues to be lacking in its capacity to provide health care coverage to the people of these countries (WHO, 2000a). On the other hand, traditional health systems have continued, in their undeveloped form, to provide majority of the population of these nations, with the day-to-day health care (Anokbonggo, 1992, Sindinga et al., 1995).

In a number of Asian countries traditional medicine has maintained its popularity. China and India, for example, have developed very sophisticated systems such as acupuncture and Ayurvedic medicine based on traditional medicine. The Fact Sheet No. 134 (WHO, 1996) outlines in some detail the extent of traditional medicine use world-wide. In China, traditional medicines (herbal preparations) account for 30 to 50 per cent of the total medicinal consumption. In Japan, from 1974 to 1989, there was a 15-fold increase in Kampoh ("Chinese method") medicinal preparations in comparison with only 2.6-fold increase in the sales of mainstream pharmaceutical products.

In developed countries, the demonstrable success and effectiveness of modern medicine, outlined in the last section, should have marginalised alternative medicine into oblivion. Interestingly, this has not been so. Indeed, there has been growing interest in the use of traditional medicine in many developed countries, and particularly, during the last decade (WHO, 1996). The best example is in one of the best developed country in the world, the United States where there were more visits to providers of unconventional therapy (425 million) than to primary care physicians (388 million). In terms of percent, about 33 percent of American adults have used alternative treatment and 60 per cent of the public in the Netherlands and Belgium, and 74 per cent in the United Kingdom are in favour of complementary medicine being available within the framework of the National Health Service.

2.2.2 Medicinal Biodiversity

Medicinal plants are ~~also~~ important for pharmacological research and drug development, when they are used as basic materials for the synthesis of drugs or as models for pharmacologically active compounds. The contributions of these products in modern medicine have had a positive feedback on the demand for medicinal plants for drug discovery and development. Indeed, many multinational drug companies have increased their bioprospecting activities in gene rich tropical ecosystems. It is within these ecosystems that local communities are also custodians of libraries of information on uses of plants for medicinal purposes that drug companies tap.

Analyses on 120 biologically active compounds found in plants and used in Western medicine, revealed that 74 per cent of them have the same therapeutic use in traditional societies (Moran, 1994). This significant proportion is also reflected in market values of the drugs. For instance, at the beginning of the 1990s, worldwide sales of pharmaceuticals amounted to more than $130,000 million annually. A conservative estimate suggests that $32,000 million of these sales were based upon traditional medicines (RAFI, 1994). In 1995, worldwide sales of plant derived drugs, including opiates, taxanes, digoxins, ergot alkaloids and catharanthus derivatives, sales ranged from $150 million to $1.5 billion (CMR, 1997). By the late 1990s, crude conservative estimates put annual market values for pharmaceuticals and botanicals medicines derived from genetic resources at between $20 and 150 billions (ten Kate and Laird, 1999) In the US, the modern pharmacopoeia includes some 150 plant derived drugs from North American indigenous communities (Kloppenburg, 1988). These contribute, in part, to one fourth of prescription drugs in the market. It is estimated that in 1990, the consumption of these plant derived prescription drugs, amounted to the value of over $15.5 billion in the US (Moran, 1994). The bulk of the contribution of medicinal plants to the pharmaceutical industry is from the tropical gene rich countries. According to an intergovernmental meeting of developing- country experts in Tanzania in 1990, the estimated value of annual contribution of developing – countries' germplasm to the pharmaceutical industry was projected to $47,000 million by the year 2000 (RAFI, 1994).

Among the most famous contributions include the antimalarial drug Quinine extracted from the bark of *Cinchona* sp. (Rubiaceae), from South America, the analgesic Aspirin from *Salix alba*, the Willow tree, anticancer drugs Vinblastine and Vincristine from *Catharanthus roseus*, the Madagascan periwinkle; Taxol from the Pacific Yew; skeletal muscle relaxant d-tubocurarine, derived from the Amazonian arrow poison known as curare made from barks of mainly *Chondodendron tomentosum* (Menispermaceae) or *Strychnos* sp. (Loganiaceae) and; antihypertensive reserpine from *Rauwolfia serpentina*.

2.2.3 Global Pool of Traditional Medicines

It is estimated that 35,000 to 70,000 plant species have at one time or other been used for medicinal purposes by various peoples of the world (Lewington, 1990). Most of these, more than two thirds of the world's plant species — at least 35,000 of which are estimated to have medicinal value — come from developing countries in the tropics (RAFI, 1994). The WHO lists 10,000 species of medicinal value commonly used by a majority of households in Africa (Anon, 1987). A similar number of 10,000 medicinal plants species are used in Chinese medicine (Wei Ping, 1998).

There is no doubt, that international utilisation of herbal medicines and natural products is world-wide and has been on the rise. Around the world the demand for herbal medicine or phytomedicines has increased dramaticaly during the last 10 years. Annual growth rates range from 10 to 18 percent. Associated with the rise is also the market share and value, as recorded in the WHO Fact Sheet No. 134 (1996). In 1993, the total sales of herbal medicines in China amounted to more than US$ 2.5 billion. By 1995 sales amounted to $5.00 billion (Iwu, 1996). The Malaysian government estimates that sales of traditional medicine currently amount to US$60 million, which, for a country with a population of only 15 million people, is quite significant. In Japan, the 15-fold increase in herbal preparations, from 1974 to 1989, also generated a 15-fold increase in herbal sales.

In the developed countries, according to a report in the Journal Market of Herbal Medicines (WHO, 1996) in the United States of America and Canada, Over The Counter (OTC) sales of herbal medicines reached US$860 million with a growth rate of 15 per cent in USA in 1990. By 1998 retail sales were estimated at $3.87 billion (Brevoort, 1998). In the European market, OTC sales of herbal medicines amounted to US$1.550 million in Germany in 1990, and the national growth rates in other Western European countries were from 5 to 22 per cent, as reported by the European Scientific Cooperative on Phytotherapy in 1992. Germany is the world's largest consumer of commercial phytomedicines. In 1996 sales amounted to $3.6 billion representing 26 per cent of the market. (Gruenwald, 1997; Zhan, 1997; Yuquan, 1998). A survey among Member States of the European Union in 1991 identified about 1400 herbal drugs used in the European Economic Community. Together, Asian and European markets combine to form 86 per cent of the world market. The world trade in raw materials for phytomedicines, vitamins and minerals in 1997 was estimated at US$8 billion (NBJ, 1998).

Various reasons are cited for the growing popularity of herbal medicines in developing countries and subsequent expanding market share in developed countries (WHO, 1993). These include economic, cultural and therapeutic. In developing countries, it is cited (Chang, 2000; Sindiga et al., 1995) that the traditional medicine practitioners know the socio-cultural background of the people; they are highly respected and experienced in their work. Traditional beliefs, among the rural people in these countries, are very strong, a factor that contributes significantly to the social acceptability of the practice. In addition, the fact that modern health professionals are fewer in the rural areas means that access to modern health care is limited. In comparison, traditional medicine is more accessible, cheaper and efficacious. While economic considerations play a major role in the selection of traditional medicine in developing countries, efficacy is the major factor for expansion of traditional medicine used in developed countries, particularly for problem diseases that modern medicine has no effective cure. Related to efficacy is the derived increased market value due to demand.

Evidently, traditional medicine offers great benefits to current health care systems and has great potential in the development of cost effective appropriate health care in developing countries. In particular, tropical countries with a great wealth of genetic resources stand to benefit greatly from enhanced development of traditional medicine and utilization of medicinal plants in health care. However, the policy structures for health and technologies in most developing countries in Africa have been inadequate at facilitating optimal harnessing of these benefits, leading to loss of traditional knowledge and biodiversity. The following section 2.3 illustrates how policies and institutions for traditional medicine have developed and their impact on the structure of health care systems in Asia, the Americas and Africa.

2.3 POLICIES AND LEGAL FRAMEWORK FOR TRADITIONAL MEDICINE

As a result of the emerging importance of traditional medicine in developing countries and growing interest in developed countries, the pertinence to incorporate it into national health systems has been widely recognised. To catalyse the process, the World Health Assembly, has over the years, adopted a number of resolutions giving recognition to main facts (WHO, 1978). First, that most of the populations in various developing countries around the world depends on traditional medicine for primary health care. Secondly, the resolutions give recognition that the work force represented by practitioners of traditional medicine is a potentially important resource for the delivery of health care. Thirdly, that medicinal plants are of great importance to the health of individuals and communities.

An emerging international policy climate has thus seen new recognition given to the efficacy, affordability and sustainability of many of the local traditions of health and medicine. In 1977, the WHO (1978) established the Traditional Medicine Program which was designed to support countries where most people depend on traditional medicine, to incorporate it into national health systems. The program aims at assisting such countries to identify and provide safe and effective remedies and practices for use in the public and private health services as well as to optimally utilise the potential of services by traditional practitioners. In 1978 at the International Conference on Primary Health Care, Alma -Ata, a declaration "Health for All by the year 2000" was proclaimed. In the declaration, traditional medicine was recognised as a key player in achieving the goal. WHO thus integrated traditional medicine in its 1990-93 work program. Subsequently the WHO has since focused on, among others, development of national policies for traditional medicine.

The WHO supports Member States in their efforts to formulate national policies on traditional medicine, and the promulgation of legislation that defines and standardise basic elements of traditional practices and remedies. Consequently, over the past few decades, traditional systems of health in a number of nations have undergone a major process of revival. As outlined in sections 2.3.1 to 2.3.3, some countries have already integrated traditional forms of medicine into their national health systems while some have not.

Some Asian governments have long been concerned with how best to use traditional medicine to strengthen primary health care in remote areas. In developed countries, the growing interest and application of traditional medicine have created a common need for governments to both regulate its use and ensure that demand for treatment involving traditional medicine is met safely. In most of Africa, such efforts should be intensified. In particular, emphasis should be on use of local resources and making traditional medicine an integrated component of minimal health care packages.

2.3.1 Asia

Traditional health systems in Asia have for several decades, been incorporated as formal components of national health care. China has had a policy of integrating traditional medicine into national health care for more than five decades and has an extensive and integrated national program in which modern and traditional medicine are combined as formal components of national health care provision.

After more than a century of grappling with the relationship between Western and traditional health care systems, India gave official place to the Ayuvedic and Unani medical systems through the Indian Medicine Central Council Act of the 1970. In 1995, a new Department of Indian Systems of Medicine was established, with a permanent head and a cabinet minister responsible for the department. There are now more than 200,000 registered traditional medicine practitioners in India. While traditional methods of training continue according to the *guru/chela* /master/ apprentice relationship, the majority of Indian practitioners have received their training in degree granting government colleges of Ayuvedic or Unani medicine. In both India and China, the traditional health sector provides the majority of health care to the poor and to rural communities.

Pakistan and Bangladesh both have departments of traditional medicine within their health ministries. In Sri Lanka, there is widespread use of Ayuverdic system of medicine, and there is a Department of Ayuverda within the Health Ministry. In Nepal, there is a college of Ayuverdic education in Kathmandu and a Department of Ayuverda within the Health Ministry. In Korea, where health insurance coverage is available for Oriental medical treatments, between 15 and 20 per cent of the national health budget is directed to traditional medicine services. Korean government reports indicate that traditional medicine is favored equally by all levels of society (Choe Won Sok, 1995). In Japan, where physicians have been permitted to both prescribe and dispense medications, over two thirds of all physicians are reported to prescribe herbal medications at times, some with great frequency (Norbeck and Lock, 1987).

2.3.2 The Americas

A number of South American nations have established departments or divisions of traditional medicine within their health ministries. In Mexico, whose population includes 9 million indigenous people, there has been a comprehensive program to revitalize the indigenous health traditions. A program of ethnomedical and phamacognostic research has identified over a thousand traditional medicines. The governments and indigenous organizations have established training centers to communicate traditional medical knowledge to new generations of health care workers. Traditional health care practitioners in Cuetzalan, where an extensive integrated community health program has been implemented, have been examining ways to cultivate medicinal plants under controlled conditions as a means of generating income for their association (Zolla, 1993). Hospitals of traditional medicine have been established in a number of rural areas, and the Mexican constitution is reportedly under revision to give traditional forms of health care a constitutional place in national health care provision (Argueta, 1993).

During the war in Nicaragua, the international economic blockade resulted in a severe shortage of medical and pharmaceutical supplies. As a matter of necessity, Nicaragua in 1985 began to reappraise its herbal tradition as a potential means of addressing national medical needs. The government established a new department of indigenous medicine to develop popular and traditional medicine as a strategy in the search for a self-determined response to a difficult economic, military and political situation (Sotomayer, 1992). This new department undertook a program of ethnobotanical research in which more than 20,000 people throughout Nicaragua were interviewed concerning their use of traditional herbal remedies, their methods of preparation, and the locations and plants from which the material were derived.

In Canada, the Midwifery Act (Bill 56) of 1994 formally exempted aboriginal midwives from its jurisdiction and regulatory process. This gave new impetus to the revitalization of traditional midwifery in Canada. Even before this legislation, the Inuit Women's Association of Canada had developed a program to revitalize traditional birth practices. Video recordings of women who were midwives for many years in their own communities are used to train young Inuit women in the use of traditional delivery methods in combination with western training in hygiene and safety (Flaherty, 1993). The Six Nations Aboriginal Traditional Midwifery Training Program is another instance of revitalization of local midwifery tradition where traditional approaches are emphasized in the delivery process.

In the United States, Native American communities have been incorporating traditional forms of treatment into Indian Health Service (IHS) alcohol rehabilitation programs. An analysis of 190 IHS contract programs found that 50 per cent offered a traditional sweat lodge at their site or encouraged its use. The presence of medicine men or healers greatly improved the outcome when used in combination with the sweat lodge (Hall, 1986).

2.3.3 Africa

In Africa, governments facing overwhelming drug bills in the face of the growing AIDS crisis as a matter of necessity are looking to their indigenous medical traditions and medicinal plants to identify inexpensive and effective treatments for at least alleviating the suffering of AIDS victims. This is in recognition of the effectiveness of community based health care systems where traditional medicines have been efficacious at managing opportunistic infections hence increasing life expectancy. A

WHO survey (2000b) revealed that a number of African countries, about 53 per cent, have developed programs within their health ministries to support the study and promotion of traditional health care within primary health care services.

In Uganda, where 70 per cent of trained medical doctors leave Uganda on graduating, there is inevitably continued strong reliance on traditional sources of health care. In articulating national priorities in drug research, the Ugandan National Drug Policy and Authority Statute (1993) has stated that the national drug policy shall intensify research, in all types of drugs including traditional medicines. The Joint Clinical Research Center in Kampala and the Uganda AIDS Commission, in conjunction with traditional medicine practitioners' associations, has investigated several traditional treatments for opportunistic infections associated with HIV/AIDS. A February 1994 newspaper (which paper) report quotes an official of the AIDS Commission as saying that recent research had shown that traditional medicine is better suited to the treatment of some AIDS symptoms such as herpes zoster, chronic diarrhea, shingles and weight loss (Kogozi, 1994).

While the WHO country office budget allocates 20 per cent to traditional medicine activities, a survey of 46 African countries indicated that only about 27 per cent of them dedicated budgets to traditional medicine activities (WHO, 2000b). The survey also revealed that focused efforts on policy and legislation, for the practice of traditional medicine, was recorded in 53 per cent of African countries. Although a significant proportion of them, 73 per cent, have associations of traditional medicine practitioners, a lower percent, 57 per cent, have institutional development for the management of traditional medicine. Research centers have been established in a number of countries. About 67 per cent have at least one institution conducting traditional medicine related research (WHO, 2000b).

In professional development, 13 per cent of the countries have specific traditional medicine training programmes for traditional medicine practitioners and traditional birth attendants. In Malawi, traditional healers have received training in counseling people in AIDS prevention and care and are considered a significant component of the national AIDS control program (Berger, 1995). Other countries that have some level of integrated health care include Tanzania, Ghana, Mali, Zimbabwe, South Africa and Madagascar. Only 7, 6 and 10 percent of the countries have modules on traditional medicine included in doctors', pharmacists' and nurses' training programmes, respectively. However, a number of regional collaborations exist among natural products researchers, including the Natural Products, Research Organization of African Unity (NAPRECA). Local production of traditional medicine is reported in 50 per cent of the countries while 59 per cent conserve medicinal plants through botanical gardens or cultivated arboreta.

At the same time, a number of African countries have yet to incorporate traditional medicine into their national policies. Upon the introduction of modern medicine, during colonization by the West, these nations' health systems did not take appropriate steps to develop the traditional medicine systems. Their health systems continue to neglect the practice and underutilize the valuable resources of which they are richly endowed. Unfortunately, Kenya is among them.

2.3.4 Legislation on Traditional Medicine

Legislative controls in respect of medicinal plants have not evolved around a structured control model. There are different ways in which countries define medicinal plants or herbs. As a result, different approaches have been adopted with regard to licensing, dispensing, manufacturing and trading in order to ensure the safety, quality, and efficacy of medicinal plant preparations. Divergent approaches offer limited opportunities for cohesive regulation of international trade on medicinal plants. It therefore appears ironical that despite increase in international trade in medicinal plants and the appreciating market value, the herbal medicines market in most countries is not adequately regulated. The products are unregistered and often not controlled by regulatory bodies. Because of the enlarging market and economic and conservation ramifications, the establishment of regulation and registration procedures has become a major concern in both developed and developing countries.

2.4 CONCLUSION

As a result of the policy and institutional initiatives towards traditional medicine ,there has been a broadened production and utilization of herbal medicines in health care systems of nations that have invested in the development of traditional medicine. Traditional medicine has continued to increase its presence in health care systems, a fact that illustrates the point that it is a viable source of therapeutic drugs whose potential, when achieved, will greatly enhance the performance of health care systems. There are important lessons that Kenya can learn from the health care arrangements in Asia, in response to WHO recommendations to integrate modern and traditional medicine. In the following chapter the model and principles through which the Integrated Health Care system may be achieved are discussed.

CHAPTER THREE: KNOWLEDGE, TECHNOLOGY AND HEALTH CARE

3.0 INTRODUCTION

This chapter examines the divide between modern and traditional knowledge systems with the view to present the technological, policy and institutional challenges of integrating the two in the modern economy. It begins by introducing the concepts of knowledge, technology and innovation and their systems. It then focuses on the nature of traditional knowledge and the current role that products of traditional bio-innovation play in development, including health care. In particular, perspective on the divide between modern and traditional knowledge and health care systems are examined, with the view to extrapolate possible solutions. The evolution of international policy and legal regimes for traditional knowledge and genetic resources is outlined. The technological co-evolutionary model is examined as a potential arrangement for bridging the systems' divide. Building blocks for the model namely natural selection and market theories are also outlined. Institutions with a role for technological change are then discussed.

3.1 KNOWLEDGE, TECHNOLOGY AND INNOVATIONS AND SYSTEMS

3.1.1 Definition of Terms

Knowledge

All societies strive to make sense of how the natural world behaves. Models about the functioning of the world are thus developed, whose interaction with man in turn generate new knowledge. The knowledge generated becomes instrumental in guiding practices of manipulating the environment. As the producer of life sustaining relationships between people and the overall environment, knowledge, is therefore, anything that is known by somebody (Machlup, 1980). It is that which is held in human memories that is accessible, by real and practice of learned skills in a useful way, in day-to-day life. Often used interchangeably, information may be distinguished from knowledge as knowledge conveyed by the act of communication in contrast to knowledge previously accumulated in a knower's mind or records. This would be analogous to the economist's indispensable distinction between flows of information (e.g. data) and stocks of knowledge. Subsequently, one may liken the flow of incoming knowledge as information, to income that is added to the existing stock of knowledge capital. The transient knowledge could be sourced from other people, personal observation or investigation and, could be presented in one of various forms including tacit, coded or embodied.

Technology

A significant portion of knowledge accumulates essentially as a consequence of solving a series of specific problems, for instance through scientific inquiry. By analysing properties and modes of functioning of natural objects or systems, fundamental research leads to physical insights, heuristic principles and manipulative skills which enables one to control and exploit properties of the same. This type of knowledge capital is organized and applied to perform various productive functions. Constituents of such knowledge entities include techniques, which, in a particular productive function, constitute a basic technology. An important property of basic technologies is their highly generic character, whose technological insights can be transferred into other areas of application. In particular, when diffused into receptive environments, they can be transformed into functional insights and lead to new technologies. For example, genetic engineering, originated as experimental techniques or instruments in scientific laboratories.

Technology is thus a term that is frequently used to encompass both the body of knowledge about techniques (Freeman, 1974) and the tangible embodiment of that knowledge in an operating system using physical production equipment. It usually carries the implication of a change in the way in which knowledge about productive techniques is organised. For example, that body of knowledge which relates to the production or acquisition of medicine, food, clothing, shelter and other human needs is technology.

There are two levels at which technology can be analysed:

i) The technical systems-in-use — the actually existing products and production processes —; and

ii) The technological knowledge associated with them (Granberg and Stankiewicz, 1981).

Technological knowledge-systems consist of a) insights into the functional requirements of various technical systems, b) knowledge of the possibilities, limitations and manipulability of various natural processes and structures which might be utilised in technical practice, as well as c) a wide range of design concepts through which such processes and structure are harnessed to the performance of various functions. Technology-as-knowledge can thus be compared to a biological 'gene pool' which when 'expressed' takes the form of technical systems-in-use.

Within these technical systems, technological development logic can be mapped and technological dynamics become coherent. For example, the development of a technology follows a specific non-linear trajectory of technical changes on a basic technology. Within the technological pathway is a series of changes in the techniques which change (enhance or reduce) the performance of a particular technology. These changes in technical systems in use are technical innovations or innovations.

Innovation

According to Schumpeter, an innovation in the economic sense is accomplished only with the first commercial transaction involving an invention. An invention is an idea, a sketch or a model for a new or improved device, technique, product, process or system. A distinction is here made between an innovation and an invention. Inventions do not necessarily lead to technical innovations. In fact, the majority do not. An innovation is therefore brought about by a change in a production technique or technology that is perceived as new by an individual or other unit of adoption but with an economic application.

Innovations can either be embodied in capital goods and products or disembodied i.e. the know-how included in patent, licenses, design, R & D activities or embodied in skilled personnel. The nature and significance of innovations are largely a function of the character and structure of the systems within which they take place. Innovations are very heterogeneous in nature. Depending on the nature of change - economic and/or technological, they impart to a technology or technic, innovations may be classified as "improvement" or "basic", "incremental" or "discrete", "minor" or "major". Sources of innovations may be either internal or external to the organization. Some innovations have a single user industry- they are produced and used within the same organization. Most significant innovations have a more pervasive impact across industries; they move among organisations and sectors.

The word is also used to describe the whole process of translating inventions into usable products. The innovation process is complex and heterogeneous. It involves a variety of interacting elements ranging from formalized Research and Development (R & D) to production. Innovation, is therefore, not a linear process going from R&D activities to the eventual commercialisation of products. On the contrary, the elements of innovation interact throughout various stages to weave a complex web of relationships (OECD, 1992). The chain of events is often long and hazardous. It includes the introduction of the product or process, patenting, introduction to the economic system and diffusion. Schumpeter (1961) rightly points to the crucial role of the entrepreneur in this complex innovative process (whether public or private) in particular in the introduction of a product or process into the modern economy. While technical innovation is used to describe the introduction and spread of new and improved products and processes in the economy, technological innovation describes advance in knowledge (Freeman, 1974).

Advances in the body of knowledge of techniques of a particular technology bring about technological change. Technological changes could either be stimulated by technological demand- pull or the technological changes could create a powerful technological push. These changes could be either incremental or radical, the latter of which lead to the starting of new technological trajectories and new dominant design concepts. There are three main mechanisms which, usually in combination, bring about revolutionary shifts:

i) Abrupt shifts in the nature of demand and prices;

ii) Exhaustion of the developmental potential of the dominant design concepts particularly when there is demand for enhanced performance or reduced costs;

iii) Unanticipated emergence of new basic technologies can totally change the fundamental premises of the system in question and offer potential performance far in excess of what can be obtained with the traditional set of basic technologies. In fact, the new technologies may revolutionise not only the concept of the design but also that of function giving rise to new technical systems satisfying new configurations of needs.

A knowledge system is thus the wider context within which technologies are developed. The awareness of their existence and functions contributes to the stock of knowledge. Dependent on the environment, including economic, technological pathways evolve through technical and technological changes or innovations to contribute to a particular technical system in use. Innovative activities have a variety of visible outcomes, some of which are reflected in the performance of production systems and the economy in general.

3.1.2 Knowledge and Economic Production

In the classical model of economic development, there are two basic agreements: that the growth of labor force and the accumulation of capital are the fundamental sources of economic growth and; that the possibilities of productivity growth in an economic sector, such as agriculture, from the division of labor and invention are more limited. For instance, classicalists Ricardo and Malthus were overly pessimistic about the potential of technological progress in agriculture. Except in the theory of patent protection[2]-the stock of knowledge and especially the state of technology have customarily been treated as exogenous variables or a trend function in economic models. In this paradigm, it is only certain kinds of knowledge that have played a part in economic analysis. In the market model, the theories of supply and demand, of competition and monopoly and all the rest, have all been based on the assumption that sellers know the highest prices at which they can sell and buyers know the lowest prices at which they can buy. It is often assumed that producers have knowledge of the technology of the time, that is, of their production opportunities. However, the impact of progress of technical knowledge on the economic production function was never analysed. However, a divergent view that treats technological change as an endogenous variable to the economic production function has since emerged.

The beginnings of the theory of technological progress, in production systems, were developed by Adam Smith (1776). He stated that at any rate of increasing productivity; it was due to the division of labor. Implicitly, Smith had the sketch of a theory of growth in which an increased division of labor improved productivity, which increased demand, which permitted an increase in the division of labor. In this form it would appear that knowledge is constant, that growth is simply a matter of increasing returns to scale. But when Smith explained why the division of labor increased productivity, one of the reasons was the increased skill of an operator after performing a task repeatedly (what is now called learning by doing). Another was the increased ability to innovate. There was at least a hint, then that technology could be an endogenous variable and innovation was affected by endogenous factors. Notably however, Schumpeter (1939) is the name most closely associated with the explicit introduction of innovations into economics. In 1939 the identification by Hansen (1939) of the labor saving character of technological innovation contributed further to

2 In the theory of patent protection there is a direct positive relationship between technical innovation and the productivity of a particular economic activity.

the validation of Schumpeter's treatment of technological innovation as an endogenous variable in the production function.

In the years following World War II, economists increasingly identified productivity growth, resulting from technical change as a fundamental source of economic growth. Over the decades, it became widely assumed among economists that economic growth rates in the advanced industrial economies converge towards a "natural" rate that depends on the rate of growth of the labor force, the savings rate, and the rate of technical change. In the 1980s, among its critics, technical and technological change came to be regarded as one of the challenges confronting both the modern world and the poor countries that had been left behind (Ruttan, 1971). Indeed aggregate studies of the role of technology as a source of countries' competitiveness have shown that a higher intensity of technological activities has generally a positive impact on national growth. Without technological innovation, economic progress would cease in the long run and in this sense technology is regarded as primary, although operating in close association with other factors in the economic production function. At the micro level, technology also influences an organisation's economic performance in a variety of ways, including productivity, growth and competitiveness. It has also been shown that the market value of an organisation is positively associated with its technological performance.

3.1.3 Institutions for Knowledge Growth and Technological Change

In most cases, knowledge is produced chiefly as a consequence of solving a series of specific problems. Its production is essentially a process in which one learns of something he or she has not known before, even if others have (Machlup, 1980). Producing knowledge therefore means discovering, inventing, designing, and planning as well as disseminating, diffusing and communicating. It generally includes at least two levels:

1. A process of eliciting know-how, such as skills in technology i.e. skills arising out of experience -a process of acquiring, communicating and

performing certain skills, particularly those processes resulting in different production strategies; and

2. A critical consciousness of the know how, enabling to distinguish between a process of domestication and one of liberations.

The first level basically involves the active process of generating new knowledge through research. Through the application of science and technology, research and inventive activities form part of the very wide complex of 'knowledge industries' with the R & D system at the heart of the whole complex. Innovation, including technical change and technological change, form a significant part of the active process of knowledge production. Although traditional industries tend to use sources external to the firm and often acquire innovations embodied in capital goods, in contemporary society however, the R & D system originates a large proportion of new and improved materials, products, processes and systems as the ultimate source of economic advance. For instance science based industries use internal sources such as R&D and design (Pavitt, 1984; von Hippel, 1988; Archibugi et al., 1991) as the main source of innovation.

However, the fundamental science environment tends to be highly restrictive as regards development of technologies beyond the needs of science itself. It is therefore of crucial importance that the technologies, which originate within science, get widely diffused at the earliest possible stage into a broad range of environments of potential application. The early transfer of new technologies to many potential user environments is necessary for the simultaneous and balanced development of both the generic capabilities and the application of specific knowledge. The wide diffusion of a new technology creates a broad contact area with other technologies. This permits rapid integration of the new technology into a diversity of systems, thus further stimulating its effective evolution. A new technology can hardly ever become important without fusing with a whole range of other new and old technologies. In fact, it is only after it has become an organic part of the dominant 'technological paradigm' that a technology can exercise its full impact on the economy and society.

A critical element in successful innovations therefore, is the social coupling mechanism, which links the professional R & D groups with the potential users of the innovations. This involves the second level of knowledge production of technology transfer which involves disclosure, dissemination, transmission and communication. Three main modes of technology transfer are: i) experiential- where technology is transferred as personal knowledge; ii) codified- where technology is transferred as information; and iii) embodied- where technology is transferred as in the form of artefacts (consumer or capital goods). The broader the range of contexts within which the new technology is being applied, the more rapid the evolution of the generic knowledge, which in its turn facilitates the application of the technology to a yet wider range of problems. To this effect, the education system, industrial training, the mass media and information services are important in the dissemination of knowledge and become part of the wider concept of production of knowledge.

It is implicitly recognised by development specialists that the stock of knowledge can therefore be increased by special efforts directed at building intellectual capital among the brainworkers. This is based on the premise that increase in the ratio of knowledge producing labor to physical labor is strongly associated with increase in productivity and thus with the rate of economic growth. It therefore also responds, in particular, to the hypothesis that new technological knowledge tends to result in shifts of demand from physical labor to brainworkers. The allocation of resources to education and to R & D has thus become an important economic variable which can significantly alter the rate of increase of knowledge, both basic and applied.

The main types of actors in the development of basic technologies are; universities, companies, institutes and various public/governmental development programs. The individual inventor almost always operates in the context of these organisations and institutions.

Universities

Universities have functioned as 'incubators' of many science-related basic technologies such as chemical synthesis techniques, nuclear technology, laser technology, and several materials and biotechnologies. Academics have also played important roles in the 'scientification' of many traditional basic technologies such as fermentation technology and ceramics technology. To the extent that new basic technologies of great importance tend to have their origin in science, the role of universities is likely to become even greater in the future. They have the strength in the transfer and diffusion of basic technologies, which has to do with the educational function of universities. The new technologies can be disseminated through the graduate and undergraduate training programs.

Nevertheless, there are certain inherent limitations as far as the role of universities is concerned. There are serious intellectual, institutional and resources constraints on the amount of effort which an academic institution can be expected to put into the development of basic technologies without compromising its commitment to a balanced, many faceted and autonomous program of research and training. The most important weakness of the academic system as the incubator of new basic technologies is its limited integrative capability. The university system is highly compartmentalised and the programs located in it do not achieve the necessary degree of interdisciplinarity and of systems-expertise. The development of basic technologies tends, therefore to proceed with little experience of the actual technological context in which they will be required to function. These limitations therefore call for the creation of new types of academic units.

Companies

The intensive participation of companies in the development of basic technologies has the advantage of greatly increasing the total volume of R&D effort in the field, of exploring a large spectrum of application niches and developmental strategies and of promoting effective technological integration.

The most important function of the company environments is the integrative one. The multi-disciplinary character of the industrial research laboratories, the accumulated practical experience from a large spectrum of old and new technologies, combined with the financial strength and marketing experience provide the necessary context in which effective incorporation of new technologies into more complex systems can take place.

However, their participation in the development of new basic technologies from an early stage is of decisive importance. Many large R&D multi-technology companies such as IBM and AT&T have played a major role in the early development of several important basic technologies. These firms as well as several European and Japanese corporations, scan the scientific horizon in search of new basic technologies which may significantly affect their businesses — often resulting in the setting up of long-term research projects which in some instances can result in true breakthroughs. Many small high-tech companies — spin-offs from large R&D intensive companies or universities, stake their future on the ability to develop applications of the emerging basic technologies quickly.

National Laboratories and Institutes

National laboratories and free-standing institutes have played significant roles in the development of several basic technologies, especially in connection with energy and some medical programs. However, in relative terms they appear to have been far less important than universities or industry, at any rate in civilian technologies. The national laboratories and institutes may have been occasionally superior to the universities in being able to mobilise large resources quickly and to set up multi-disciplinary programs. On the other hand they tend to be generally inferior in terms of creativity- especially in the long term, and in the ability to transfer and disseminate technology. Their role as a source of technological know-how and skills tends to decrease as the general R&D sophistication of industry increases.

3.1.4 Incentives for Technological Change

Because of the important role of innovations in economic growth, there is a broad scope for public policy in the definition of the tools, priorities and objectives of the innovation process in the national economy. Consequently, many essential aspects of technology and innovation are affected or regulated by governments through patent regulations, the setting of standards, public procurement, anti-trust rules, etc. For instance in designing an R&D system, key economic questions must be addressed. How can the flow of new information, inventions and innovation be improved? Can the gestation period for innovations be shortened? What kinds of organizations are most likely to innovate and under what market conditions? What types of incentives stimulate invention and innovation most effectively? How are innovations diffused through the economy?

Lack of funds, the excessive cost of innovation, and high risk are generally indicated as major obstacles (ISTAT, 1995) to innovation. In effect, factors affecting the rate of innovation in these institutions include the level of resource inputs, the acquisition of new equipment, skills and techniques and the provision of incentives to the innovators.

National intellectual property systems and the appropriation of benefits from innovations have been designed to provide incentives for innovators and organisations. The large body of literature on the appropriability of benefits from innovations has shown that the amount of resources devoted to innovation by firms is associated with the possibility of appropriating some of the returns.

The objectives and nature of national intellectual property systems have emerged from the need to find a balance between the different and sometimes contrasting interests that are relevant to an intellectual property system. Its basic requirements include:

(i) A balance between providing adequate incentives to generate invention and innovation (through strong protection of intellectual property), on the one hand and ensuring rapid diffusion of new technologies, on the other;

(ii) A balance between the private interest of the inventor, on the one hand, and society's interests in creating a stable system conducive both to inventions and to diffusion, with due attention to welfare considerations, on the other;

(iii) A balance between the temporary monopoly power granted to inventors by patent protection, on the one hand, and the norms for the protection of competition (such as anti-trust laws, industry regulations, etc.) on the other.

The patent systems of industrialised countries were originally intended for protecting the intellectual property rights of firms and individuals for the products or processes they invented. They also act as an incentive for further innovation (Smith, 1992). The patent system is one method firms use to protect their inventions. Patents are a direct outcome of the inventive process and more specifically of those inventions which are expected to have a commercial impact. They are a particularly appropriate indicator for the rate and direction of invention as well as for capturing the proprietary and competitive dimension of technological change. Thus, they stimulate focused production of inventions.

3.2 TRADITIONAL KNOWLEDGE

3.2.1 Definition

Over time, knowledge encoded in various forms is communicated over successive epochs and interacts with new contemporary information and knowledge. Thus, traditional knowledge becomes. Traditional knowledge (TK) may be here defined as the totality of all knowledge, technologies and practices, whether explicit or implicit, used in the management of socio-economic, cultural and ecological facets of life. It is that knowledge which is held by members of a distinct culture and/or sometimes acquired "by means of inquiry peculiar to that culture, and concerning the culture itself or the local environment in which it exists" (UNEP, 1997a).To this definition must be added the following. It is a body of knowledge built up by a group of people through generations of living in close contact with the natural world including a system to organise observations and initiate action (Gunn et al, 1988; Johnson, 1992a). It reveals an understanding of the particular place (Beilawski, 1992) of human beings in relation to the world in both an ecological and spiritual sense (Jull, 1991; Young 1992; Hobson, 1992) governing the interactions between people (Johnson, 1992 b) and the natural world. The knowledge is developed through everyday experience in activities such as harvesting, traveling, searching, and hunting (Brody, 1981; Osherenko, 1988; Usher, 1987) and through individual observation and training (Ridington, 1992). It is dynamic. In response to local socio-economic, ecological and technological changes, new management models and manipulative skills are developed and modified. It is thus cumulative — building upon experiences of earlier generations (Johnson, 1992b). Thus, traditional knowledge enlarges over time. These — knowledge, technologies and innovations, are consolidated and typically transmitted from generation to generation through historical sharing of stories, song and dance (Okrainetz, 1992; Osherenko, 1988; Riddington, 1982).

The term traditional knowledge is variously used interchangeably with traditional environmental knowledge and traditional ecological knowledge, terms whose use qualify the spatial extent of the use of the particular knowledge. For instance the 'environment' qualification implies knowledge generated from empirical observation about the local environment including landscape, ecosystems, habitats and the species and the system of self management that governs resource use. The 'ecological' qualification however excludes that knowledge that has been generated at the landscape level. These definitions however exclude the embodied information and knowledge within the species and the genes whose cognitive expression in various cultures falls within the domain of indigenous knowledge systems. Traditional knowledge is, therefore, the broader terminology that encompasses traditional environmental knowledge including local and indigenous knowledge which are hereby defined.

Local knowledge is described as that which is gained from astute observation of local environments (Pawluk et al, 1992) and the internalization of detailed information about local topography, climate, resources, biotic and abiotic characteristics, animal and plant life cycles and other environmental features. An outstanding attribute of local knowledge is that it comprises an understanding of the complex relationships between these individual environmental components and the dynamics of local ecosystems (Berkes, 1977; Okrainetz, 1992). This knowledge extends beyond specific attributes of nature to the general characteristics of a given region like those of a rain forest, or arid or semi-arid lands or of mountainous areas (Davis, 1993). Not all local knowledge is transmitted over time and does not necessarily become traditional.

There is neither single definition of indigenous knowledge nor consistent use of the term. There are great overlaps between a number of terms used interchangeably with indigenous knowledge as well as definitions. The list of terms used synonymously to indigenous knowledge in literature include 'local knowledge', 'ethnoscience', 'folk science, 'traditional knowledge', 'village science, 'rural people's knowledge, folk ecology, customary law, knowledge of the land, 'peoples' science, and indigenous technical knowledge (Hunn, 1975; Chambers, 1983; Richards, 1985; Johnson, 1992a).

Nevertheless, several traits distinguish indigenous knowledge broadly from other knowledge. Indigenous knowledge is the local knowledge that is unique to a particular culture and society (Meehan, 1980). It is the basis for local decision-making in agriculture, health, natural resource management and other activities (Warren, 1991). Much (but not necessarily all) of indigenous knowledge is based on accurate, detailed and thoughtful observations collected and passed over many generations (Chambers et al., 1989). There is a wealth of useful information stored in indigenous knowledge systems e.g. in respect to utilization of local plant species — use of specific plants and/or parts thereof, identification of medicinal properties in plants and harvesting practices, ecological requirement of different plant species and possibilities for stimulating their production. Indigenous knowledge contrasts with the knowledge generated by university, research institutions and private firms. Much of this knowledge is reflected in indigenous management practices and is embedded in community practices, institutions, relationships and rituals.

Indigenous information systems are dynamic and are continually influenced by internal creativity and experimentation which when influenced by contact with external systems (Warren, 1995) contributes to traditional knowledge. While local knowledge may not be traditional, all indigenous knowledge is traditional but not exclusive.

3.2.2 The Nature of Traditional Knowledge

Traditional knowledge can be contrasted with the cosmopolitan knowledge in a number of aspects. The traditional knowledge among the indigenous and other rural communities is in this regard classified as informal system while the scientific knowledge system in the public and private institutes of research as formal. Although to a great extent, indigenous knowledge of plants is accurate and sometimes similar to formal science (FAO, 1990) indigenous knowledge has more ecological particularism than formal science (Kajembe, 1994). For example, local people may identify more tree species and varieties than scientists (FAO, 1990), perhaps because they have had more time to search and find all the plants in the areas. Local people's knowledge and classification of plants is usually more pragmatic and immediately utilitarian than the formal scientists. For example, in Sudan, all -plants that are not useful or good for forage are given the names of less respected animals e.g. rat, ass etc. (FAO, 1990b). While traditional knowledge is drawn from local experiences, cosmopolitan knowledge is drawn from global experience and combines western scientific discoveries, economic preferences and philosophies with those of other widespread cultures (UNEP, 1997b).

The informal innovation system has the profound macrobiological understanding of the microenvironment while the other has a strong microbiological understanding of their macro-environment. Based on diachronic observations where observations are transmitted from one generation to another, traditional knowledge is usually a collective property of a society while western science is synchronic and the most of the knowledge is private.

In discussing traditional knowledge systems two major views emerge. The first view contrasts the traditional knowledge system from the cosmopolitan knowledge system in the pathways and mechanisms for the production of the particular knowledge. The second view locates the two as parts of one paradigm with the line between them fairly diffuse.

A group of authors variously describe traditional knowledge as a paradigm, as a view of the world, and as an avenue to truth that is fundamentally different from that which is held by those whose knowledge is based on European philosophies (Davis 1993, Department of Culture and Communications, 1991; Freeman 1985, Warren 1989, 1991; Wheeler, 1988) and as operating from a different epistemological basis than western scientific thought (Freeman, 1991). Scientific knowledge is based on objectivism, reductionism and positivism, whereas traditional knowledge is characterised as subjective, holistic and existential (Gunn et al, 1988; Johannes, 1989; Warren 1989; Wolfe et al., 1992). Within this view, Western science pays little regard to traditional knowledge, describing it as anecdotal, non-quantitative, without method, and unscientific (Cruikshank, 1984, Hobson 1992). Freeman (1985) describes traditional knowledge as eschewing reductionism and placing little emphasis on the study of small isolated parts of the ecological system (Kuhn and Duerden, 1996).

For some time, conventional science believed that traditional knowledge was a hit or miss affair through which communities built up a storehouse of useful experiences passed from generation to generation. Conventional wisdom argued that this building-up of knowledge was erratic and imperfect. The scientific process championed by Isaac Newton and others was said to differ from traditional knowledge in its emphasis on experimentation and documentation. Subsequently, focus on formal science grew while traditional knowledge was ignored and relegated to indigenous communities. Traditional knowledge was marginalised by policies and institutions for knowledge growth, thus excluding it from the modern economic space.

In the second view, Malinowski (1954) argued that science, consisting of empirical observation, was as much a part of pre-industrial societies as religion and magic. Levi-

Strauss (1966), focusing on what he referred to as the science of the concrete ,emphasized the tremendous knowledge that pre industrial peoples possessed regarding flora and fauna; knowledge that was codified in elaborate and sophisticated local taxonomies (Kuhn and Duerden, 1996). Johnson (1992a) noted that traditional knowledge includes systems of classification and systems of self management and thus is like any other knowledge system, inseparable from a cultural and philosophical basis. According to RAFI (1994), the custodians of the traditional knowledge who pursue a cooperative innovate system observe the same fundamental processes of discovery and experimentation that characterize institutional innovation systems. Such experimentation is illustrated in the development of a herbal remedy for diabetes among the Blackfoot people.

"Diabetes appeared among Blackfoot people only within the last 75 years, although it has now reached epidemic proportions. Within the past generation, a herbal tea has gradually come into widespread use by Blackfoot traditional healers, which is effective in controlling the metabolic symptoms of diabetes. The same plant had unrelated medicinal uses at least a century ago, so it appears that healers have been experimenting with the applications of their existing pharmacopoeia to diabetes and other 'new' and introduced diseases. The Blackfoot healers generally agree today on a single herbal remedy as the most effective. Hence they have not only been experimenting, but sharing the results with each other" (UNEP, 1996). Innovation in the cooperative system is thus incremental and evolutionary the same way that the institutional system is with respect to development of technologies for health care.

Recent years have witnessed a paradigm shift in the recognition of and appreciation for the role of traditional knowledge. There is new awareness among scientists ('conventional', 'laboratory', 'Western' or 'institutional') that farmers and indigenous peoples not only have knowledge but often actively engage in research. Rather like the rediscovery of Mendel's Laws at the beginning of the 20th century, the end of the century saw a rediscovery of the creativity and innovation of rural societies.

Scientific researchers who have studied and assessed the contributions of farmers in Africa to the management of their genetic resources for food security and productivity, found that the traditional knowledge base is built through experimentation and documentation on genetic resources used in *inter alia* health care and agriculture (The Crucible group, 1994). Examples of the generation and application of technical and technological changes abound. Virtually all of the agricultural biodiversity of current and potential use within the reach of rural communities — be it in the fields or in the forests — has been nurtured or developed by community conservers and innovators. Traditional knowledge is now recognised as an organized, dynamic system of investigation and discovery that has yielded — and continues to yield — information that could be critical to the survival of the planet in agriculture, pharmaceutical, DNA and other industrial production. As discussed in chapter two, on health care systems, it is a legitimate and increasingly accepted source of knowledge by non indigenous groups and could be applied in formal decision making processes. Spiritual and cultural uses, traditional medicine production techniques, natural resource management with the use of indigenous knowledge and technologies, methodologies for evaluation of biological diversity, including non-economic values such as existence, religious, ethical and cultural values of technologies are valuable technologies for the sustainable use of biological diversity and its components.

Despite the new awareness of the validity of the traditional knowledge system to contribute to science, the recognition and subsequent rewarding of the traditional innovators is yet to be realised. It is unfortunate that the first view still persists with respect to this issue. The second view needs to be furthered into policies, laws and institutions that reflect its principle. In this thesis, the latter view is advocated for, because of the following reasons: Under the current development and economic imperatives, the traditional knowledge systems are at risk of being completely eroded because of the lower economic appreciation and returns to the traditional innovators and biodiversity. Lack of economic incentives mean that local innovators will opt for those alternatives with higher economic returns which may destroy biodiversity and loss of the associated traditional knowledge. Loss of biodiversity will deprive human of resources whose future value is unknown and potential immeasurable. To keep these options alive, it is imperative that the productivity of the traditional knowledge system is maintained of which its understanding and development of its products is crucial. The development of the traditional knowledge system and its products will increase the diversity of options for solving various development problems concerning environment and health care, among others.

3.2.3 Traditional Knowledge in Development

Reflective of where people go on the land, the body of traditional knowledge provides valuable insights into natural resource use and ecosystem management. Since the birth of ethnobotany as an academic discipline, researchers have pointed to many benefits that result from studying the traditional knowledge of traditional agriculturists, pastoralists, forest dwellers and other people living close to nature. Economic planners have often argued that indigenous knowledge can facilitate the development process in cost-effective, participatory and sustainable ways (Blaikie and Brookfield, 1987; Warren, 1991). There is now a general consensus that local people have an important role to play in sustainable management of the environment (Martin, 1995). Through their practices and rituals, indigenous people contribute to human development in various ways.

Through the careful selection of domesticated crops over many generations and seasons, traditional farmers have developed crop varieties with favorable characteristics such as drought tolerant, disease and pest resistant, special culinary and nutritional characteristics. These biological resources thus developed contribute to a significant extent, to local diets, and food security, by playing supplementary roles during crop failures. In health care, traditional medical practitioners and the medicinal plants they use contribute significantly to reduced health care costs particularly in rural areas where modern health care services are inadequate or absent. Some of their rituals and practices, towards for example sacred groves and forests, effect a non-exploitative use of natural resources, by playing a regulatory function. The resulting ecosystems form very important repositories of biodiversity. The accumulation of experience, knowledge and beliefs in dealing with the natural environment may be viewed as a somewhat cultural capital and hence the crucial role of traditional knowledge systems in cultural sustainability.

Some forms of traditional knowledge have meaning outside their local content and can have a role in international economic development (Davis, 1993; Warren 1991). For many practitioners and scientists indigenous knowledge about the environment provides new information that can (or must) be incorporated into the decision making processes (Kuhn and Duerden, 1996) for the research and development in all sectors of development. This interest in traditional knowledge is as a result of the increased productivity of the research and development process when traditional technologies are appropriated.

It is becoming more apparent that combining knowledge of the use of local species in traditional medicine with industrialised countries technology — merging indigenous and modern knowledge systems — offers a powerful methodology for more efficient drug discovery and development. The current increasing commercialization of genetic resources and biodiversity prospecting mean that traditional knowledge is increasingly becoming a 'technical lead' in new product development in biotechnology, pharmaceutical and human health care industries. An analysis of products derived from nature reveals that there is a high corroboration to traditional applications of the biological resources by indigenous people. For example, out of 120 medicinal compounds derived from plants, 74% of them have the same therapeutic property (Moran, 1991). A number of pharmaceutical companies, for example Shaman Pharmaceuticals, rely extensively (and some exclusively) on traditional knowledge in their screening activities.

Because of the significant role that traditional knowledge now plays in industry and R & D programs currently, a significant part of the global economy is based on its appropriation and use. Contributions of indigenous and other traditional peoples to the global crop production system have well been documented (Kloppenburg, 1988; Roht-Arriaza, 1996). It is estimated, for example, that the United States of America economy alone has annual sales of at least US$50 million from genes of 15 major crops that were first cultivated and enhanced by traditional peoples (Roht-Arriaza, 1996). Traditional crop varieties have been the major source of genes for pest and disease resistance and drought tolerance, thus contributing to reduction in costs for disease and pest management. What is often called 'wild' species may be more properly called 'associated' species as they are often an integrated part of farming systems and can be considered to form part of the intellectual achievements and contributions of rural societies (Prance et al., 1987). It can therefore be extrapolated that farmers and traditional medicine practitioners are researchers; farmers' fields and forests are laboratories; and every season an experiment. These facts and trends suggest that the competence of the traditional innovation system in participating in the modern economy is implicated.

The growing recognition among the international community, of the important role that traditional people and their knowledge play and its crucial role at sustaining vital production systems stimulated the need to protect traditional people's rights, knowledge systems and biodiversity. An analysis of policies and laws for traditional knowledge follows below. Focusing mainly on the protection of traditional knowledge, the analysis presents the evolution of indigenous concerns at both the international and national levels. The impact of the various structures on traditional knowledge and biodiversity is also examined.

3.3 POLICIES AND LEGAL FRAMEWORK FOR TRADITIONAL KNOWLEDGE

Concerns for traditional people and their knowledge at policy and institutional levels have only recently, from about 1950s, gained importance. The first internationally legally binding instrument concerning traditional people's rights was conceived through the International Labor Organisation (ILO) in Convention 107 in

1957. It was later, in 1989, revised to Convention 169. Through the United Nations Sub Commission on Prevention of Discrimination and Protection of Minorities, the ILO made the first attempt at defining indigenous populations referring to "their descent from the population which inhabited the country, or geographical region to which the country belongs at the time of conquest or colonisation" and their tendency to live in conformity with their own social, economic and cultural institutions. Debates in this process centred on the importance of recognising indigenous peoples as subjects of international law (Barsh, 1986). This process culminated in the Declaration on the Rights of Indigenous Peoples, which calls for the protection of and just compensation for intellectual Property rights of indigenous and tribal peoples (see paragraph 19). Subsequently, the role of indigenous people and the traditional knowledge that they bring to the management of natural resource were discussed seriously during the deliberation of the World Commission on Environment and Development (WCED) during the 1984-87 period.

Indigenous people figure prominently among local constituents in many parts of the world. The United Nations estimates some 4 percent of the world's population or about 250 million people meet the definition of "indigenous people" as proposed by the World Council of Indigenous People (WCIP) in 1977 (UNEP, 1998). The WCED report by Brundtland, observed that indigenous people are largely marginalised in today's society (WCED, 1987). This report therefore put great emphasis on the importance of local level participation in decision making and local capacity building.

In 1992, the Earth Summit carried the topic considerably further, and developed a number of aspects in much greater detail. All the Earth Summit outputs including The Rio Declaration of Principles, Agenda 21 (the Action Plan emanating from UNCED), the Statement on Forest Principles and the Convention on Biological Diversity (Cicin-Sain and Knetch, 1995) emphasised a great deal the importance of traditional knowledge and its participation.

The United Nations Convention on Environment and Development (UNCED), followed up on the Sub Commission's recommendation, of 1990, that the UNCED convention should "provide explicitly for the role of indigenous peoples as resource users and managers, and for the protection of indigenous peoples' right to control their own traditional knowledge of ecosystems (UNEP, 1998). Subsequently, there was progressive recognition of the important role of indigenous people in the new environment and development order. The concept of indegism was thereby advanced. The importance of protecting traditional knowledge, innovations and practices was highlighted and a call for them to benefit through equitable sharing from sustainable development lauded (Posey, 1994).

It was also during the UNCED that the concept of sustainable development was developed. The process brought development and environment into one logical framework and formed the "ideological bridge" between the traditional and the modern sectors by recognizing the significance of indigenous peoples' holistic knowledge of the environment and management of natural resources (RAFI, 1994). The process also regards people as both the means and the end of social and economic policies. It also recommended that indigenous people should participate fully in such decision making, especially as it affects lands, waters, and resources in which they have had a traditional interest.

Recognition of the special status of indigenous concerns was not just confined to the international agreements reached at the Earth Summit, but was evident in many of the national reports prepared by nations participating in the Earth Summit. These data make it clear, at least in rhetoric, that indigenous issues figured prominently in the Earth Summit negotiations. In particular, the Convention on Biological Diversity has been most explicit about traditional people's concerns and biodiversity.

3.3.1 The Convention on Biological Diversity

The Convention on Biological Diversity (CBD) which was opened for signature at the Earth Summit and entered into force in December 1993 is a legally binding international agreement, having been ratified by now 160 countries. It has three major interdependent objectives: a) the conservation of biological diversity, (b) the sustainable use of its components, and (c) the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. In ratifying the convention, countries committed themselves to, *inter alia*, (a) developing national strategies and plans for the conservation and sustainable use of biological diversity; (b) identifying and monitoring the components of biological diversity; (d) establishing a variety of measures to conserve biodiversity *in situ*, such as through the creation of protected areas; and (e) establishing a variety of measures to achieve *ex situ* conservation.

The Convention recognizes the inextricable linkages between cultural and biological resources whose interactions and experiences over time have led to the development of a wide ranging body of knowledge, innovations and practices which has enabled many communities to live within the limits of their local environment and contributed to their cultural and spiritual identity as well.

For the first time, indigenous and local communities embodying traditional lifestyles are expressly mentioned, and their invaluable contribution to biological diversity conservation recognized (Posey and Dutfield, 1996). Indigenous concerns are addressed in several sections of the Convention: in the Preamble, articles 8 (j), 10 (c), 17 (2), and 18 (4). In the preamble, the Convention recognizes " the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources..."; preambular paragraph 13, the role of women in biodiversity conservation; Article 8 (j) which is the primary Convention obligation addressing the knowledge, innovations and practices of indigenous and local communities; Article 10 (c) addresses the need to protect and encourage customary use of biological resources in accordance with traditional cultural practices; Article 17 (2) on international exchange of information among nations on "indigenous and traditional knowledge" and; Article 18 (4) on international cooperation on the development and use of technologies, including indigenous and traditional technologies, in pursuance of the objective of the Convention. Article 18 (4) recognizes that traditional and western technologies relevant to the conservation and use of biodiversity are equal in status and should be treated so in intellectual property regimes.

3.3.2 Article 8 (j) and Intellectual Property Rights

Article 8 (j) is the most explicit statement on traditional knowledge. It states that subject to its national legislation, a Contracting Party is required to:

- Respect, preserve, and maintain the knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant to the conservation and sustainable use of biological diversity
- Promote the wider application of traditional knowledge, innovations and practices with the approval and involvement of their holders; and
- Encourage the equitable sharing of benefits arising from the use of traditional knowledge, innovations and practices.

Considering the far reaching concession by the Convention, this article has been referred to as representing the most forceful provision in an internationally legally binding instrument for safeguarding indigenous peoples' rights (UNEP, 1998). If effectively implemented, this Article will go a long way in guaranteeing intellectual rights of traditional communities. However, there must be acknowledgment that traditional knowledge is an intellectual property in the broadest sense but is not adequately accommodated within the existing intellectual property rights regimes (IPBN). One of the challenges to be faced in this initiative is the fact that knowledge, innovations or practices concerned may not be confined to a single community or person, posing problems of deciding precisely who should benefit and how.

Some of the options a Party may choose to undertake to fulfill article 8 (j) may need to be implemented in conjunction with policies or legislation which provide individuals and communities, whether indigenous or local, certain rights under the law. Among others, these could be associated with land, culture, intellectual property, legal recognition, legal personality and the right to associate (Glowka et al, 1994).

Effective implementation of this article, calls for creation of enforceable international legal structures to develop mechanisms for protection of, and equitable sharing of benefits from traditional knowledge, innovations and practices (Posey and Dutfield, 1996).

3.3.3 Intellectual Property Rights and Traditional Knowledge

The increasing participation of traditional knowledge in industry and trade should inevitably lead to integration of indigenous intellectual property concerns into the World Trade process. An examination of the development of intellectual property regimes shows that discussions have been mainly on concerns by the technology-rich developed countries to enforce the protection of their new technologies and products in developing countries. But considering the level of pharmaceutical trade with considerable content of traditional technologies, the concern for protection of these technologies is even more justified.

Intellectual Property rights at the international level can be traced back to the *Paris Convention for the Protection of Industrial Property* (1883) which is still in force, albeit in a modified fashion, through the *Agreement on Trade Related Aspects of Intellectual Property Rights, Including Trade in Counterfeit Goods of the General Agreement on Tariffs and Trade* (1994), commonly known as 'TRIPS' — a legally binding instrument. As the name and date suggest, the Paris Convention was formulated by what is now known as the developed world at a time when the rest of the globe had little, if any, influence in world affairs. TRIPS simply co-opts large sections of the Paris Convention and thus generally reflects the same interests. These interests largely arose during the Enlightenment in Europe that was the birth of the idea of individual rights and freedoms, largely in opposition to the more traditional theories of communal responsibility. TRIPS and the Paris Convention both aim at protecting the rights of individual inventors of products or processes and do not really look at what the invention is based upon in terms of resources, and as long as the 'novelty' requirement is fulfilled in terms of previous knowledge either. The TRIPS Agreement also aims at "reducing distortions and impediments to international trade, and taking into account the need to promote effective and adequate protection of intellectual property rights and to ensure that measures and procedures to enforce intellectual property rights do not in themselves become barriers to legitimate trade" (Mugabe, 1999). At the time these IPR tools were developed, traditional knowledge was not considered patentable technology. In addition, genetic resources were considered a common heritage. Basically, these tools were based on western models of science and technology. These include *inter alia* patents, Plant Breeders Rights and Trade secrets. Each of these is discussed below.

Patents:

A patent is a legal certificate that gives an inventor exclusive rights to prevent others from producing, using, selling, or importing the innovation for a fixed period (usually 17- 20 years). Legal action can be taken against those who infringe the patent by copying the invention or selling it without permission from the patent owner. Patents can be bought, sold, hired, or licensed. A patent application must satisfy the patent examiners that the invention is

- *Useful:* have industrial application
- *Novel:* the invention should be recent and original.
- *Non-obvious:* not obvious to a person skilled in the technology and more inventive than mere discovery of what already exists in nature.

The invention must be disclosed to the patent examiners in a detailed way that would enable a skilled technician to make and use it. In the case of an invented process, the patent can cover a non-obvious way of making something already known (previously invented or discovered).

Plant Breeders' Rights (PBR)

The Union for the Protection of New Varieties of Plants (UPOV) Convention provides for rights commonly known as PBR. According to the latest 1991 revision of the convention, breeders are people who breed, discover, or develop crop varieties. PBR prevent other breeders from breeding and selling the same plant varieties. To be eligible for protection, the plant variety must be:

- *Distinct:* distinguishable by one or more characteristics from any other variety whose existence is a matter of common knowledge
- *Stable:* remain true to its description after repeated reproduction or propagation;
- *Uniform:* homogenous with regard to the particular feature of its sexual reproduction or vegetative propagation;
- *Novel:* not have been offered for sale or marketed, with the agreement of the breeder or his successor in title, in the source country, or for longer than four years.

Trade Secrets

The knowledge or know-how of an individual or the whole community might be protected as a trade secret as long as the information has commercial value and provides a competitive advantage, whether or not the community itself wishes to profit from it. If a company obtains such information by illicit means, legal action may be used to force the company to share its profits (Gollin, 1993).

Apart from trade secrets, all conventional IPR tools don't accommodate traditional knowledge. Essentially there is need for a more effective tool, a *sui generis* system provision of which is given in Article 27 3 (b) of the TRIPS Agreement. The following section, outline experiences in the application of these tools on traditional knowledge and genetic resources in Africa. Attempts to address the inadequacies are also outlined.

3.3.4 Intellectual Property Rights in Africa

The regional property regimes in Africa and many national regimes have also not yet integrated indigenous concerns. They apply the western modeled patent system which ignores traditional knowledge as a technology even though it contributes significantly to majority of rural livelihoods and whose owners are increasingly involved in market economies. Legislation existing in countries in Africa and the two regional organizations dealing with intellectual property, namely the African Regional Industrial Property Organization (ARIPO) based in Zimbabwe and the African Intellectual Property Organization (OAPI) for French speaking countries in Africa based in Cameron shows that most of the countries provide for the protection of the principle objects of intellectual property namely patents, trademarks, industrial designs and copyright.

The ARIPO protocol on patents and industrial designs; legislation on the protection of inventions and industrial designs; as regards most of its contracting states, compliments existing national legislation regulating those objects of industrial property. ARIPO has a membership of 12 countries. They are: Botswana, the Gambia, Ghana, Kenya, Lesotho, Malawi, Somali, Sudan, Swaziland, Uganda, Zambia and Zimbabwe. The OAPI groups 12 French-speaking countries under the Bangui Accord of March 3, 1997. These are Central African Republic, United Republic of Cameroon, Congo, Benin, Cote d'Ivoire, Gabon, Burkina Faso, Mauritania, Niger, Chad and Togo. It protects and promotes patents, trade secrets and trademarks, copyright, of both nations and foreign residents of signatory countries.

Most of the countries in Africa have laws providing for the protection of inventions, although the specific modalities of protection vary sometimes considerably from country to country. Countries that were formerly British colonies had patent registration system based on corresponding patents for the same invention in the United Kingdom. They were the Gambia, Kenya, Ghana, Seychelles, Sierra Leone, Uganda and the United Republic of Tanzania. Now all these countries have repealed the registration legislation and enacted industrial property laws that allow them to grant national patents. For example in Kenya, the Patent Registration Act Cap 508 was repealed in 1989 and replaced by the Industrial Property Act (Cap 509) of 1989 and 2001, to enable Kenya grant patents and register patents independently (Sese, 1997). In Ethiopia, no formal title of protection for inventions was issued before 1987.

Inventions would be protected by a system of cautionary notices. This included publication of cautionary notices in local newspapers and a waiting period of one month was allowed for the lodging of objection by third parties. A number of countries in Africa have recently amended their patent laws to include the protection of pharmaceutical, foodstuffs, and agricultural chemicals, which were previously excluded from patentability. Some of these countries are Ghana Uganda, Tanzania, etc. Many more countries have amended the laws to include some inventions as outlined in the TRIPS Agreement within given transitional period of ten years for developing countries from January 1995.

National legal institutions don't support or even recognise local knowledge which is considered to be in the public domain. Because such knowledge is often widespread in one or more communities, there are no identifiable inventors and consequently no protection under normal IPR schemes such as patents, copyrights, or trade secrets. Increased recognition of traditional knowledge will require the development of alternative concepts of property, ownership and value.

In response to the TRIPS Agreement (Article 27 3 (b)) requirement for a *sui generis* law, as well as the increasing smuggling of medicinal plants, African countries have under the auspices of the Organization of African Unity (OAU) prepared a model law on community rights and access to biological resources. The African Model Legislation for the Protection of Rights of Local Communities, Farmers, Breeders and for the Regulation of Access to Biological Resources aims at establishing a framework for national laws to regulate access to genetic resources. Community rights recognized include rights over their biological resources and the right to collectively benefit from their use, rights to their innovations, practices, knowledge and technologies and the right to collectively benefit from their utilization. In practice, these rights allow communities the right to prohibit access to their resources and knowledge but only in cases where access would be detrimental to the integrity of their natural or cultural heritage. The law considers *inter alia* refusing to recognise any patent on a drug made from natural products found in Africa if it doesn't acknowledge the ownership and contribution of the relevant community. The law states that ownership of new compounds should rest with indigenous local communities for all times and in perpetuity (Anon, 1998). Further the state is to ensure that at least fifty per cent of the benefits derived from the utilization of their resources or knowledge is channeled back to the communities.

3.3.5 Illustrative Case Studies: National Cases to Protect Traditional Knowledge:

An overview of national cases to protect traditional knowledge in Africa reveals that there are two general levels of efforts. Most prevalent in developing countries, is absent or inadequate property regimes and emerging attempts to encourage benefit sharing in new access to genetic resources legislation, or project initiatives — primarily in response to Articles 15 and 8 (j) provisions in the Convention on Biological Diversity.

In these countries, bioprospecting activities have proceeded unmonitored and no benefits have accrued to either the country or the indigenous communities whose knowledge has been instrumental in identifying biologically active compounds. The bioprospectors have documented the knowledge and published it putting it in the public domain and applied it in chemotaxonomy to identify related valuable natural resources. Predominant in nations in this category, are also absent or inadequate legal mechanisms for regulating access to biogenetic resources. Consequently, with the use of the knowledge, the identified genetic resources have also been freely collected for further biochemical studies either for mass production of the medicinal product or as a template for developing synthetic analogues of more potent biochemical compounds and subsequent industrial production. Biomedical research focusing on ethnodirected leads has proved to be efficient and cost effective in identifying biologically active compounds from natural products.

High corroboration, in addition to advances in biotechnology and screening techniques, has contributed immensely to increasing bioprospecting in the tropical developing world leading to over exploitation of the natural resource base and indigenous intellectual property. Although trade in medicinal plants from developing countries has increased in past few decades, more drugs developed from them, little if any benefits accrue to the source countries or the indigenous communities. According to Iwu, the total trade in herbal remedies and botanicals in 1995 yielded over US$ 56 billion (Ayafor, 1997). However, the only payments to the communities were for the manual labor involved. This is because current national property regimes don't recognise traditional knowledge as patentable. As a result, these countries and the indigenous people are losing benefits that could provide incentives for them to conserve traditional knowledge and the genetic resources.

In Kenya, traditional knowledge and medicinal plants as intellectual property cannot be protected using either the patent system or plant breeder's rights legislation. This is because, as stated earlier, the law property did not have traditional knowledge in mind nor did communities with traditional knowledge intend to be legally protected as private property. The industrial Property Act of 1989 and 2001, Kenya's patent legislation, excludes plants varieties from patentability unless they are products of biotechnology. The Seeds and Plant Varieties Act confers plant breeders' rights only on persons who have bred or discovered the plant variety concerned. Those with knowledge that a plant has medicinal properties can neither be said to have bred or discovered these plants. The only reference is in utility models as herbal and nutritional formulations and limited to formulations previously not available in Kenya. There is no law to protect the proprietary interests of those with knowledge that plants are medicinal. However as Juma and Ojwang extrapolate, there are provisions in the Kenyan law to convert legitimate social or economic interests into legally recognizable and protectable property (Juma and Okoth-Owiro, 1996). Implications for such a weak policy follow.

Knowledge on the use of *Maytenus buchananii* by the Digo in Kenya to treat cancerous conditions attracted the interest of the National Cancer Institute (NCI), which in the 1970s set off to collect the plant material for screening. More than 27.2 tonnes of the shrub were collected by the US NCI from a game reserve in the Shimba Hills for testing under a major screening programme (Juma, 1989). The plant yields maytansine which was considered a potential treatment for pancreatic cancer. All the material collected was traded without the consent of the Digo neither was there any recognition of the local innovators. The government's response to protect the local communities against such incidences through legislation has been very slow. This has led to increasing exports of medicinal plant for the development of pharmaceutical products protected under partial patent systems. Such incidences have contributed to loss of biodiversity and the related traditional knowledge, thus affecting traditional bio-innovation.

Evidently, current legal arrangements are not conducive to the survival of indigenous knowledge, and are ill adapted to protect the legitimate interests of communities in traditional agriculture, medicine and genetic conservation. We need diversity in the innovation processes related to biomaterials. Policy makers must find a way to stimulate innovation at the community, national and international levels in formal and informal, public and private sectors. The challenge of Agenda 21, particularly Article 8 (j) of the CBD, is to find equitable mechanisms that allow these diverse forms of innovation to collaborate for the benefit of humanity. For example, the combination of accumulated knowledge and the potential for innovation and adaptation of traditional systems and the equivalent knowledge base and innovative capacity of 'modern' or 'scientific' systems, if encouraged offers substantial, opportunities for identifying improved techniques for conservation and sustainable use of biological diversity.

As traditional innovations continue to contribute to the development of technologies which currently have legitimacy to participate in the modern economic space, it is imperative that the traditional knowledge system and innovations enjoy the same incentives. The principle for developing a process that could offer such incentives is reciprocity between indigenous and western science — a status where indigenous knowledge enjoys equivalent economic space. What this implies is that the integration of modern and traditional health care systems discussed in the last chapter, should be within the broader framework of knowledge and technology systems — an aspect that

African countries ought to give adequate attention to as well. The integration of traditional and modern knowledge in formal resource management decision-making structures has been lauded as important by many authors (Colorado, 1988; Heber, 1989; Johnson 1992a; Nakashima, 1990; Reed, 1990; Wolfe et al., 1992).

Ways to integrate, in modern management practices, knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles are in demand. The traditional knowledge and innovation system is vitally necessary to complement the institutional innovation system that dominates science. The following section 3.4 focuses on integration mechanisms for such technologies.

3.4 INTEGRATION OF TECHNOLOGIES

An important property of science based technologies is their cognitive convergence or homogenisation. While the major basic technologies of the past rested on highly divergent cognitive foundations, today there is a trend towards a remarkable degree of convergence. This trend seems to be a consequence of the fact that many science-based technologies rely on knowledge and methodology of the molecular and submolecular sciences which themselves are increasingly unified from the theoretical standpoint. Today many of the most exciting technical developments occur precisely in the areas where the basic technologies begin to converge as for instance, bioeletronics, or in parts of biotechnology.

One can distinguish at least three different ways in which technological integration can take place (Grandstrand and Sigurdson, 1981): i) technological fusion; ii) technological co-evolution; and iii) standardisation.

Technological fusion means that two or more basic technologies are combined into a single one. This sort of development usually requires deep technological competence regarding all the component technologies under a single organizational roof. Sahal (1985) predicted that beginning from the twenty-first century, there would be an accelerating trend towards the 'fusion' of certain important technologies based on intermingling of knowledge from a wide variety of fields.

Technological co-evolution means that basic technologies are developed and applied in the context of specific subsystems but at the same time are coordinated in relation to the requirements of certain super technical-systems in use. It demands effective mutual adjustment in the development of different parts of a complex technical system based on intensive communication and interaction among the actors involved. Large-scale technology development programs, R&D collaboration, joint ventures, close user-producer interactions are among the mechanisms which can enhance co-evolution of technologies. The super system context leads to a precise definition of requirements which have to be satisfied by the technology systems involved. They must have the capacity to generate new innovations which may replace older innovations (Endler and McLellan, 1988). It also focuses and intensifies the research effort at the interfaces of various technologies.

Technological standardisation involves formal agreements which regulate interfaces between various systems and technologies with the aim of increasing their compatibility and thus integration. Such agreements can, however, be reached only when at least the most important of core technologies underlying the system have reached a certain degree of maturity and stability. Once achieved, standardisation allows very rapid diffusion of technologies in the embodied form.

The integration of basic technologies with others is a complicated, costly and time-consuming process. Because of the fairly high level of communication between the actors involved, effective integration of basic technologies calls for organisational and institutional innovations facilitating the sharing of generic knowledge. This is particularly true between technologies that have been traditionally regarded as separate and unequal in their competence at contributing to the same technical system in use.

While standardization is instrumental in diffusion of embodied technologies, for the two technologies to integrate, coevolution appears to be strategic and transitional to providing the space for possible fusion of technologies. Because of apparent inequities between modern and traditional medicine technologies, this thesis adopts the coevolutionary approach, in particular as an avenue for diffusion of traditional medicine technologies into the modern economy.

3.4.1 Co-evolution of Technologies

Technological co-evolution of traditional and modern medicine products and services in health care could enhance diffusion of traditional medicine technologies into the modern economy.

In health care, technological co-evolution would be guided by the following principles:

i) Mutual adjustment by both modern science and traditional knowledge systems;

ii) Intensive communication and interaction among modern medicine doctors, traditional medicine practitioners and their institutions and;

iii) Fair competition and natural selection forces equally experienced by both modern and traditional medicine technologies and products.

This means that the modern and traditional medicine technologies are developed and applied in the context of the health sector but at the same time are coordinated in relation to the technological requirements of a community's health care system.

A critical process in initiating the co-evolutionary process is the artificial selection of the traditional medicine technologies, products and processes into the modern economic space. Artificial selection is the selection of certain traits and propagating only individuals that possess desired traits. This essentially creates a demand on these goods and services to be fit enough to compete with other goods and services in the modern economy. The traditional medicine knowledge system must therefore meet Darwin's criteria for natural selection, as outlined in his book "The Origin of Species" (1859), listed below:

i) Produce more products than will survive to maturity;

ii) Variation among the products necessary for evolution by natural selection and can be passed on to the next generation;

iii) The products must compete with one another for the limited resources available for them i.e. "survival for existence" and;

iv) At least some of the products must posses the most favorable combination of characteristics most likely to survive and reproduce.

Therefore for co-evolution to take place, the technologies, products and services of traditional medicine bio-innovation must be fit in the production of goods and services that can compete in the same economy as those of the modern medicine innovation system. The artificial selection of traditional medicine technologies into the modern economy offers them the opportunity to derive three types of benefits. Firstly, they get the opportunity to assert themselves in the market and enlarge their market share. The enlarged market share provides incentives for bio-innovation. The mechanism through which they derive these benefits is hereby described.

By participating in the modern economic space these goods and services are exposed to market forces of supply and demand and natural selection pressures. Through this process, these goods and services can attract the right market price as steered by the price mechanism under the market system. Price mechanism is the system in a market economy whereby changes in price in response to changes in demand and supply have the effect of making demand equal to supply. If consumers decide they want more of a good, demand will exceed supply as is the situation in health care for the demand for alternative technologies for the management of prevalent as well as problem diseases. The resulting shortage will cause the price of the good to rise. This will act as an incentive to producers e.g. traditional innovators to supply more, since the production will now be more profitable. The market forces and natural selection will also lead to propagation and evolution of the appropriate products which meet specific economic and therapeutic demands, which enhance their market value. These could be either modern medicine, traditional medicine or their derivatives.

It is well recognised that such evolutionary processes yield immense benefits to humanity that are not realisable through deliberate action (Hayek, 1978). Since traditional medicine offers effective remedies for many diseases including problem diseases, there is a high probability that traditional medicine products and services will attract a high market price that will offer incentives to the innovators to sustain the production of these products and services. In a complementary effort, modern medicine products and services that will meet specific individual economic and therapeutic demands not met by traditional medicine, will attract a high market price that will offer incentives to the innovators to sustain the production of these products.

On the other hand, if consumers decide they want less of a good, supply will exceed demand. The resulting surplus will cause the price of the good to fall. This could act as a disincentive to producers, who will supply less, since production will now be less profitable. It will however, encourage consumers to buy more. The price level which producers and consumers face will adjust until supply equals demand and efficient market allocation is achieved. Technological co-evolution therefore makes use of the price mechanism as an incentive to both producers and consumers of traditional medicine.

Secondly, even under low prices, so long as there is demand for the product, traditional medicine producers will still have a market. The acceptance of these products into the modern economy will also provide a conducive environment for traditional innovators to invest in development of new traditional technologies or products that could attract more profits.

Contact with modern medicine technologies could also lead to evolution of the same into new technologies or new design concepts and hence innovation. It also offers them the opportunity to add value and fetch higher prices. For example, raw material for the anticancer drug taxol, from the yew tree fetches $0.75, while the drug fetches $12 million per kilogram (ten Kate and Laird, 1999).

The outcome of the interactions is determined by the effect of natural selection forces on the various products in the market pool and their characteristics. Insights into the selection process in a market, reveal that genetic epistemology can be applied to knowledge and its products, where understanding of knowing and knowledge is advanced by an analysis of their development and history, their structural organization, and their construction by active human minds. For instance, in the same way that the order and novelty found in biological and cognitive development is explained by the neo-Darwinian model of chance variation and selection (Overton and Gallagher, 1977), is the same way that dynamics in knowledge development are explained by evolutionary and economic theories.

Selection of one form of knowledge or its products, or another, is not a chance occurrence but an active choice that results from regulative activity. Variations are the products of directed activity of the whole, which controls at the same time the performances as trials and their selection as choices. According to Monod, selection is no longer an automatic lottery based on simple probabilities of encounter or non encounter with elements of the external environment, but rather an active choice which is the outcome of teleonomy, through regulatory activities. This activity can be conceived as a final generalisation of the principle choice in stereo specific discrimination. If a certain environment imposes on a given organism a totality of selective constraints, it is frequently the case that the environment has been first chosen by representatives of the particular species. The organism adapts itself to the environment probably because it has within its genome some information concerning the outcome of its responses to environmental tensions.

Selection thus consists of a probabilistic process directed in good part by the choices of the organism; essentially it leads to a modification of the proportions in the composition of the genome and the genetic pool as well as in the coefficient of multiplication or variation. For example, different organisms inhabiting the same ecological niche interact in very different and specific ways with outside conditions (among which must include other organisms). These specific interactions, which the organism itself elects, at least in part, determine the nature and orientation of the selective pressure the organism sustains (Overton and Gallagher, 1977). The initial conditions of selection encountered by a new mutation simultaneously and inseparably include both the environment surrounding the organism and the total structures and performances of the teleonomic apparatus belonging to it (Endler and McLellan 1988). These processes eventually shape the definition of the group of products that succeed in the market.

3.4.2 Challenges of Integrating Two Knowledge systems

Effective integration of technologies, similar to their effective generation and diffusion, poses a whole range of complicated economic, institutional, and even political, problems. Different companies and national R&D systems may be better or worse suited to achieve integration or profit from it. For instance, in integrating modern and traditional knowledge and technology systems, there are challenges at the concept and institutional levels. As indicated above, there is apparent tension between the two knowledge systems that is evident in how traditional knowledge and medicine are treated. The divide presents challenges that must be addressed in order to effectively integrate the associated health systems.

For example, although traditional knowledge and related genetic resources are increasingly appropriated into the pharmaceutical industry, to date, there are no international legal instruments or standards which adequately recognise indigenous and local communities' rights over their knowledge, innovations or practices. The same is true for ownership of their genetic resources. Traditional bio-innovations are mostly excluded from the private property reward system thus offering little economic incentives to traditional innovators. Current systems of intellectual property rarely recognise and reward the intellectual contribution of traditional innovators. They have no mechanism to ensure that benefits flow back to local communities. This is, among the modern science community, often justified by the claim that definitions and scope of innovations and innovators protectable by patent is limited to those technologies which are novel, have industrial application and non-obvious criteria. Traditional technologies don't meet these criteria. However, companies may patent and claim economic proceeds from a product they have developed from biological substance known to a traditional community, that is not patentable. This is because the notion of innovation as it is used in the context of the industrialized countries tends to by-pass the intergenerational, communal innovations of indigenous peoples and local communities and generally disregards the informal innovation system.

This reflects, on the part of the world economies, a deficiency in the way actual economic decisions are made — they fail to capture the economic values of traditional knowledge and the biodiversity that can be identified (Pearce and Moran, 1995). This attitude is also inherent in many developing countries' governments towards traditional institutions.

Part of the reason for the divide is the inadequate understanding of traditional institutions, in particular by contemporary society. Subsequent to colonisation in most parts of Africa, traditional institutions were misconstrued as centres of power that threatened the colonial powers. There was therefore a move to disempower traditional institutions. Traditional institutions and practices were thereby outlawed and marginalised. Their importance slowly faded away as modern medicine took over the management of health. As modern medicine gained importance, all resources were devoted to modern science development as a result of which modern science knowledge increased and displaced traditional medicine knowledge. There were no resources devoted to the development of traditional medicine practices until traditional knowledge became redundant, less and less explored and less understood.

Even in post-colonial eras independent governments inherited the colonial legacy. Because of the inherited knowledge gap the government had no basis for investing in traditional knowledge and medicine and continued to marginalise traditional institutions and practices. For instance, many opponents of traditional medicine claim that it doesn't have the scientific intelligibility to meaningfully contribute to health care. Rather than attempt to understand traditional medicine, many governments opted to develop modern medicine and neglected traditional medicine. To date the modern medicine professionals regard traditional medicine as a primitive practice that should be kept away from mainstream health care.

It was not until access to modern medicine services and technologies appeared unattainable for majority of population, did some governments realise the pertinence to seek alternative health care systems such as traditional medicine. The rising costs of modern medicine against fast declining economies have meant that traditional medicine could offer some practical solutions. However, the process of bringing back traditional medicine into the fore is currently constrained by the knowledge gap. This must be addressed.

In resolving the tension, artificial selection of traditional medicine is crucial at reducing the institutional gaps between the two knowledge paradigms. The resulting technological development will eventually have an impact on how traditional technologies and medicine are treated and rewarded. Effective change will demand policy and legal change and institutional innovation to contain and regulate dynamics in the interface between modern and traditional medicine. This thesis is therefore designed to contribute to minimising the knowledge gap between the two knowledge systems by enhancing understanding of traditional knowledge and traditional medicine, thus creating space for traditional medicine to participate in the modern economy and claim its rightful market share.

CHAPTER FOUR: RESEARCH METHODS

4.0 INTRODUCTION

This chapter outlines the research methods used to test the hypotheses outlined above. Three study sites in two developing countries, representing a continuum between two contrasting health care systems were selected. The underline of this study was to determine the appropriate policy response for Kenya's health care needs. Kenya's health system thereby formed the basis upon which two other systems – Madagascar's health care system and Chinese medicine, as practiced in Kenya, were tested against.

Kenya's health care system represented an arrangement where modern medicine technologies are accorded exclusive space in the modern economy and evolve apart from traditional medicine technologies. The health care policies, laws and institutions systematically ignore the role of traditional medicine. At best traditional medicine is only just mentioned in policy documents. The main criterion guiding the selection of the other study sites was therefore a presence of an integrated health care system of some sort.

Madagascar was selected because it has, since the mid 1970s, begun the process of integrating traditional medicine into mainstream health care. The health care policy structure recognizes and promotes traditional medicine and supports its integration into mainstream health care. Madagascar's health care system represents a mid-level of the continuum of which the upper end is represented by a more integrated health care system.

Chinese medicine also qualified and was selected to represent the upper most end of the continuum. China's integrated health care system was initiated in the 1940s and represented a system in which traditional medicine is fully integrated into mainstream health care. In this system, traditional medicine co-evolves with modern medicine technologies and participates actively in the modern economic space including both in public and private domains. Chinese medicine is currently practised worldwide including Kenya. The Chinese medicine health care system, as practised in Kenya, was therefore selected to represent an integrated health care system.

There were two major parts to the study, each responding to a specific hypothesis. The first part involved testing the first hypothesis that putting products of the traditional knowledge system, specifically those of traditional medicine into the modern economy would generate economic incentives for the same. The second part involved testing the hypothesis that the traditional knowledge system, particularly of traditional medicine in Kenya, has the technological competence to co-evolve with modern medicine knowledge system. Methodology for the first and second parts is presented below in Sections 4.1 and 4.2 respectively.

4.1 PART ONE: HEALTH CARE FRAMEWORK AND INCENTIVES FOR TRADITIONAL MEDICINE

There were two objectives to this part. The first objective was to determine the link between health care policy framework and the practice of traditional medicine. In effect, it was aimed at defining the policy, legal and institutional processes that determine the level of participation of traditional medicine in the modern economy. The second objective was to test the effectiveness of the two health care arrangements at generating economic incentives for the traditional medicine system.

To achieve these objectives, a multi-method approach was employed to facilitate collection of both qualitative and quantitative types of information and data. Both secondary and primary sources of data were consulted. Secondary sources of data included primarily official health policy documents, reports and publications. See list of documents studied in Appendix 4.1. The criteria used in the selection of these documents included the presence of provisions related to health care and traditional medicine, expressed either explicitly or implicitly. The content of the documents contributed to the preliminary definition and appraisal of the health care policy structure and; determination of policy, legal and institutional mechanisms at play.

These documents were studied to identify key issues that were strategic to the hypotheses. The key issues identified included the:

i) political and legal status of traditional medicine;

ii) role of the government in developing traditional medicine;

iii) processes and mechanisms that were instrumental for developing the integrated health care system where it was present

iv) impact of the current health care arrangement on health care provision

v) impact of the current health care arrangement on traditional medicine

vi) competence of the traditional medicine system

These strategic issues formed the main focus of subsequent field studies. They were thus included as points of inquiry in the preliminary questionnaire.

Examination of the documents revealed an indication of the level of investment and commitment, by the particular government, towards development of both modern and traditional medicine systems. The extent to which investment was dedicated to traditional medicine served as an indicator to the economic space available to traditional medicine products in particular. Policy statements, laws and programmes that were explicit and/ or implicit on traditional medicine were a positive indicator of some measure of economic space for the products. The analysis was also designed to determine factors, which stimulated the development of the particular health care arrangement.

Subsequent to studying the policy documents primary data was collected through field studies in identified sites in Madagascar and Kenya.

4.1.1 Field Work

The whole exercise of field data collection, for both parts one and two, took a total of 46 weeks or ten months over the period July 1998 to February 2000. It included rapid appraisals in all the study sites, followed by detailed data collection.

Rapid Appraisal

A rapid appraisal constitutes a crucial step in social research that is undertaken prior to detailed discussions with respondents in the field. It involves preliminary evaluation of the study's hypotheses and objectives. During such an appraisal, discussions are held with randomly selected respondents representing all levels of authority. Pertinent aspects of the study are discussed. In this study, preliminary surveys were undertaken to first determine the health care arrangements in place and thus establish the link between policy pronouncements and practice. The main objective was to establish in general, the health care status of the populaces at both the national and community levels. Subsequently, the role of health care options in healthcare delivery was established. A rapid assessment, including random on-site observations, was done to get an indication of main health problems in the area and people's perspectives on the current system, including of the traditional system. During the preliminary appraisal, the prepared questionnaire was tested, subsequent to which it was further developed to conform to the hypotheses' requirements. See Appendix 4.2 for the finalised questionnaire.

Successful fieldwork is dependent upon gaining entry and establishing rapport with target respondents. Government officials are resourceful entry points because they allow for interaction with the people. In this study, discussions were undertaken first, with health authorities at the national level and subsequently with local authorities and local people at the community level. Other government officers in relevant sectors such as economics, social culture and natural resources were also consulted at this level. Such officers have a sound knowledge of potential resource persons and are respected by the people under their jurisdictions. Through them, ~~I was~~ ~~able~~ to identify and gain access to respondents at all levels including policy makers, policy implementers and health care practitioners in both modern and traditional medicine. Key institutions, organizations and individuals including public, non-governmental and private organizations, to be consulted were identified as the pool of potential respondents from which samples were drawn for further detailed discussions during the main field exercise. See list of respondents consulted for each of the case study in Appendix 4.3. For each study site a representative sample of respondents was determined. As far as possible the study site was divided into administrative units for which the number of potential respondents was recorded. At least 30 per cent of potential respondents per administrative unit were interviewed. The selection was random whereby the names of respondents were randomly picked from the total list. The other criterion that guided the selection included gender representation.

A rapid appraisal is particularly important when working with a tribal group whose study about requires close interaction with them. It is a valuable approach for gaining acceptance and establishing rapport with the community. The appraisal gave ~~me~~ the opportunity to create an atmosphere of trust. This necessitates treating respondents, particularly the traditionals, as respected equals and understanding them in terms of their ideas and values rather than in terms of the researcher. In such an environment, the researcher should cast aside any mask or 'professional role' that may create barriers between the traditional medicine practitioners and the researcher (Lipp, 1989). These principles guided the ~~my~~ approach when interacting with the local people in the study sites.

The appraisal was followed by detailed field surveys as outlined below.

4.1.2 Discussions and Interviews on Health Care Structures

To follow up on the translation of the policies, laws and strategies determined above, into practice on the ground, more detailed discussions and interviews, using the pre-tested questionnaire, were carried out in each study site.

Interviews in this study, refer to asking respondents about their work experiences, beliefs and perspectives on health care options. In open-ended or semi-structured interviews, respondents gave extensive responses to a series of general questions, some of which had been prepared in advance (see Appendix 4.2), and some which naturally arose during the course of the conversation. The information generated through this method was mainly qualitative. In this initial part of the exercise, representative officials — including governmental, non-governmental and private health care policy planners, health economists, medical doctors, culture and social services officers, natural resource officers, marketing officers and; traditional medicine practitioners at national, district and community levels — were interviewed.

The main objective of the discussions was to appraise the policy structure related to health care at the national level. In particular, the extent to which the structure supported development of traditional medicine products and their diffusion into the modern economy was central to the discussions. More current documents on policies, laws, programs and institutions on health care were sourced, examined and discussed. Subsequently, extensive discussions were done on:

a) development of traditional medicine, and

b) research and development of phytomedicines,

Subsequent to these policy analyses, focused studies on the impact of the policy structure on economics of traditional medicine, at the community level, in all the study sites, were undertaken. The methodology for determining the impact is described below.

4.1.3 Determination of Economic Incentives for Traditional Medicine

In this exercise, analyses of the two types of health care arrangements were done, to determine the extent to which each generated economic incentives for the traditional medicine system. The exercise focused on determining the participation level of traditional medicine products and practitioners and their economic value in each system. These — participation level and economic value — were subsequently compared among the study sites.

These aspects — identified in this study as market allocation and value — were determined through an examination, at the local level, of a selected community's health care system. Within the community, discussions and interviews using a pre-tested questionnaire (see Appendix 4.2), were held with the health care personnel concerned, including medical doctors, medical records officers, researchers and traditional medicine practitioners, to document various technological aspects of the systems. The exercise focused primarily on quantitative data as prescribed in the questionnaire.

There were four specific activities. The first two were concerned with collecting data on space allocated to the technologies, while the other two were concerned with collecting data on economic values for the same.

Market Allocation

In this study, market space allocation is defined by the level of participation of a particular technology — either modern or traditional — in health care management, in terms of the proportion of burden of disease managed by either. Discussions focused mainly on the curative aspects of the system.

The first activity involved documentation of disease incidences experienced by the community. This was determined through discussions with the medical personnel supplemented with medical registers and; traditional medicine practitioners' memory recall and records, where available. The number of disease cases reported and managed by the health care facility or practitioner was documented and the five most prevalent disease conditions determined.

The second activity involved documentation of the management regimes prescribed for each disease condition. Technological dynamics of the regimes and their success or efficacy rates were determined where possible. The technologies applied were analysed to determine the proportion of burden of disease managed by either practice. The proportions were calculated for each of the disease conditions. These proportions were computed as the number of disease cases managed by the particular practice over the total burden of disease for the five disease conditions. These proportions represented the space allocated to either health system.

The economic implications for the extent of participation of traditional medicine in health care systems were subsequently determined.

Market Value

The market value in this study is determined as the price that either technology arrangement fetches. It is a measure of the willingness to buy, by the government, community or individual. It may be attributed to either the investment costs for its development through R & D, or the efficacy role that it plays (e.g. patients are willing to pay more for remedies for problem diseases) or a combination of both factors.

The third activity therefore involved documentation of the price of prescribed management regimes. The prices were determined by the practitioners and quotes included both consultation and prescription charges. Comparisons were then made among the exclusive modern medicine, traditional medicine and integrated health care systems. The prices indicated the market value of the particular technology. The product of the prices and prevalence rates for each health care approach in the health care arrangements gave indication of their market share. As far as possible, tangible economic benefits to the practitioners were also determined through examination of the remunerations accorded to each, in a particular health care arrangement. Comparisons were then made to determine generated economic benefits towards the traditional medicine practitioner *vis a vis* benefits accrued to them by an alternative health care system.

Other Economic Incentives

The fourth activity involved an economic analysis of the cost implications to the health care provider for either health care arrangement. Based on total costs for the management of each of the five most prevalent diseases, the total costs of the particular health care system were computed. The contribution of the particular health care practice to the total cost was computed as the summation of the product of the prevalence and the unit cost for managing a disease case by either modern or traditional. Where both types of regimes were used, the contribution for each was assumed to be equal. The aggregate cost implications for the resultant health care system were computed through a comparative analysis of the three available options including modern medicine, traditional medicine and integrated health care. The aggregate savings computed either at the individual, community or government levels, suggested the level of incentives, offered by either health care system, to the health care provider. Below follows a description of the specific activities undertaken in each study site.

4.1.4 Study Sites

Madagascar

The Madagascar case study, the first study, was undertaken between July 1998 and September 1999. The field study, took a total of six weeks between February and September 1999. During the fieldwork, a total of 10 organisations including 22 randomly selected respondents were consulted. These are listed in Appendix 4.2.1

At the community level the study was done among the *Tsimihety* at the Manongarivo Special Reserve in Ambodisakoana village in Northwest Madagascar. Among the *Tsimihety*, an Integrated Health Care System had been in practice for four years from 1994 to 1997 under the Manongarivo Integrated Health Care Project. Based mainly on medical doctors' experiences at the *Clinic de Manongarivo'* patients' register, data on disease burden was generated for the period 1994 to 1997. Average annual rates were computed and the five most prevalent disease conditions rated.

Chinese Medicine

The second study was on Chinese medicine as practiced in Kenya. A total of 13 randomly selected Chinese medicine clinics located in various divisions in Nairobi, were consulted over a period of ten weeks, between July 1998 and February 2000. The clinics and respondents that were consulted are listed in the Appendix 4.2.2.

In addition to discussions on the extent to which the policy structure supported the development and diffusion of traditional medicine products into the modern economy, their diffusion into health care systems outside China was also discussed.

The factors that contributed to the growing popularity of Chinese medicine in Kenya were also determined and discussed.

This exercise was done among the Nairobi people in various parts of the City. This exercise was aimed at first determining the participation level of Chinese medicine products in the health care provision of the people in Nairobi. The number of disease cases diagnosed and managed at the Chinese clinics over a specified period was recorded mainly from medical doctors and nurses' patients' records. Since most of the clinics were fairly new, the statistics for only the immediate past one year were selected for analysis. Subsequently, technological and economic analyses were undertaken. The numbers were recorded and annual estimates computed for the five most prevalent disease conditions.

Kenya

The third study was on Kenya's health care system. Field-work for this first part took a total of twenty-four weeks or six months over the period July 1998 to October 1999.

After discussions with headquarters staff in Nairobi, focused discussions moved to district and divisional levels in Kilifi and Malindi districts. A total of 15 respondents comprising of government health officials at the Ministry headquarters in Nairobi, and District hospitals and health care centers in Malindi and Kilifi bordering the Arabuko Sokoke Forest were interviewed. A further 51 randomly selected traditional medicine practitioners in eight locations bordering the forest were interviewed. See list of respondents for this case study in Appendix 4.2.3.

Follow up detailed discussions were held, among the *Giriama* living around the Arabuko Sokoke Forest. Fieldwork in this area benefited from my prior research experience in the forest (Mutta, 1987; 1996). All the government health care personnel in the eight locations around the forest were interviewed while a random sample of the traditional medicine practitioners representing each location were interviewed.

Disease prevalence rates of disease conditions diagnosed and managed in the health facilities were documented. Among the official health care personnel, the data on disease prevalence were documented for a total of four years from 1995 to 1997 and average annual rates computed as the official annual burden of disease. Among the traditional medicine practitioners, responses were documented for one year, as specific data could not be obtained due to the fact that traditional medicine practitioners do not regularly keep records. The data collected were thus estimates derived mainly from memory recalls. Based on the data collected the five most prevalent disease conditions were determined. Subsequently, technological and economic analyses were undertaken.

4.2 PART TWO: RATIONALE FOR THE ARTIFICIAL SELECTION OF TRADITIONAL MEDICINE

The second part involved the testing of the hypothesis that the traditional knowledge system, particularly of traditional medicine in Kenya, has the technological competence to co-evolve with modern medicine knowledge system. The main objective of this exercise was to determine the technological rationale for artificially selecting products of traditional medicine into the modern economic space. In this exercise, an examination was undertaken on the management regimes, for the five most prevalent diseases, used by the *Giriama* living around the Arabuko Sokoke Forest at the Kenya coast. The aspects studied included technological and economic dynamics of the management regimes used. Technological data on the traditional management regimes were obtained through mainly ethnobotany as described in Section 4.2.1 below.

4.2.1 Ethnobotany

Ethnobotany is that part of ethnoecology[3] which concerns plants. It explores local people's perception of cultural and scientific knowledge of plants. This study focused

3 Ethnoecology is the broader discipline which describes local peoples' interaction

on the documentation of traditional medicine botanical knowledge and involved discussions; field surveys; and collections guided by the traditional medicine practitioners. This field exercise took a total of eight weeks between July 1998 and October 1999. Discussions were held with the *Waganga*, the traditional medicine practitioners, practicing around the forest. With the help of local field guides as translators, the *Waganga* were asked to list the plants they use for the management of the five most prevalent diseases earlier identified through official disease prevalence data at the district level. It was essential to involve local people who acted as field guides as well as translators. The field guides Mr. Kazungu Masha and Geoffrey Mashauri helped to translate the objectives of the study to the *Waganga* and also information given by the *Waganga* ~~to me~~.

In-depth interviews were held with 51 traditional medicine practitioners and discussions held on the plant species they use or employ to manage malaria (M), respiratory tract infections (RTI), diseases of the skin (SD), diarrheal diseases (DD) and urinogenital tract infections (UTI). Data was recorded in kiGiriama the local dialect, and kiSwahili, the national language, and later translated into English. The ethnobotanical information recorded included: 1) data on the traditional medicine practitioner such as name, age, gender, place of residence, occupation and specialty, 2) the local plant name used and; 3) the life form, or global category into which the plant is placed by the *Giriama* i.e., whether a tree, shrub, herb, vine or grass.

Field Collection

Based on the compiled list of species, discussions with the *Waganga* followed in the forest where they would identify the species used. Voucher specimen were prepared and field data recorded. Voucher specimens facilitate the identification of the plants' family, genus and species and permit colleagues to review the study. As far as possible, with the help of the traditional medicine practitioners, good quality voucher specimens

with the natural environment including subdisciplines such as ethnobiology, ethnobotany, ethnoentomology and ethnozoology.

were collected. A good quality specimen is one that contains a representative sample of the plant including stems, leaves, roots, flowers, fruits and other plant parts which are characteristic of the species. Whenever possible, whole plants or entire branches were included so that the overall architecture of the plant could be observed. Where adequate four specimens were collected and deposited at the Kenya Forestry Research Institute Plants For Life Herbarium, and one set for personal reference. The specimens were labeled and field information tagged to each one of them. The field data included 1) District 2) Names: vernacular and if known scientific 3) Locality 4) Habitat 5) Description of plant including characteristics used by the *Giriama* to identify the plant such as the taste, color of the flowers, smell of the crushed leaves and the sound of the foliage rustling in the wind 6) Medicinal uses 7) Date collected 8) Names of collectors and 9) Voucher number. The specimen were pressed flat in between absorbent papers, in this case old newspapers, and dried in the field.

Voucher specimen are valuable because they serve as permanent records of the plants that are known to the community. With the help of taxonomists at the East African Herbarium, the specimen were used to establish the scientific identity "... the voucher specimen is the link between two bodies of knowledge, that of the Western biological science and that of the ethnoscience of the native culture the ethnobotanist seeks to document. Based on this equation, it is possible to compare a segment of ethnoscientific knowledge with a corresponding segment of Western botanical systematics, chemistry, phenology, ecology and pharmacology" (Hunn, 1992). It is to this comparability opportunity of the taxonomic identification of the medicinal plant species that some of the following technological analyses explicitly explore. The plant species taxonomically identified were then classified into genera and families and the data advanced through the Dictionary of Natural Products to include phytochemical and pharmacological attributes.

4.2.2 Determination of Technological Attributes of Traditional Medicine

Analyses of the following aspects of the regimes, identified by Darwin as criteria for natural selection, were done to establish the technological competence of traditional medicine to co-evolve with modern medicine technologies. The following aspects were determined.

i) Variability: Variation among the regimes is necessary for evolution by natural selection. This is established through multiplicity of uses for a particular plant species and the diversity of plant species for a particular disease.

ii) Over-productivity: This refers to the capacity of the traditional medicine knowledge system to produce more regimes than will survive to maturity.

iii) Survive to reproduce. This means that at least some of the regimes must have the capacity to survive and reproduce.

iv) Competence: The regimes must possess the most favorable combination of characteristics that give them ability to compete with others for the limited resources available for them i.e. "survival for existence".

Variation, Productivity, Survivability

To determine attributes (i) to (iii), the research focused on the traditional management regimes for malaria. Malaria was selected because it was the most prevalent disease condition whose knowledge of its management was widespread and therefore with more easily available data. A total of 86 per cent of the traditional medicine practitioners have the expertise for managing malaria and malarial symptoms.

Through interviews of traditional medicine practitioners, specific data was collected on:

a) number of plant species used to treat malaria,

b) date it was first used,

c) number of practitioners using a particular plant species and

d) other disease conditions the plant is applied to.

Competence

The competence of the regimes was established through determination of a) The scientific and b) The economic attributes of the regimes

Scientific Competence

To determine the scientific attributes, the interviews focused mainly on management regimes for the five disease categories through the following studies:

Phytochemistry of Medicinal Plants

All the identified species used in traditional management of the five categories of diseases were subjected to chemical and biological analysis.

The chemical and biological properties of the plants used were based on various phytochemical and pharmacological studies on the plants by various scientists in research and academic institutions as documented in the Dictionary of Natural Products. The Dictionary of Natural Products of the Chapman and Hall/CRC chemical database contains a comprehensive structure database of 150,000 natural products.

Ethnopharmacology of Medicinal Plants

An analysis of the biological activities of the compounds was undertaken to determine whether there was a relationship between the traditional use of the plants and the biological activity of the chemical compounds identified in the various genera. For each disease category, corroboration was investigated based on the disease pathology, the desired biological action as extrapolated through modern medicine and the biological activity of the plants used in traditional medicine.

Economic Rationale

Determination of the Economic Rationale

To determine the economic attributes research focused on the burden of disease and the cost implications. These were calculated using disease prevalence data from both the official health care facilities as well as estimates from traditional medicine practitioners. Unit cost estimates for the management of a disease case were documented from the economics department of the Ministry of Health. The cost implications were computed as the product of disease prevalence and unit cost estimates for managing each case. The gross estimate attributed to traditional medicine suggested the economic contribution of traditional medicine to the local health care budget.

Results of parts one contributed to the determination of the appropriate inter-technology arrangement for Kenya's health care. Concurrently, they pointed to the specific mechanisms including policy, legal and institutional for its development. Results to part two contributed to developing the technological rationale for adopting the technological co-evolutionary model.

PART TWO:

CASE STUDIES

CHAPTER FIVE: MADAGASCAR

THE TECHNOLOGICAL CO-EVOLUTION MODEL

5.0 INTRODUCTION

This chapter presents results of discussions and interviews on Madagascar's health care system. It begins by outlining the evolution of the health care system and the development of the integrated health care system in particular. The health policy structure is outlined, discussion of which highlights economic and technological challenges, including the burden of disease, experienced. Thereafter, the policy, legal and institutional framework designed to respond to the challenges is discussed. The impact of the policy environment on the development of traditional medicine was determined through examination of an emerging integrated health care system. Technological and economic data on disease management regimes at the *Clinic de Manongarivo,* an integrated health care clinic in northwest Madagascar, were documented. Results of technological and economic analyses of the regimes are presented.

Madagascar

Madagascar is the fourth largest island in the world. Situated in the Indian Ocean, it extends from 11° 57' to 25° 32' S latitudes and 43° 14' to 53°27' E longitudes and covers an area of about 592,000 square kilometers. It is separated from the East Coast of Africa by the 400 km wide Mozambique Channel, thus forming a small continent. Its southern extremity is a little outside the Tropic of Capricorn while the rest is included in the southern tropical zone (Sayer et al. 1992) (See map in Appendix 5.1).

Madagascar belongs to the category of nations that has started integrating traditional medicine into its mainstream health care. Other nations in this category include Ghana, Tanzania, Mali, Zimbabwe and South Africa (WHO, 2000b). The official health care structure thus includes modern medicine, traditional medicine and limited access to integrated health care services.

To test the first hypothesis, the case study focused on two major aspects. The first part of the exercise explored the health care policy structure while the second part was devoted to determining the impact of the policy structure on traditional medicine. Results of the first part are presented in sections 5.1 to 5.2. Results to the second part are presented in section 5.3.

5.1 HEALTH CARE POLICY STRUCTURE

In the first part of the exercise, discussions and interviews focused on policies, laws, institutions and programmes related to health care. A total of 25 persons including policy implementers, medical doctors, traditional medicine practitioners, researchers, botanists, ecologists and local people in Antananarivo, the capital of Madagascar, were interviewed (see list of respondents in Appendix 4.2) A total of 8 institutions were represented.

Two out of 25 respondents were government health care officials. Discussions with them yielded information on health care policy and development. Six out of 25 were health care practitioners including medical doctors and traditional medicine practitioners. Discussions with them yielded information on health care challenges facing the Malagasy and the approaches in current practice. Randomly selected urbanites were also interviewed on their perspectives on health care and on traditional medicine in particular. A synthesis of the information documented, supplemented by policy documents and reports, follows.

Discussions revealed that there have been focused efforts towards the development of an integrated health care system, in general, and the promotion and development of medicinal plants and traditional medicine in particular. Two major factors were cited as the main stimuli to these developments. The first factor is related to socio- economic dynamics within Madagascar, while the second factor is related to the current and latent value of Madagascar's biocultural diversity. Each of these factors is discussed below.

5.1.1 Socio Economic Challenges

Like many developing countries, Madagascar faces chronic economic challenges, which have both direct and indirect impact on provision of goods and services including health care, to its populace. Madagascar has a population of about 15.1 million (mid 1999). About 29 percent of the population lives in the urban areas, while 71 per cent live in rural areas (World Bank, 2000). The population is growing at 2.8 per cent per year (data extrapolated from 1993 census). At this growth rate, the population is expected to double in less than 25 years. Although the population density is still low at 24 persons per square kilometer (26 for total sub-Saharan Africa), the very fast rate of population growth makes it very difficult for the government to provide essential social services. Indeed, as shown below, economic surveys on provision of essential services reveal a widening gap between performance and potential.

Over the last three decades, the Gross Domestic Product (GDP) growth rates averaged only 0.4 per cent each year. With high population growth rates, per capita incomes declined sharply. Between 1979 and 1999, the growth of Gross National Product (GNP) per capita had a negative value (-0.9 to -1.5). Since the late 1980s, the country adopted economic reforms which had a positive impact on the economy. Per capita growth turned positive and inflation fell sharply. However, from 1990 to 1993, GDP fell 4 per cent a year, on average. Inflation peaked at 61 per cent at the end of 1994 due to lax monetary management and large subsidies that increased the overall budget deficit to 11 per cent of the GDP. In 1999, the GNP per capita was about \$250.00 which was far below the average income for countries in the low-income group of \$410.00 and half of the average income for Sub-Saharan Africa of \$500.00.

The poor economic performance led to a declining budgetary allocation to health care, thus severely constraining the development of the sector. During the period 1996 to 1998, the health sector budget accounted for only US$3.7 per capita (which represented almost 10 per cent of the total public budget and 1.3 per cent of the GDP). This very low level of funding was compounded by *inter alia* poor budget execution. In 1996, 1997 and 1998, the budget execution was 78, 67 and 69 per cent respectively (World Bank, 2000). For instance, the public health budget per capita in 1997 was US$ 3.56 (1997) while public health expenditure per capita was US$ 2.39. The total health expenditures were still smaller than the reference level for low-income African countries of US$9-13 per capita, per annum, indicative cost for a district based health care system mentioned in the "Better health in Africa" (World Bank, 1993a), amount which doesn't include the cost of health care administration beyond the district level. This, it was revealed was evidenced by limited health care coverage and inaccessibility to official services by a majority of the population. Only about 65 per cent of the population has access to a health centre located at less than 5 kilometres from where they live.

Moreover, quality of care is precarious: drugs are rarely available, laboratories and clinical facilities are inadequately equipped and the buildings are old. Most were established in the 1960s and have not been well maintained. More importantly, the situation of the health personnel compares poorly with the situation in countries with similar income levels. The population per doctor in Madagascar is 12,000 a comparatively higher burden than the average for Sub-Saharan countries and all developing countries for which the population burden per doctor is 10,800 and 1,400 respectively. The problem is further compounded by geographical distribution of the technical staff which varies in different communities. As a consequence, quality of care in the public sector is poor and health facility utilisation rates low. In outpatient services there are not more than 0.2 contacts/inhabitant per year while in inpatient services 50 per cent of beds are, on average, empty.

In addition, poverty further constrained access to private health care services to majority of the population. With a GDP of $302 per capita, Madagascar remained steeped in poverty. Poverty assessment estimates for 1993 to 1999 revealed that 70 per cent of the population lived below the national poverty line. Based on estimates from the 1996 poverty assessment, around 59 per cent of the total population could be considered as extremely poor. According to the World Bank statistics in 1994, assessing poverty by Gross National Product per head of population, Madagascar came 183rd out of 203 countries. About 85 per cent of the poor lived in the rural areas, where in most cases official health care services continued to lack. Majority of the population therefore can ill afford essential modern medicine drugs which are expensive.

The economic performance gap continued to erode the government's fiscal capacity to provide adequate health care services. Concurrently, the consequential poverty continued to affect large share of the Malagasy population's access to health care services. Discussions revealed that most of the population therefore resorted to the cheaper traditional medicine which until the early 1990s provided health care services in a policy vacuum. They consult traditional medicine practitioners, either in clinics or open market places, before going to modern hospitals. Owed to the legacy of the French colonial rule (from 1896 to 1960), that neglected traditional medicine, there was little understanding of the practice. The production and utilisation of its products were generally unregulated and therefore vulnerable to abuse. As a result of the increased reliance on and demand for traditional medicine, it became a matter of necessity for the government to develop traditional medicine. The main thrust was to provide accessible safe, effective and affordable traditional health care and drugs. Hence, the emergence of the integrated health care system.

5.1.2 Wealth of Biodiversity and Traditional Knowledge

The other cited reason for increasing focus on traditional medicine is that there are various disease challenges that modern medicine has failed to address while traditional medicine has succeeded in their management. These include cancer, diabetes and sterility, among others. The important role of biodiversity and traditional knowledge in identifying potential remedies for diseases intractable by modern medicine was highlighted as crucial for health care development. It was also noted that the wealth of these resources offered an invaluable opportunity that should not be ignored.

Related to its location in the tropics and its relief, Madagascar is home to habitats rich in biodiversity. Its relief is "accidenté" (hilly, uneven, broken, and rough) and one characteristic feature is its west-east asymmetry. The highlands slope steeply towards the east while the escarpment is much less pronounced in the west. This asymmetrical relief produces a consequent asymmetry in the climate. The southeast trade winds discharge most of their precipitation on the steep slopes of the eastern mountains and so reach the western region as dry winds. This has resulted in the specification of many distinct phytogeographical regions, ranging from the dense, evergreen and ambrophilous[1] in the eastern rain forests to the strong aridity of the southwest region, where the vegetation is extremely xerophylous[2] with several adapted aphyllous[3] prickly or succulent species with swollen trunks for water storage. Such great ecosystem diversity allows most medicinal plants used in traditional and modern medicine and industry to grow and be cultivated in one or other regions of the country.

Madagascar has long been famed for its unique fauna, which has evolved in comparative isolation from mainland species ever since the island separated from Africa some 140 million years ago. The same is true for its flora, which has acquired a pronounced individuality with an unparalleled degree of endemism. It harbors some

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1 Plant life able to survive in and withstand much rainfall.
2 Plant life able to withstand a dry, hot environment.
3 Plant life having or bearing no leaves

13,000-plant species, of which 85 percent are endemic to the island. Strahm (1994) quotes 9,345 of the plant species being vascular. These plants are valuable to local communities in meeting their food, fuel, shelter and health needs. In addition, they have provided the world with some of its best known and effective modern medicines (Quansah, 1993).

It is well documented that Madagascar has tremendous potential for the production of traditional medicines and essential oils and is well known for the exportation of medicinal plants to developed countries, mainly the US and Europe, as raw materials for the pharmaceutical, fragrance, and perfume industries (Table 5.1 for list of raw materials for pharmaceutical research and development. Indigenous medicine from Madagascar has offered to the world the rosy periwinkle *Catharanthus roseus*, from which the two most powerful anti cancer drugs, Vincristine and Vinblastine, are extracted. Vincristine is used to treat leukemia, whereas Vinblastine is used to treat Hodgkin's disease and testicular cancer. The global sale of Vincristine and Vinblastine (as Velban an Oncovin) account for about US$ 100 million each year (Rajaonarivony, 1996). Between 1979 and 1988 a total of 84,233 tons of six major medicinal plants were exported to the US and Europe for a total sale of US$3,720,500 free on board (FOB) price, thus representing a major source of income for the national economy. Many foreign pharmaceutical companies are major prospectors of traditional knowledge and medicinal plants, thus making it impractical to neglect the use of medicinal plants in national health care.

Like in most tropical countries rich in biodiversity, the identification of many of the medicinal plants of value has been guided by the traditional knowledge the wealth of which is strongly associated with cultural diversity. Majority of the people are Malagasy, with cultural and historical ties to both Africa and Indonesia. This dual origin is attested by their physical features, language, customs and agricultural practices. They are composed of 19 tribes. In spite of their diversity, they are united by a common language, rooted in the ancient Malayo-Polynesian ancestor of the tongues spoken in the vast area bounded by Hawaii, the Tuamotu and Madagascar. For political historical reasons, the language has been modified by words imported from among others, the French who colonised Madagascar between 1896 and 1960. Along with the changes were also cultural influences. Other influences are from the Bantu, Swahili, Arabic and English who they continue to interact with.

However, so much of Madagascar's wildlife is now threatened that the island is frequently considered to be the single highest conservation priority in the world.

Table 5.1 Exports of Medicinal Plant products from Madagascar to Europe and USA, 1979 to 1988.

Plant species Family	Corresponding natural product	Tons exported
Catharanthus roseus G. Don CV Little Delicata Madagascar Periwinkle or Rosy Periwinkle APOCYNACEAE	Vincristine, Vinblastine.	6,628.95
Pygeum africanum Hook.f. *Pygeum=Prunus* ROSACEAE	Lipid sterols	563.33
Centella asiatica L. UMBELLIFERACEAE	Asiaticoside	476.82
Rauvolfia contortiflora APOCYNACEAE	Reserpine, reserpiline	353.35
Voacanga thouarsii Roem & Schult. APOCYNACEAE	Tabersonine	175.49
TOTAL		8,197.94

Source: Rajaonarivony, 1996

Column One presents some of the plant species whose material is exported

Column Two presents the corresponding natural product extracted from the material

Column Three presents quantities (in tons) of the material exported over the period

Madagascar's rich biological as well as cultural diversity is in danger of extinction as a result of habitat destruction, especially deforestation, and acculturation. It is therefore imperative to conserve the remaining forests to ensure the future availability of known and undiscovered, among others, medicines.

These reasons provided the impetus for mainstreaming medicinal plants and consequently traditional medicine into official health care, in order to harness economic benefits for national development and provide up-to standard health care services respectively. In view of the poor state of the economy and health care, the government could not afford to continue to ignore these resources that have gained importance among the majority poor and have great economic value in international markets. Processes were therefore, from the 1970s, put in place to harness the benefits of the resources to address health care and economic needs of the Malagasy. The processes which essentially put traditional medicine products into the modern economic space are discussed in the next section.

5.2 HEALTH CARE FRAMEWORK

Discussions with personnel in various institutions including public and private organisations, revealed that from about mid-1970s health care policies, laws and institutions have been evolving towards inclusion of medicinal plants and traditional medicine into mainstream health care. Prior to this period, mainstream health care services in Madagascar comprised mainly modern health care services as provided by the Ministry of Health in Provincial, District and Local health centers. 100 per cent of the public health care budget was devoted to mainly the development of modern medicine health care infrastructure and supplies. To date, the country has about 2,100 basic health facilities (of which 200 are private), 86 first referral hospitals (of which 12 are private) and at tertiary level, 4 regional and 2 university hospitals (World Bank, 2000).

The main technological challenge that these services continue to confront is the amelioration of the burden of disease.

5.2.1 Burden of Disease

Madagascar's population is burdened by many communicable diseases, including malaria, tuberculosis, plague, schistosomiasis and cholera.

Malaria is endemic in the coastal regions and continues to be a major determinant of morbidity and mortality. Tuberculosis (TB) continues to be a public health threat. Recently financial resource constraints have hindered the national tuberculosis program's ability to timely purchase sufficient stocks of TB drugs precluding the systematic delivery of the modern short treatment recommended by CDC-Atlanta and WHO. Plague is still endemic in the rural areas and there have been periodic outbreaks in Antananarivo and Majanga. Treatment of cases still relies on Streptomycin injections even though more effective and easier to apply oral alternatives are available. The control of plague seems hindered by poverty and lack of proper sanitation. There are problems with cost, resistance and toxicity of ratticides, antibiotics and insecticides. Schistosomiasis (urinary and intestinal) is on the rise and has become widely endemic throughout the island. The national program has just started to implement mass treatments with Praziquantel in hyperendemic villages. Emerging diseases such as AIDS or relatively well known diseases for which there is growing awareness (rabies, hepatitis B and cysticercosis) have recently been included among the priority health problems.

These diseases continue to affect the productivity and well-being of people in spite of the fact that cost effective interventions are available worldwide. Maternal mortality, infant mortality and under five mortality rates are particularly high (488 per 100,000; 96 per 1,000 and; 159 per 1,000 live births respectively) and comparable with Sub-Saharan Africa (SSA) in 1990-1996. Life expectancy at birth is 58. Although it is better than the average life expectancy for Sub-Saharan Africa of 50, it is still worse than for the low income group which has an average life expectancy of 60 (World Bank, 2000; WHO, 2000).

As earlier indicated, the non-effectiveness of the official services to manage the burden of disease because of inaccessibility, high costs and non efficacy, has led to seeking out more practical alternatives. There are compelling indications of local people's preference for traditional medicine. Currently, therefore, the focus on health care is gradually including development of traditional medicine as part of official health care.

5.2.2 Policy and Institutional Framework

Policy evolution towards traditional medicine was noted in three main areas including:

a) The public health care budget now not only covers provision of modern medicine but development of traditional medicine as well;

b) Recognition and regulation of traditional medicine and traditional medicine practitioners

c) The participation of traditional medicine and traditional medicine practitioners in official health care and research

Subsequently, evolution in programmatic and institutional focus towards utilisation of traditional medicine was stimulated. The growing focus on the participation of traditional medicine in health care development and its impact is discussed below.

In 1976, *Centre Nationale d'Applique de Recherches Pharmatiques* (CNARP) was created to implement a government policy in the development of aromatic and medicinal plant industries. It was created to focus research on medicinal plants and traditional remedies. This was in line with the national policy in the pharmaceutical industry with a view to chemically examine medicinal plants, most of which are endemic, before they were lost to extinction through wanton destruction of natural resources. Its main objective was to valorize traditional medicine and medicinal plants and to produce affordable, standard phytomedicines accessible to the poor and the local community.

A division dedicated to the development of medicinal plants was created in the Ministry of Health in 1986. It was first a division in-charge of traditional pharmacopoeia with the mandate to inventorise medicinal plants and contribute towards the development of the Madagascar Pharmacopoeia. A national inventory was done by modern health care personnel including nurses, health assistants and midwives at district and local health care centers. In 1990, a division on traditional medicine was created to advance the inventory to a national census of traditional medicine practitioners in each district. In 1991, the two divisions merged to form the *Division de la Medicine traditionnalle e la Pharmacopee Traditionalle.*

In partnership with an Interministerial Committee on Health, the new Division initiated the process of officially developing traditional medicine in Madagascar. The Inter Ministerial Committee on Health consists of representatives from the Ministries of Health, Research, Culture and Communication, Justice, National Police and Union of Liberatists and private professionals in Madagascar. Subsequently, in 1992, the contribution by traditional medicine to health care was formally recognised and its development provided for in the constitution.

Following a national referendum in 1992, Madagascar adopted a new constitution. Article 26 of the constitution on culture and science provides for the development of traditional practices. It states that:

1. Everyone shall have the right to participate in the cultural life of the community, in scientific progress and the resulting benefits
2. The state shall assure the promotion and protection of the natural cultural heritage, as well as artistic and literary production.

In the protection of the intellectual integrity of the traditional innovators, Article 17 on Personal Integrity, Dignity, Development, states that the state shall organise the exercise of rights which guarantee to the individual personal integrity and dignity, and complete physical, intellectual and moral development.

In support for the practice, the constitution provides for the protection of the environment and genetic resources that support, among others, traditional medicine Article 35 on Minority rights states that:

1. The *Fokonolona* may take appropriate measures to prevent destruction of their environment, loss of their land, seizure of herds of cattle, or loss of their ceremonial heritage, unless these measures jeopardise the common interest or public order
2. The coverage and terms of these provisions shall be determined by law.

Article 39 on Environment states that everyone shall have the duty to respect the environment; the State shall assure its protection.

In 1994/95 the committee drafted a law designed to regularize the practice of traditional medicine by giving it a legal status, allowing for the formation of traditional medicine practitioners' associations and providing a framework for the manufacture and commercialisation of traditional medicines as well as the protection of traditional intellectual property. This law is in the process of being adopted by parliament. In 1997, a consultative workshop was organized to look at the status of traditional medicine practice and in 1998; a project was developed to regularize the practice in Madagascar. There is evidence that these processes will have positive ramifications for traditional medicine as it will help safeguard the practice of traditional medicine against quacks and illegal traders. It would also enhance acceptance among modern doctors thus promoting interaction between the two medical systems. In addition, it would give confidence to traditional medicine practitioners to contribute to health care.

Two major outputs of these processes are notable. First, the formation, in 1999, of five traditional medicine practitioners' associations designed to organise the practitioners to practise traditional medicine. Secondly, it has become much easier to put products of traditional knowledge out into the market as either semi-processed or sophisticated formulations.

5.2.3 Research

Research was noted as pivotal in accelerating the process of breaking down barriers between modern and traditional medicine, in particular, to enhance awareness among policy makers of the scientific validity of traditional medicine. The *Centre Nationale d'Applique de Recherches Pharmatiques* (CNARP) has contributed immensely to the process of integrating modern and traditional medicine. It is the main research centre under the authority of the Ministry of Applied Research and Development *Ministere de la Recherche Scientifique et technologique pour le developpement.* As a national institution, it has attempted to undertake research on phytomedicines and diffused them into the modern economy.

Over the past 15 years, CNARP has developed an integrative approach involving three major steps including: the selection of research topics; ethnobotanical investigations and; development and production of phytomedicines. CNARP therefore involves a research and development process that utilizes traditional knowledge and indigenous medicinal plants as raw materials and applies modern biomedical scientific logic, tools and values for development of drugs as provided by the law.

It has five interdependent departments:

a) Botany and Ethnobotany Department

This department documents and publishes traditional medicine practitioners' knowledge on utilization of medicinal plants. By 1990, a total of 2,274 plant species (19 per cent of the Malagasy flora) had been documented to be used by the Malagasy people for medicine. The department is responsible for the collection of selected medicinal plants determined by the institute based on the health needs of the Malagasy. So far, selection of plants has focused on those traditionally used for the management of malaria, chest problems and diarrhoea. Selected plant material is collected, including herbarium specimen for taxonomic identification; plant germplasm for propagation and; plant part material for research. A medicinal plant garden attached to the department has been established to grow plant material for both research and conservation. About 400-500 plant species including herbs, shrubs and trees are being grown in this garden. The plant part material is then passed on to the next department in the research logic.

b) *Pharmacodynamics Department*

This department controls the information collected from the field and undertakes preliminary screening of crude extracts for pharmacodynamic activity including antimicrobial, antiasthmatic and antihypertension activity either *in vitro* or *in vivo*. If the extract is active or promising, it is passed on to the Chemistry Department for chemical analysis. Subsequent solvent fractions of the crude extract are prepared in the Chemistry Department and brought back and forth to this department for pharmacological testing.

c) *The Chemistry Department*

This department carries out isolation and purification of the active compound through bioassay guided fractionation in collaboration with the Pharmacodynamics Department. Once the active fraction has been identified, it is then purified to a single compound through chromatographic analysis. The pure compound is then characterised and identified through spectral analysis, with technical assistance from laboratories in France and the USA. In collaboration with the Galenic Pharmacie Department (discussed in d) below), this department undertakes a further control function to standardise the concentration of the active principle in the drug formulated as well as undertaking toxicity tests to ensure that there are no adverse side effects. To date, 200 plant species (1.7 per cent of the Malagasy flora) have been chemically and pharmacologically studied and results published (Rabodo, 1999, Personal Communication).

d) *Department of Galenic Pharmacie.*

After the extract has been verified for efficacy, toxicity and side effects, the right formulation is determined — whether tablet or syrup. A pilot factory for medicinal and aromatic products is attached to this department. The factory is responsible for the mass production of drugs formulated. These are then prepared and passed on to the Experimental Clinic Department (see (e) below) for clinical trials.

e) *Department of Experimental Clinic.*

This department is responsible for conducting clinical trials according to recommendations laid down by the WHO. The medical doctors first consult the patients for consent before testing the prepared medicine. The patients would then be requested to use the medicine for as long as the research may require so that scientific data can be effectively collected.

After a formulation has proved effective, scientific data is collected from all levels of research and submitted to the Ministry of Health. A special authorisation commission then examines the scientific documentation. Based on the results of the examination, the authority to process and to market at a larger scale may be issued.

This research logic has the advantage that it enhances scientific understanding of traditional medicine but has the disadvantage that it takes several years to get to the marketing stage yet the Madagascar people are very poor and need cheap medicines quickly.

There is a second research approach, a variant to the one above, being applied by CNARP, which has been in practice since 1986/7. In this approach, the selection of plants for study is based on the international pharmacopoeia. This has been found to be an easier approach to produce phytomedicines. Various plants identified through the international pharmacopoeia have been studied and processed into phytomedicines. These include: artichoke, persiflora, *Eucalyptus globulus*, and lemon grass, among others.

There is a third research approach applied by CNARP, in collaboration with CIFOR, which was introduced in 1994/5. Two projects in Zamina rainforest and Ankara fansika starting in 1999, were earmarked for this approach. In this approach, scientists work with traditional medicine practitioners and modern doctors as collaborators. This is done to enhance understanding of each other, and respect for both types of doctors who are regarded to be taking care of community health. Thus, complementarity is promoted. The traditional medicine practitioner is asked to allow a medical doctor to see the patient before and after treatment for cross referencing. The data is then analysed. If the treatment is effective, the traditional medicine practitioner is requested to work with the scientist on a contract basis but the remedy belongs to the traditional medicine practitioner. If the remedy can be developed into a drug and marketed, the traditional medicine practitioner will get a share of the royalty. If the plants are threatened or rare, the local people are asked to cultivate them for conservation. In this approach, there is an increase in the appreciation of the traditional medicine practitioners' skills and their status is improved.

Through the experiences at CNARP, the validation of traditional medicines demonstrated the scientific rationale for development of traditional medicine products. Thus, CNARP has become a major player in the development of legislation on traditional medicine in collaboration with the Division of Traditional Medicine and Traditional Pharmacopoeia in the Ministry of Health. CNARP also draws this mandate from being a World Health Organization (WHO) collaborating centre that has the mandate to help develop and implement the legislative framework of traditional medicine in Madagascar, with reference to Resolution of 1977 (WHO, 1978a) on the development of traditional medicines.

CNARP has also played the regulatory role for the conservation of natural resources. Between 1979 and 1988 CNARP was given the mandate by the government to regulate exportation of medicinal plants in response to the over exploitation of the natural resources and over harvesting of rare plants. During this period, it was necessary to have official approval from CNARP in order to obtain an authorization permit for exportation of medicinal plants. A joint effort between the Ministry of Research through CNARP, the Ministry of Commerce and the Ministry of Agriculture was established for monitoring the exportation and protection of phytogenetical resources.

Other organisations and institutes involved in research and development on traditional medicine include IMRA, CNRE, Ministry of Water and Forests, ANGAP[4] Universite d'Antananarivo Chemistry and Pharmacology Departments — all guided by the Ministry of Health's disease management priorities. For example, the postgraduate students at Universite d'Antananarivo have within the past ten years, studied over 80 medicinal plant species including plants used for intestinal worms, ulcers and cancer among others etc.

It was speculated that the development of the Integrated Health Care System at Manongarivo was stimulated by the enabling policy environment described above. Details on the process of integrating modern and traditional health care systems are outlined and discussed in section 5.3 below. This is followed by detailed analyses on the impact at the local level, on market allocation and economic value of traditional medicine. It was documented that, in turn, experiences at the project fed back to the development of legislation on traditional medicine.

5.3 IMPACT OF THE POLICY ENVIRONMENT ON TRADITIONAL MEDICINE

The resultant policy environment has had two major impacts. First, there was the enhanced participation of traditional medicine products in official health care, through institutional reform. Secondly, there was enhanced market allocation and value of traditional medicine products and traditional medicine practitioners. The institutional rearrangement is discussed in 5.3.1below and its subsequent impact on traditional medicine in 5.3.2 to 5.3.3.

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[4] ANGAP is the national agency for co-coordinating research projects related to biodiversity.

5.3.1 The Manongarivo Integrated Health Care Project

In the second part of the exercise, detailed information on the integrated health care system was documented to tease out the impact of the system on traditional medicine. In addition to the respondents to the first part of the exercise, more respondents that have been involved in the project, including 3 medical doctors, 1 traditional medicine practitioner, 1 ethnobotanist and 2 pharmacologists, were interviewed. In particular, the interviews focused on the burden of disease and the management regimes applied. Technological and economic dynamics of the system were analysed.

The Manongarivo Integrated Health Care Project (IHC) in northwest Madagascar illustrates how the policy environment facilitated the participation of traditional medicine in an organised formal healthcare system. The project was established in the Manongarivo Special Reserve, in northwest Madagascar, in 1993, as a pilot project within a World Wide Fund for Nature (WWF) Ethnobotany project. The Manongarivo Special Reserve is a 35,000 hectare forest reserve with a population of up to 4,000 Malagasy dependent on it for the provision of various forest products and services. The project was designed to develop an integrated health care system in which the use of traditional and modern medicine technologies in disease diagnosis, prevention and treatment is practised, with the view to provide appropriate health care and therefore provide incentives for the local community to conserve the biocultural diversity of the area.

The project responded to results of earlier studies (Quansah, 1996) with the *Tsimihety*, the main ethnic group in Manongarivo, which revealed that health was the most important principal community concern. The surveys also revealed that the most prevalent diseases were malaria, diarrhoea, dysentery, sexually transmitted diseases, pneumonia and wounds. The nearest clinic which was served by one unqualified nurse, was 80 km away, with a third of this distance to be made on foot. In addition, drugs in the clinic costed about ten times the cost price and therefore unaffordable (Quansah, 1994a, 1996a).

In late 1993, the project built a rural health clinic, the *'Clinique de Manongarivo'* in which traditional and modern medicine technologies were both used to provide health care services for the local community in Ambodisakoana village. The village clinic operations were carried out by a multi-disciplined team constituting a field team made up of ethnobotanists/botanist, traditional medicine practitioner, medical doctor and local helpers and; a laboratory team comprised mainly of pharmacologists. The project's line of development was based on optimising the strengths of both the modern and traditional medicine for health care while strengthening the weaknesses of each in a complementary manner. It was founded on the facts that both traditional and modern medical practices have strengths as well as weaknesses. Traditional medicine, characterised by the use of medicinal plants, is cheap, accessible and efficacious against a number of diseases. However, medicinal plants cannot meet all the health care needs of the community. This weakness is complemented by the use of modern medicine. Modern medicine is effective for the treatment of some of the diseases that traditional medicine cannot. However, it is very expensive and often inaccessible. Therefore integrating the two systems through the Integrated Health Care System (IHCS), harnesses the strengths of both while at the same time each supplements or complements the weakness of the other. Through interactions of the two technologies within the defined socio-economic and biological environment, appropriate technologies from either of the knowledge systems were identified for the management of particular disease conditions diagnosed.

The Mechanism of the Integrated Health Care System (IHCS) and the Process

The IHCS is the system that consciously targets and harnesses traditional people's innovations particularly of medicinal plants, for health reasons, to contribute towards meeting the health and economic needs of the *Tsimihety* people, supplemented by modern medicine technologies and products. Integrated in the project's context means that participants in both modern and traditional medicine practices work with each other side by side as team members with each contributing his/her quota to help meet the health needs of people. Integration therefore goes beyond recognition of both medical systems working parallel to each other, something which is happening the world over where both medical systems are recognized by governments and citizens. In effect, the IHCS calls for mutual trust, respect, honesty, recognition and acceptance of the capabilities and importance of the roles of the different specialists from the different professions. There is mutual adjustment by both practices resulting from intensive communication and interaction between them.

Under the IHCS, technological products and services of the traditional and modern medicine research and development systems are combined. Traditional medicine practitioners and medical doctors work together, as a team using the available medicinal plants and pharmaceutical drugs for the diagnosis, prevention and treatment of different diseases. These practitioners then join forces with other specialists — ethnobotanists, botanists, chemists, pharmacologists, pharmacists etc. — to complete the multi-disciplined relay team required to carry out the various activities necessary for the attainment of the IHCS goal.

The available traditional medicines forms the basis for the IHCS, while modern medicines complement where the community has no effective medicinal plants. Hence, the principle of the IHCS is: use resources (material and human) in a sustainable and complementary manner.

The Project

The project is implemented by the multidisciplinary team consisting of both trained and trainee personnel from the Departments of Botany and Pharmacology and the Medical School of the University of Antananarivo and the local communities living in and around the west -southwestern parts of the Manongarivo Special Reserve in northwest Madagascar. A local health committee, *"Voamieran ny Fahasalamana"*, with eleven members (seven men and four women) from two *Fokontany*[5] (local sub-district administrative level) was elected by the community in Ambodisakoana to over- see the project's implementation.

To fulfill the project's objective the following activities were undertaken:

1. Systematic visits to villages to document the traditional knowledge on the use of plants for medicine among the communities through group discussions and one-on -one interviews of both specialists and local people. Over 200 plants species have been documented to be medicinal in the Manongarivo Special Reserve. Out of these 113 species occur in the primary forest situated outside the forest special reserve; 17 species in the secondary vegetation; 39 species in both primary and secondary vegetation; 23 in cultivated areas and two are endemic to the Manongarivo Special Reserve (Pers. Comm, Quansah, 1999).
2. Consultation and examination of patients at the Integrated Health Care Clinic in order to diagnose, identify and document the types of diseases affecting the people. The medical doctor and traditional medicine practitioner work side by side through interactive consultation while examining the patient, during diagnosis and drug prescription.
3. Treatment of the identified diseases using the appropriate means. One of the three treatment types is selected depending on the disease: traditional medicine (medicinal plant) only; combination of traditional medicine and modern medicine and; modern medicine only. Pharmaceutical products are used to complement local treatments where not effective. The use of these pharmaceutical products depends on the disease, the evolution of a disease and the response of a patient to a treatment as observed by medical doctor and traditional medicine practitioner.

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5 Fokontany is the local sub-district administrative level. Each Fokontany has a health committee which takes care of public health care including maternal care, vaccination, hygiene, etc.

Patients obtain medicinal plants very cheaply but have to buy modern medicines from a community pharmacy attached to the Clinic.

4. Authenticate and standardize the known effective medicinal plants being used. Data from the Clinic's medical records which include empirical information on medicinal plants used in the clinic, the medical result noted during treatment and follow up by medical doctors and traditional medicine practitioner, are sent to the Laboratory team at the *Universite d'Antananarivo*, for further investigation. The laboratory team seeks to authenticate the empirical use of the medicinal plants, standardize the known effective remedies and provide information that enables the field team and the community to arrive at maximizing the benefits to be gained by the sustainable use of local medicinal plants. To this effect, research is carried out: to select the most effective medicinal plant (s) for a particular disease and the most effective part of the plant to be used as well as the optimum quantity of plant material required for an effective dose. For a particular disease, 4 or 5 different plant species are tested and the best one selected, taking into consideration the ecology of the plant, its distribution status, its rate of recovery or regeneration and its seasonal variation. Different parts of the plant are compared for biological activity and the part that regenerates quickly is picked for conservation aims. Of the effective plants used for the same disease, the one which is not rare, easy to regenerate and the parts which are available the whole year and easily accessible in the forest, are selected. Similarly, investigations on secondary effects, toxicity and undesired effects and for the improvement of the method of preparation of the medicinal plant are undertaken. Pharmacological screening and toxicity studies are undertaken to validate and verify the traditional medicine use. Subsequently, isolation and purification of the active principles are undertaken to help standardise the formulation. So far, plants used for the following conditions have been studied: respiratory diseases, bacterial infections, stomach-ache (*in vivo*), diarrhea (*in vivo*), fever, parasitic, wound (*in vivo*) and worms (*in vitro*).

5. Return of the results of laboratory analyses to community members to encourage them to continue the use of effective medicinal plants and discourage the use of ineffective and potentially harmful ones. All laboratory results are returned through the field team to the community to help optimize efficiency and conservation. Plants recommended for use in the Clinic and by the community must already be known to be used by the community and/or the traditional medicine practitioner; must be effective, less toxic and have a wide distribution.
6. Participatory health and conservation education programs are organised to increase the communities' awareness of the importance of personal hygiene and the sustainable use of resources. The health programs also include vaccination for polio, whooping cough, tuberculosis, tetanus, diphtheria and measles. The conservation education program includes discussions on sustainable use and management of natural resources. During the discussions, problems are discussed and appropriate technical advice is given.

The integrated health care system greatly enhanced the participation of traditional medicine in health care. The level and value of its contribution is elaborated below.

5.3.2 Technological Dynamics

Data on annual disease prevalence computed from *Clinic de Manongarivo's* medical records is presented in Appendix 5.3 and Table 5.2. In Appendix 5.2, column one, presents the disease conditions diagnosed. Columns two to four presents the morbidity rates diagnosed and managed, for each of the condition, for a particular year. Column five presents the total morbidity rates (T) (the sum of values in columns two to four along the rows) for the period 1994 to 1996. Column six presents the average annual prevalence rates for each of the disease condition (X) (the mean of values in columns two to five across the rows). The annual prevalence rate is computed by dividing the total rates by the number of years, three.

Over the period 1994 to 1996, the *Clinique de Manongarivo* diagnosed and treated a total of 4,570 disease cases computed to an average of 1,478 disease cases per year. Notable from the records (see Appendix 5.2), the clinic recorded a significant increase in the utilisation of the clinic's facilities. During this period, the number of disease incidences diagnosed and managed at the clinic increased by 34.9 per cent, from 1,182 to 1,594 per year.

Table 5.2, presents summary statistics on the disease prevalence in the area. Column three presents percentage per total morbidity for each condition and is computed as the product of the proportion represented by the condition and 100. The fourth column presents the incidence per capita for each of the condition and is computed as the proportion of the morbidity per condition of total population.

It can be deduced that a total of 43.28 per cent of the disease cases are caused by pathogenic microbes. The most prevalent disease conditions include malaria which accounts for 15.85 per cent; flu which accounts for 11.57 per cent; bronchopneumonia which accounts for 6.22; wounds which account for 4.98 per cent and; diarrhoea which accounts for 4.64 per cent of the morbidity.

The disease incidence per capita ranges from 0.017 to 0.059, with the five most prevalent conditions adding up to 0.160. The total disease incidence per capita is 0.370. This means that out of a population of 100 an average of 37 *Tsimihety* individuals will contact the clinic for any one of the disease conditions once in year.

Management Regimes Applied at the Clinic

Prior to 1993, the main technological products for management of these diseases in the Manongarivo area were based on traditional medicine while official health care management regimes were based on modern medicine. It was noted that the modern health facilities were inaccessible and in most cases, the modern drugs were never adequate. On the other hand, traditional medicine was readily accessible and costed much less, up to 90 per cent less. Upon the establishment of the clinic, the modern and traditional medicine technological products and services were combined.

The project enhanced communication between the modern medicine and traditional medicine practices so that the strengths of each supplemented the other. The traditional medicine provided medicinal plants that had been used by the local people for generations. These were provided by a traditional medicine practitioner who worked at the clinic as a consultant together with a modern medical doctor. Modern medicine brought in modern technologies for diagnosis, treatment and laboratory analysis of the traditional drugs on trial. These included laboratory equipment, modern drugs and immunization services. These were administered by 8 medical doctors who contributed to the integrated health care project at different stages of the project, two at a time. The two different practitioners would diagnose the patients' disease conditions and come to a consensus on the disease and method of treatment. Laboratory analysis was designed to advance the understanding of the traditional medicine by verifying the biological activity of the preparations. The plants studied were subjects of chemists, botanists, pharmacologists and medical students.

The plants used for the management of the following diseases were studied: fertility, fever, diarrhoea, wound, parasitic disease, asthma, stomach-ache, flu and herpes. This activity was supported by clinical trials in the treatment of the diseases results of which guided the selection of the most efficacious traditional treatment which the modern medical doctors used at the clinic without hesitation.

As a result of studies on some 50 plant species the following were deduced and recommended:

a) The plants which did not exhibit biological activity *in vitro* and *in vivo* were not to be used at the clinic and by the traditional medicine practitioner.

b) The plants for which the leaves and the roots extracts exhibited the same biological activity, the use of leaves was recommended as they regenerate more rapidly than roots.

d) When many species were used for the same disease and had the same biological activity, the use of plants which were rare or endangered was discouraged.

e) For medicinal recipes containing different species, the use of superfluous plants was discouraged.

Table 5.2 Summary statistics on disease prevalence rates diagnosed at the *Clinic de Manongarivo* 1994 to 1996

Disease Condition	Annual Prevalence Rates (X)	Percentage (%)	Incidence per Capita
Malaria	234.33	15.85	0.0586
Flu	171.00	11.57	0.0428
Bronchopneumonia	92.00	6.22	0.0230
Wound	73.67	4.98	0.0184
Diarrhoea	68.67	4.64	0.0172
Subtotal	639.67	43.28	0.1599
Others	838.33	56.72	0.2096
Total	1,478.00	100.00	0.3695

Column One presents disease condition diagnosed and managed at the clinic

Column Two presents annual prevalence rates (X) computed as mean values of disease incidence diagnosed at the clinic over 1994 to 1996

Column Three presents the proportion of the disease incidence over the total disease prevalence, in percentage. $X= [(X/\Sigma X) \times 100]$ %

Column Four presents disease incidence per capita computed as the annual disease prevalence (X) per population (P) (X/P) where P= 4,000

The incidence per capita rates illustrates the annual rate per population that an individual will seek medical services for that particular condition. The population is 4,000

Activities carried out in the first two years of operation resulted in the selection of appropriate plants and parts used for asthma, diarrhoea, fever, intestinal worms and wounds. Through this selection process, the number of medicinal plants used were reduced from 240 to 20, decisions on nine of which resulted from laboratory analysis. The Clinic was able to effectively treat 16 disease conditions strictly with local medicinal plants; four diseases with a combination of medicinal plants and modern medicines and five diseases with modern medicines only (see Table 5.3) below.

Focusing on the five most prevalent disease conditions, Table 5.4 below presents the development of the management regimes applied at the clinic for the five conditions (see column two). Column two in the table presents the treatment method applied which was either traditional medicine only (TM) or modern medicine (MM) only or combination of both modern and traditional medicine (TM + MM). Beside each treatment regime is a date in year showing the time a new application was adopted.

Noteworthy, there were two levels of technological changes. First was the evolution of traditional medicine remedies applied in management of the disease conditions evidenced by the four new additions adopted for managing bronchopneumonia, wounds and diarrhoea in 1995 and 1996 (see Table 5.4). Secondly, was the emergence of a line of technologies combining modern and traditional medicine which recorded an enhanced efficacy. These technological dynamics illustrate that the two technology systems became key participants in health and mutually adjusted to meet the health requirements of the Tsimihety. The results demonstrate the competitive ability of the traditional medicine products in that they are able to compete with modern medicine in the provision of health. This aspect of the traditional medicine is further elaborated in the second part of the Kenya Case Study presented in Chapter eight.

5.3.3 Economics

In addition to the collection of data on health care technologies, data was also collected on the economic implications of the integrated health care system on both medical practices. The interviews focused on the market status of products of modern and traditional medicine in the modern economic space. In particular, data on market allocation and value was documented and analysed.

Table 5.3 Treatment regimes for the various disease conditions diagnosed at the *Clinic de Manongarivo*

Disease Condition	Treatment Regime
Acute bronchitis, acute bronchopneumonia, acute malaria, sexually transmitted diseases and typhus fever syndrome.	Modern Drugs only (MM) In most cases requiring antibiotics modern medicine is preferred. This is partly due to the fact that the project doesn't have access to equipment for antimicrobial analysis and therefore unable to scientifically verify traditional medicine
Malaria, cough, bronchopneumonia, and wound with complications	Modern Drugs and Medicinal Plants (MM + TM) For malaria, a medicinal plant is used to reduce the fever while Chloroquin is used to kill the malarial parasite. If the malarial attack is very severe an injection of modern medicine is preferred.
Abscess, asthma, fatigue, fever, flu, diarrhea, dysentery, dysmenorrhoea, dysuria, herpes, intestinal worms, jaundice, measles, stomach-ache, scabies, wound,	Medicinal plants only (TM)

Column One presents the disease conditions diagnosed at the clinic

Column Two presents the effective treatment regimes adopted where MM denotes modern medicine drugs and TM denotes the use of Traditional Medicine or medicinal plants.

Market Allocation

Based on disease prevalence and management regimes data presented in Tables 5.2 and 5.4, the allocation of either practice in official health care was computed and presented in Table 5.5 below. Table 5.5 presents the proportions of the burden of disease managed by either modern medicine or traditional medicine treatment regimes at the *Clinic de Manongarivo*. Percentage data was based on the five most prevalent disease conditions only.

The Integrated health care system invites the participation of traditional medicine. An analysis of the management regimes reveals an increasing acceptance and participation of traditional medicine technologies for most of the disease conditions, particularly when compared with other official health care arrangements. The allocation to traditional medicine ranges from 7.19 to 26.73 per cent per disease condition, while for modern medicine it ranges from zero to 18.32 percent. It was deduced from Tables 5.4 and 5.5 that the participation of traditional medicine in official health care increased from zero to 74.50 per cent of the total official burden of disease between 1994 and 1996. This represents the proportion of disease conditions effectively managed by traditional medicine technologies either in part or in whole. About 48.96 per cent required the application of traditional medicine technologies only. A similar proportion of 51.01 required the combination of both modern and traditional technologies. A total of 25.51 per cent of the official burden of disease was managed by modern medicine in part. None, 0.00 per cent, of the disease conditions required the application of modern medicine only. This represents a decrease of 74.50 per cent in space allocation to modern medicine from 100 per cent. The system thus allocates a larger share of the space to traditional medicine to contribute to official health care than in the previous health care system. See also Figure 5.1.

In evaluating the performance of the health care system, data was also collected on the efficacy of the management regimes. This is defined as the proportion of diseases cases effectively managed over the total number of cases diagnosed and treated at the clinic. Based mainly on medical records, for the year 1994, the success rates were computed on the patients who returned to the clinic. A total of 55 per cent of the patients did not return to the clinic after the course of treatment. They might have been either satisfied, died or gone to another center or are on self automedication.

Table 5.4 Development of treatment regimes for disease conditions diagnosed at the *Clinic de Manongarivo* 1994 to 1996

Disease condition	**Treatment method[6]**
Malaria	TM + MM
Flu	TM
Bronchopneumonia	TM + MM (1995, 1996 two new TM applications)
	Acute bronchopneumonia is treated by MM alone.
Wound	TM (1995 a new application)
Diarrhea	TM (1996 a new application)

Column One presents the disease conditions diagnosed at the clinic

Column Two presents the effective treatment regimes adopted at the clinic over the period. Notes in parentheses document the date in year that new medicinal plant applications are integrated into the treatment regimes.

TM stands for traditional medicine.

MM stands for modern medicine

[6] Notes in parentheses document the date, in year, new medicinal plant applications were integrated into the treatment regimes.

The success rate is expressed as the percentage of those for whom treatment was a success. A sample of 286 patients was selected, the management regimes applied determined and the success rate documented. Results are presented in Table 5.6. Based on the selected sample, analysis of the success rate of these management regimes revealed an enhanced effectiveness attributed to the participation of traditional medicine (see Table 5.6). The application of modern drugs alone led to a success rate of 27 per cent which was lower than that of traditional medicine alone which led to a rate of 45 per cent. The effectiveness of the modern medicine drugs was, when combined with traditional medicine, enhanced to a higher value of 48.4 per cent which was also higher than that of traditional medicine alone.

Its important to note that the results are based on the outcome of the first year's experience at which time traditional medicine was the first choice of treatment while modern medicine was applied where traditional medicine failed. This explains the larger allocation to traditional medicine. Although the success rate to modern medicine appears low, over the years, allocation to modern medicine declined thus confirming selection against its solitary use. But no doubt its in combination with traditional medicine enlarged and enhanced success-thus suggesting its selection as a complement.

Market Value

Data on the cost implications for the participation of traditional medicine were also documented. This included the direct costs of the management of the burden of disease at the clinic and market rates for modern medicine and traditional medicine systems. Unit costs per disease case for the five most prevalent conditions are presented in Table 5.7 and Figure 5.2. These represent costs that would be incurred by the *Tsimihety* under the various disease management approaches.

The modern medicine system attracts the highest market rates than either IHC and traditional medicine systems. Traditional medicine products cost as low as 20 to 11 per cent of the market costs for modern medicine products for the management of the same disease condition. The IHC systems products cost as low as 24 to 11 per cent of market costs for modern medicine products. Depending on the disease condition, the IHC products are marginally more costly than traditional medicine products. Except for the management of malaria and bronchopneumonia the costs for the IHC system are similar to traditional medicine products. The disease burden due to these two disease conditions is shared between modern and traditional medicine.

Table 5.5 Allocation of the burden of disease to the treatment methods applied at the *Clinic de Manongarivo* 1994 to 1996

		Annual Number of Disease cases managed[7]	
Disease Condition Annual	**Annual Prevalence (%)**	**Modern Medicine (%)**	**Traditional Medicine (%)**
Malaria	234.33 (36.63)	117.165 (18.32)	117.165 (18.32)
Flu	171.00 (26.73)	0	171.00 (26.73)
Bronchopneumonia	92.00(14.38)	46.00 (7.19)	46.00 (7.19)
Wound	73.67(11.52)	0	73.67 (11.52)
Diarrhoea	68.67 (10.74)	0	68.67 (10.74)
Subtotal	639.67 (100)	163.165 (25.51)	476.505 (74.50)
Percentage (%) Of space allocation	100.00	25.51	74.50

The prevalence rates assume that when the two are applied, the contribution by either is equivalent i.e. 50: 50

7 The prevalence rates assume that when the two are applied, the contribution by either is equivalent i.e. 50: 50

Figures in parentheses represent percentage rates of disease prevalencies based on the five most prevalent conditions only

Column One presents the disease condition diagnosed and managed at the clinic

Column Two presents annual prevalence rates per disease condition

Column Three presents the number of diseases cases managed by modern medicine

Column Four presents the number of disease cases managed by traditional medicine

The final row presents the proportions, in percentage of the allocation of the burden of diseases for either treatment regime based on the five most prevalent disease conditions.

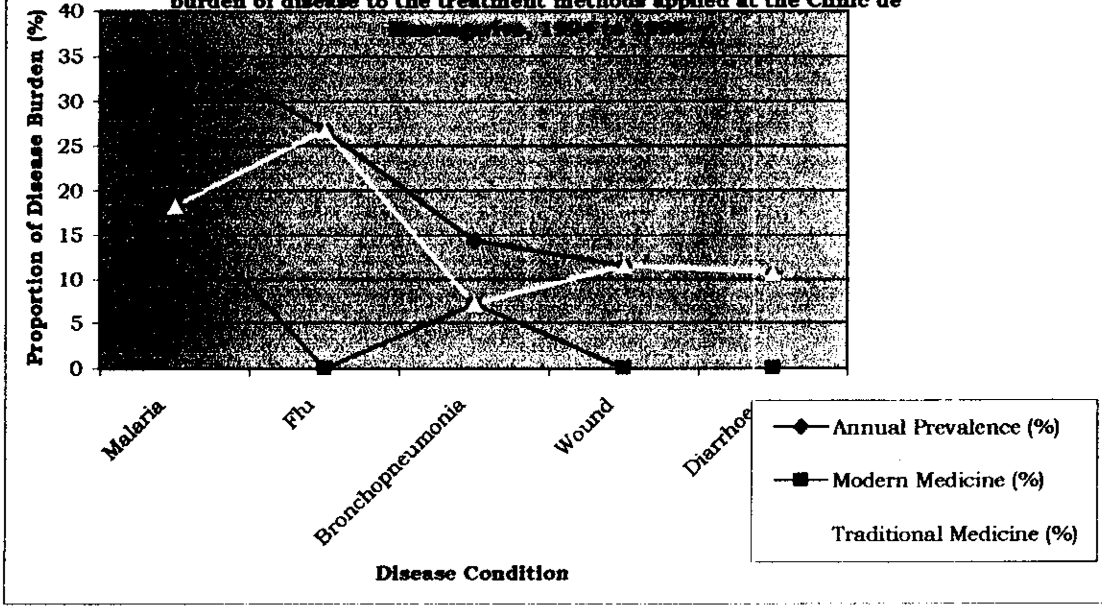


Figure 5.1: Scatter diagram with smooth lines comparing allocation of the burden of disease to the treatment methods applied at the Clinic de

Table 5.6 Success rates of the various treatment methods used at the *Clinic de Manongarivo*, January-December 1994

Treatment Method	Number of Cases (x)	Percentage of Total cases (p) (%)	Success rate Documented (%)
MM	18	6.3	27
TM	204	71.3	45
MM + TM	64	22.3	48.4
Total	286	100.00	

Source: Aumeeruddy et al., 1995.

Column One presents the treatment method applied at the clinic in the year 1994

Column Two presents the number of diseases cases managed by the particular treatment method. This also presents the allocation of the disease burden to a particular treatment method.

Column Three presents the proportion (p) of the disease cases managed by the particular treatment method of the total cases diagnosed and treated at the clinic that year, as a percentage. P = [(x/286) x100]%

Column Four presents the documented success rate in percent of the particular treatment method.

Hence, the moderating effects of the varied costs of the two approaches. The higher costs of modern medicine tend to increase the cost of the remedy applied while the lower costs of traditional medicine products significantly reduce the cost of the remedy applied. The higher proportion of diseases managed by traditional medicine, in part or in whole, thus effectively reduces the cost of the IHC system.

Table 5.8, Figure 5.3 and Appendix 5.3 presents aggregate annual expenditures that would be incurred by the *Tsimihety* under the different treatment approaches for the diseases diagnosed at the clinic. The IHC system costs $1,285.83 per year or $0.32 per capita per year for the five most prevalent disease conditions. Under the modern medicine system for the same disease burden the *Tsimihety* would incur annual expenditures of $7,645.85 or $1.91 per capita. The IHC system therefore costs 17.00 percent of the modern medicine system (see Tables Table 5.9.1 and 5.92). This represents a further cost reduction compared to the market unit costs of the management regimes. This is because of the higher reliance on traditional medicine regimes. Tables 5.9.1 and 5.9.2 presents the annual expenditures for the various treatment alternatives as proportions of annual expenditure under the IHC system in Table 5.91 and the inverse proportions in Table 5.9.2.

Costs analysis of these management regimes reveal that the *Tsimihety* are saving money under the IHC system (See Table 5.10 and Figure 5.4). Analysis of the costs between modern medicine, traditional medicine and the IHC reveals the following: The cost of health care is reduced to approximately one sixth when the technologies in the integrated health care system are used when compared to official modern medicine technologies. Between the most prevalent disease conditions the IHC saves $1.59 per capita per year. The reduced cost is due to the inclusion of traditional technologies whose aggregate costs are 15 per cent of modern technologies. The cost of IHC system is not significantly higher than the cost of traditional medicine technologies. The cost of IHC is 112 per cent of the cost traditional medicine technologies and is, therefore, affordable. For the management of malaria, the community saves $9.00 per disease case; $12.00 for flu; $13.00 for bronchopneumonia; $5.50 for wounds and; $7.00 for diarrhea. On the aggregate, per year, the community saves between $405.19 in the management of wounds, and $2,226.14 in the management of malaria. These savings add up to $6,360.02 or 1.59 per capita per year. The funds saved are used to purchase the essential modern medicines in demand as well as meeting the costs of sending their children to school. Apart from the impact at the local level the policy environment also contributed to diffusion of traditional medicine products into the market. The following section presents a discussion on those developed by the government.

Table 5.7 The cost, per disease case, in US$, of various management regimes for the five most prevalent disease conditions diagnosed at the *Clinic de Manongarivo*

Disease Condition	Unit Cost of Treatment, in US$		
	Modern Medicine	Traditional Medicine	Integrated Health Care
Malaria	12.50	2.00	3.00
Flu	13.50	1.50	1.50
Bronchopneumonia	15.00	3.00	2.00
Wound	6.50	1.00	1.00
Diarrhoea	8.00	1.00	1.00

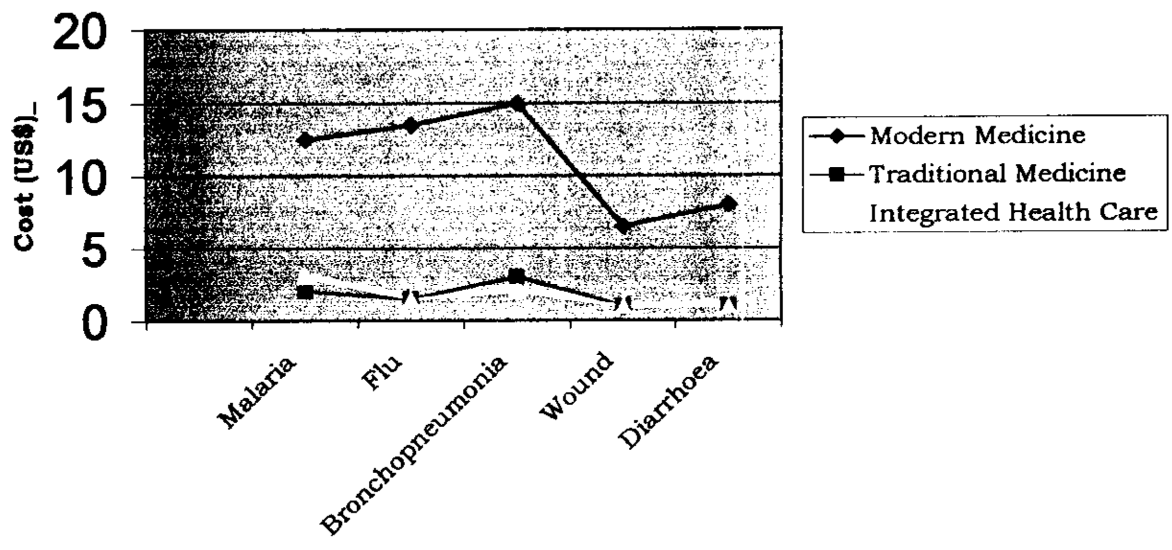
Column One presents disease condition diagnosed and managed at the clinic

Column Two presents the market unit costs, in US$, for managing a disease case by modern medicine. The values are median rates for range of costs recorded

Column Three presents the market unit costs for managing a disease case by traditional medicine

Column Four presents the unit cost for managing a disease cases by the integrated health care system technologies

Figure 5.2: Scatter diagram with smooth lines comparing the cost, per disease case, in US$, of various management regimes for the five most prevalent disease conditions diagnosed at the Clinic de Manongarivo



Production of Traditional Medicine Products for the Market

Between 1990 and 1996, CNARP initiated the production of phytomedicines in collaboration with the United Nations Industrial Development Organization (UNIDO). Cheap and effective medicines were produced from purified extracts and locally processed essential oils using information from traditional medicine practitioner and the application of the principles of aromatherapy. To date, CNARP has been able to produce ten phytomedicines used for various physiological systems some of which have been in the market for between four and 14 years. These include Vaseline *Niaoulee pommade antiseptique bronco-pulmonaire exteme*, Manafana *baume*, *Fanaferol pommade cicatrisante*, Huile Niaoulee 2 *solute huileux antiseptique O. R. L. exteme Enfant*, Fanaferol *poudre*, Mahatony *sirop sedatif nerveux*, Huile Nioulee 5 *solute huilex antiseptique O. R. L. exteme Adulte*, Eugenial solution *antispetique bucco-dentaire*, Hevokina *solution antiseptique O. R. L. en inhalation.* Currently, a total of eight phytomedicines are in the process of being developed. The most important of the developed phytomedicines is a wound healing cream standardized from *Ilex mitis* (Aquifoliaceae) under the trade name Fanaferol. Approximately 6,000 to 10,000 bottles of 100g of the Fanaferol are sold each year each costing 4000 Mg F < US$1.00.

It was noted that the private sector is also investing in development of products based on natural products identified through ethnobotany. The participation of the private sector in R & D will greatly increase the volume of research, facilitate the experimentation and exploitation of new market areas. Companies have the advantage of great financial strength and marketing experience which provides the necessary context in which diffusion of new products can take place.

Table 5.8 **The aggregate annual expenditure, in US$, incurred by the *Tsimihety* community living around the Manongarivo Special Reserve, for the management of the five most prevalent disease conditions under the various treatment approaches applied at the *Clinic de Manongarivo***

Disease Condition	Modern Medicine	Integrated Health Care	Traditional Medicine
Malaria	2,929.13	702.99	468.66
Flu	2,308.50	256.50	256.50
Bronchopneumonia	1,380.00	184.00	276.00
Wound	478.86	73.67	73.67
Diarrhoea	549.36	68.67	68.67
TOTAL	7,645.85	1,285.83	1,143.50
PER CAPITA	1.91	0.32	0.29
Per Disease case	11.95	1.79	2.01

Table 5.9.1: Aggregate cost of treatment approaches expressed as proportions of the IHC system

	MM	TM
IHC	7,645.85/1,285.83	1,143.50/1,285.83
	5.95	0.89

MM/IHC and TM/IHC

Table 5.9.2: Cost of the IHC treatment approach expressed as proportions of modern and traditional medicine treatment approaches

	IHC	
MM	1,285.83/7,645.85	0.17
TM	1,285.83/1,143.50	1.12

IHC/MM IHC/MM

Figure 5.3 Scatter diagram comparing the aggregate Annual expenditure, in US$, incurred by the Tsimihety living around the Manongarivo Special Reserve, for the management of five most prevalent disease conditions under the various treatment approaches

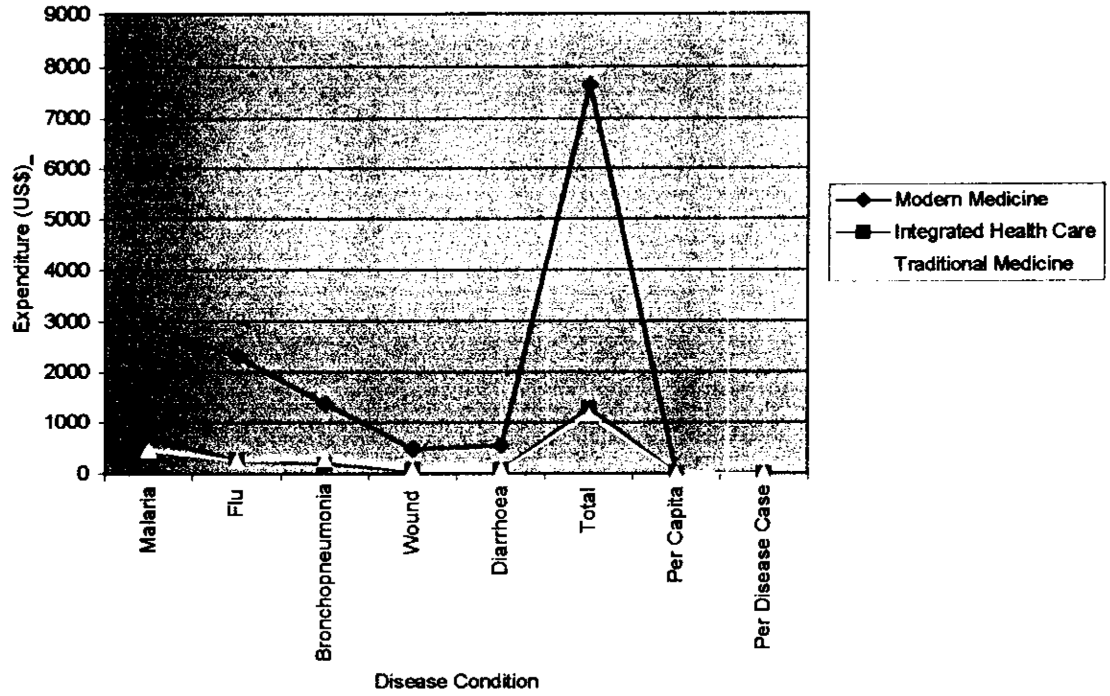
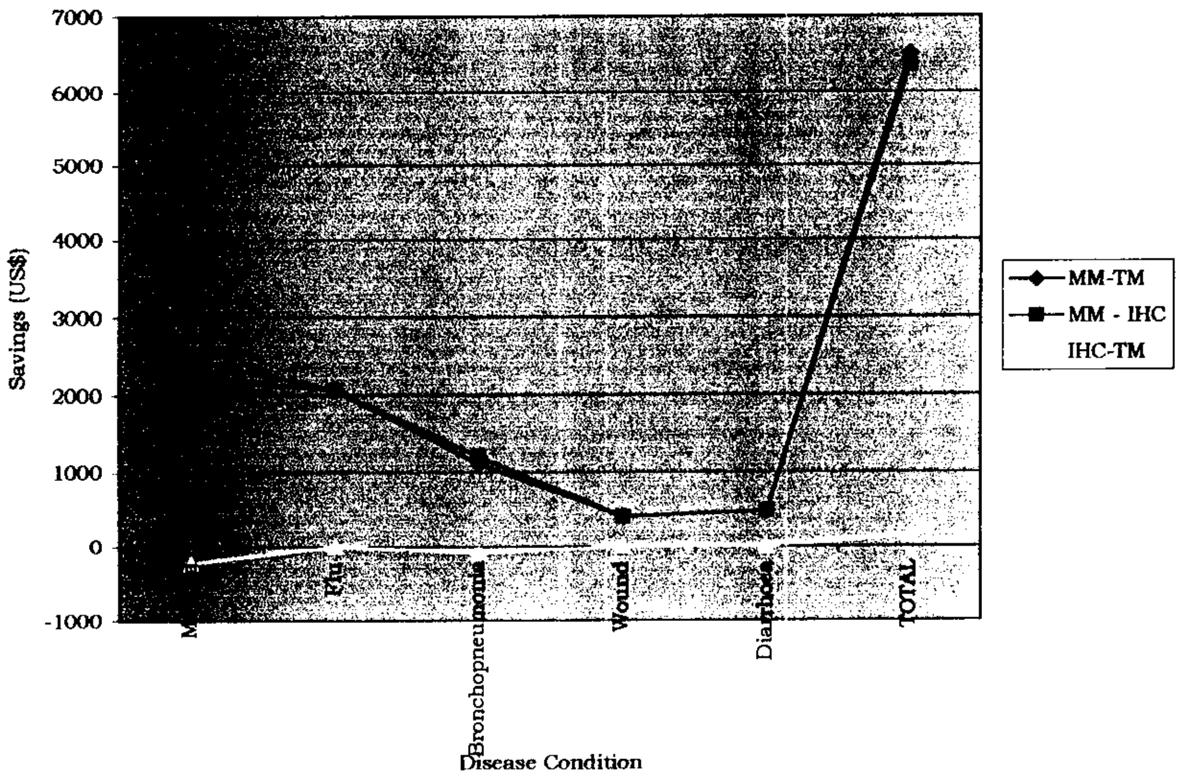


Table 5.10: Aggregate annual expenditure savings between modern, traditional and integrated health care treatment approaches

Disease Condition	MM-TM	MM - IHC	IHC – TM
Malaria	2,460.47	2,226.14	-234.33
Flu	2,052.00	2,052.00	0.00
Bronchopneumonia	1,104.50	1,196.00	-92.00
Wound	405.19	405.19	0.00
Diarrhoea	480.69	480.69	0.00
TOTAL	6,502.35	6,360.02	142.33
PER CAPITA SAVINGS	1.62	1.59	0.04

Figure 5.4: Aggregate annual expenditure savings between modern, traditional and integrated health care treatment approaches Savings



5.4 DISCUSSION

The technological and economic analyses reveal that bringing products of traditional medicine into the modern economic space provides economic incentives for the development of traditional innovations. As illustrated above, institutional reorganization was instrumental in realizing the benefits. For instance, crucial to the IHC process was the pertinence of both the modern and traditional medical system to bury the differences and work together. For instance, the effective diffusion of traditional technologies into the official health care required the change in attitude of the medical doctors. Discussions with the project medical doctors revealed a significant change in their attitude towards traditional medicine. They acknowledged that the formal training they received at the Medical School clearly resisted the idea of using traditional medicines and discredited their usefulness and adequacy. However, through the experiences in the project, the sceptism was wiped away. Though they at the beginning had difficulties prescribing medicinal plants without being sure of the effects, they became convinced of the usefulness of the approach because of the positive effects obtained. The system facilitated the process of acquiring and communication of different technologies resulting in the development of appropriate treatment regimes. After working together with the traditional medicine practitioner for over two years, the medical doctors were able to carry out prescription of medicinal plants based on the Clinic's reference data on local pharmacopoeia on diseases and their treatment.

The six medical doctors who were involved with the project have come to accept the crucial role of traditional medicine in health care as authentic and of economic and scientific value. There is one medical doctor who has opened a clinic about 25 km from the project area who is using the technologies developed by the IHC project. A second doctor in Andapany plans to apply the project technologies in his practice. These initiatives illustrate the spread of these technologies and therefore persistence and the survival of traditional medicine products over time. The medical doctors also felt that collaboration with the local traditional practitioner created diversity of approach which turned out to be more efficient than application of pure modern medicine alone. Such an experience, though not representing the whole professional medical sector in Madagascar, has a demonstrative value which has been recognised by government officials of the Ministry of Health. Results of the project are valuable and have stimulated and contributed to the development of the Ministry of Health's division of traditional pharmacopoeia and medicine. Following an evaluation of the project's activities, it was proposed by a Ministry of Health official, that the IHC project serves as a training centre for doctors who want to learn more on the IHC approach.

The project demonstrates the practicability of integrating two systems of knowledge and practice and illustrate that collaboration between medical doctors and traditional medicine practitioners is possible and profitable. The system did not replace the traditions and culture of the people thus sustaining the traditional institutions and knowledge systems that supported the production of traditional medicines. The continued use of local medicinal plants by these people also meant that the productivity of the traditional knowledge system was maintained and traditional bio-innovation is thus stimulated to meet new disease challenges. The participation and increased currency of traditional technologies in mainstream healthcare increased the confidence of the traditional innovators to sustain the productivity of the traditional research and development. Additionally, the scientific validation of traditional remedies contributed to the increased confidence of the traditional medicine practitioner. The increased confidence in his profession thus encouraged him to acquire more information on and try new plant products. As a result of the project, the traditional medicine practitioner now transmits part of his knowledge to the population as a whole and to the medical doctors, guides and ethnobotanists. The totality of his knowledge was until this time transmitted only to his own son. The villagers now wish that this knowledge is transmitted to their children and grandchildren a positive indication of their desire to conserve traditional knowledge and reducing its loss.

The IHC system has led to the development of an innovative line of technologies which combines modern and traditional medicine thus offering the opportunity for the development of an array of innovative remedies that will increase the diversity of technological products. This opportunity also offers stimulus to traditional innovators to develop new innovations that can combine with modern technologies.

The IHC system provides economic incentives for both the health care provider (government) and the community through the cost savings. The reduced cost of the health care services means that the government is able to spread the services further and increase access to health care for its populace. For instance, improvements in health care have been achieved in the reduction of mortality due to measles. According to the population, in 1984 measles affected many children who died from lack of medical attention. Since the establishment of the clinic, this reduced significantly because of the ease of access to health care. Applying such an approach at the national level could yield greater benefits not only in terms of meeting peoples health needs on a cost effective basis but also it would be possible in the long -term to restrict purchase of modern medicines only to those for diseases that have no effective local treatment. This will save precious funds that could be used in financing other national programs. These are incentives for the government to sustain the productivity of the traditional knowledge system through the appropriate policy. It is no surprise that results of the research in the project have been valuable to the Ministry of Health in the formulation of the law on medicinal plants.

At the community level, the cost savings and the increased access provide incentives to sustain the knowledge system and conserve the related biodiversity. Practicing the IHCS approach has had a significant impact on the biocultural diversity conservation of the area. The project has helped to maintain and strengthen the links between the people and the biodiversity of the area, while at the same time enabling them to see the importance and practical benefits of such biodiversity and knowledge.

The conservation of the rich biocultural diversity of this area was already being achieved. It was noted that some people had stopped clearing primary forest areas of the Manongarivo Special Reserve for cultivation, for the simple reason that certain medicinal plants from that part of the reserve have successfully treated their diseases.

5.4 CONCLUSION

The study on Madagascar's health care system in this chapter points to the policy, legal and institutional changes that are facilitating the participation of traditional medicine products in official health care. The processes are essentially mechanisms for artificial selection of traditional medicine products into the modern economy. The allocation of government resources directed to traditional medicine significantly increased the rate of increase of knowledge on traditional medicine and medicinal plants, which continues to inform the policy process. Technological and economic analyses of the IHCS reveal both economic and subsequent conservation incentives.

Having established the impact of the reformed policy structure on traditional medicine in Madagascar, the following chapter on Chinese medicine seeks to test the fertility of establishing the co-evolutionary model in Kenya's economic context.

CHAPTER SIX: CHINESE MEDICINE CASE STUDY

6.0 INTRODUCTION

This chapter presents results of discussions and interviews on Chinese medicine health care system as practiced in Kenya. It begins by outlining the evolution of the Chinese medicine health care system and the development of the integrated health care system in particular. The health care policy structure is discussed and its impact on traditional medicine determined. Focusing on Chinese medicine within Kenya's economic context, the performance of Chinese medicine products is analysed with the view to first determine the extended impact of the Chinese health policy environment on traditional health care technologies and products in the international market. Concurrently, the study was also aimed at illustrating the fertility of developing the integrated health care system within Kenya's economic context.

To fulfil these objectives, data was collected on the burden of disease managed by the Chinese medicine clinics in Nairobi and; the disease management regimes. Results of technological and economic analyses of the regimes are presented. Factors that contributed to the performance of Chinese medicine in Kenya were also determined.

Nairobi

Nairobi the capital city is Kenya's principal economic, administrative, and cultural center. It is also one of the largest and fastest growing cities in Africa. It has a population of 1,504,900 (1990) served by various major health care providers namely: the government through the Ministry of Health; non governmental organizations, through mission hospitals, and the private sector through private hospitals and private consultants. In addition to these major providers are minor but important health care providers including urbanised traditional medicine practitioners including local and Chinese medicine practitioners.

6.1 HEALTH CARE POLICY STRUCTURE

Focusing on Nairobi, discussions were held with the Ministry of Health personnel including economists and planners; and Chinese medicine clinics' personnel including doctors, nurses, pharmacists and managers. A total of 13 randomly selected Chinese medicine clinics in Nairobi were consulted (see list of respondents in Appendix 4.2) . A total of 19 respondents were interviewed. Data was collected through the interview method using a pretested questionnaire.

Discussions with Chinese medicine doctors and clinic personnel practicing in Nairobi revealed that Chinese medicine has had a long history of putting together modern and traditional healing systems. The technical personnel native to China revealed that in Chinese medicine, traditional medicine operates alongside modern medicine. This was mainly as a result of the Republic of China's government's investment, for over five decades, towards development of its traditional medicine system. The major objective was to develop it to a level where it could be used effectively alongside modern medicine. As a result, although modern medicine and drugs, introduced to China over two centuries before, replaced some traditional medicines, some Chinese herbs were still used in health care.

The respondents cited three major factors that stimulated and catalysed the process of integrating modern and traditional medicine. The stimuli include cultural significance, efficacy and low cost of traditional medicine remedies. The catalysts included government intervention — through an enabling policy and legal environment; supportive research and development programmes and supportive institutional arrangements.

6.1.1 Cultural stimuli

The Chinese people have always had deep belief and strong attachment to their cultural traditions, including, among others, traditional medicine. Attributed to their long standing traditions, Chinese medicine represents the crystallization of the Chinese people's long tested wisdom and cultural experience. All people in the vast rural areas and both the common people and the upper class in many cities earnestly believed in traditional medicine. What proved effective in clinical practice was preserved, handed down from generation to generation and continually improved upon. Strongly related to the attachment is the fact that traditional Chinese medicine had a unique theoretical system which could neither be replaced nor explained by modern medicine, including the theory of yin-yang, vital energy and blood, and so forth. Reasons for their confidence in traditional medicine was however not limited to the cultural attachment. Other cited factors include efficacy and low cost.

6.1.2 Efficacy

The respondents indicated that the use of Chinese medicine yielded satisfactory results in the treatment of most diseases, including some intractable by modern medicine. Traditional medicine could reduce symptoms and even produce remission. It was noted that the efficacy of Chinese medicine was evidenced by the fact that patients in China do as well as those in the West. The efficacy has also been corroborated, for some of the remedies, through the application of modern science. For example, Ginseng (*Panax ginseng*), documented in the *Nung Ben Cao* that predates Dioscoroides' *De Materia medica,* was said to "strengthen the mentality, relax stress, calm down nerves..." It has now been scientifically established that the active principles of ginseng, panaxosided, do exert effects on the central nervous system and the cardiovascular system and stimulate the adrenocorticotropic hormone-cortisol axis (Huang, 1999).

6.1.3 Low Cost

In the absence of accessible and adequate modern medicine health care facilities and effective medical insurance schemes, particularly in developing countries, cheaper options have been in demand. It was also noted that Chinese medicinal herbs were readily available at low cost, convenient and simple to use and had very few side effects. Chinese medicine thus enjoyed much popularity with the vast majority of people.

6.1.4 Government Intervention

It was noted that the government has played a major role in stimulating the development of traditional medicine and subsequently catalysing the process of integrating modern and traditional medicine. The government's involvement in the development of traditional medicine can be traced back to 594 AD when the emperor commissioned scholars, including physicians and researchers, to develop the *Tang's Newly Revised Materia Medica*, the earliest pharmacopoeia promulgated by the government. The pharmacopoeia is widely utilised within China and other countries. By the 12th century, the Song Dynasty published *Tai-Pin Hui-Min He Ji Ju Fang* which was the world's earliest prescription book of pharmacy issued by the government. Developed over 4000 years, the Chinese pharmacopoeia continued to expand to include modern science principles such as pharmaceutics, botany, zoology mineralogy and metallurgy. See Appendix 6.1 for list of literary works on Chinese Medicine.

Despite these efforts and advancements in Chinese pharmacopoeia, the development of traditional medicine practice was not without setbacks. For instance, in 1929, the central government of Kuomintang passed a bill "to ban the traditional medicine in order to clear the way for developing medical work". But for reasons outlined in 6.1.1. to 6.1.3 above, the government did not succeed in banning and replacing it. Traditional Chinese medicine survived and was never eliminated in spite of the persecution. In favour of the practice, in 1949, during the inauguration of the People's Republic of China, the Communist Chairman Mao of the 1949, revolution made a pronouncement highlighting the importance of traditional medicine, that turned the tide. The pronouncement brought forth all the positive energies of traditional Chinese medicine into the modern medicine arena in an effort to speed up its modernization. The intervention not only stimulated the development of traditional medicine but also catalysed the process as outlined in section 6.2 below. The products and services of traditional medicine were actively selected to participate in official health care.

6.2 HEALTH CARE FRAMEWORK

6.2.1 Policies, laws and institutions

The positive attributes of the Chinese traditional medicine knowledge system made traditional medicine a formidable competitor to modern medicine. This fact was well recognised by the Communist Chairman Mao of the 1949 Revolution. He pronounced that "Chinese medicine is a great national treasure; we must strive to improve and elevate its status". Subsequently, the People's Republic's government reemphasized the importance of Chinese traditional medicine. A campaign to rehabilitate Chinese medicine commenced, intended to break China's dependence on the West. By the 1990s, more than ten traditional medical colleges and institutions had been established. Integration between traditional and modern medicine was set up in all hospitals and clinics.

"To foster unity between Chinese- and Western-trained doctors" was one of the four principal policies for health work laid down by the Government. To effect this objective, these two schools of medicine had to be mutually supporting and complementary without any strife. Traditional medicine could then contribute more to the welfare of mankind. The integration of traditional medicine with modern medicine helped to correct the deficiencies of each and certainly promoted the development of medical science (Wang Pei, 1983).

Later, the policy on traditional Chinese medicine was formulated according to the actual needs of the country. The main points of the policy were as follows:

1) to strive to inherit, develop, systematize and raise the level of traditional Chinese medicine;
2) to unite and rely on traditional Chinese doctors so as to give full effect to their initiative;

3) to organise ways for Western-trained doctors to learn and study traditional Chinese medicine;
4) to modernise traditional medicine and pharmacology gradually
5) to develop traditional Chinese medicine and conduct research on the integration of traditional Chinese and modern medicine in a planned and rational way;
6) to protect, utilize and develop the resources of Chinese medicinal herbs.

In order to ensure the implementation of this policy, a parent organization in charge of traditional medicine was established within the Government. The ministry of Public Health set up a bureau of traditional medicine, while departments of traditional medicine were placed under the provincial and municipal bureaux of public health.

To support and advance the integration process towards a unified new medicine and pharmacology, capacity building of the medicine practitioners was recognised as crucial. The Central Government, provinces and municipalities organised many orientation courses for Western-trained doctors to study traditional Chinese medicine; thus many doctors specialised in both Western and traditional medicine have been trained. The medicine training curriculum also changed to include traditional medicine. Currently, students within China's Western-style medical colleges are taught to use herbs; therapy and acupuncture in treating their patients. Fifty percent of their training period is devoted to studying traditional medicine. Now, there are three types of doctors in the country, namely traditional, Western-trained, and Western-trained with qualifications in traditional medicine. In order to enable the traditional medicine practitioners to master some modern science and technology, many provinces and municipalities organized various types of training and orientation courses for traditional doctors to study and raise their level of modern science. Interactions of these categories in health care has led to the development of a syncretic knowledge and innovation system.

6.2.2 Research

It was also pointed out that the good performance of the Chinese medicine health care system was attributed to the dynamic traditional knowledge research and development system. Developed over 4000 years, the traditional innovations contributed to *inter alia*, the abundance of information and descriptions of the uses of substances, plants, chemicals, and animals in treating illnesses the world over. Today this knowledge is still in use, neither obsolete nor forgotten. The China State Environmental Protection Administration (Zhang, 1998) lists about 10,000 medicinal plants used.

Since the Communist revolution in 1949, through the application of modern science tools, scientists worked to isolate and identify the ingredients of many important herbs testing their effectiveness on hospitalised patients. Among many others, pharmacological action has been investigated by Prof. Jang Chang Shou (Jang, Chang-shou, *Xian Dai Zhong Yao Yien Jiu* China Science Library and Equipment Co. Shanghai, 1954, on *Jia Zhu Tao* (a cardiac glycoside), *Ya Dan Zi* (an antimebal agent), and *Chang Shan* (an antimalarial agent) (Chang, 2000).

The potential of scientific inquiry, as a 'knowledge industry', in Chinese medicine, is yet to be exhausted. It is believed that Chinese medicine contains some scientific elements which will continue to make a contribution to mankind if conscientiously explored and systematised by modern scientific method and technology. The success in medicinal chemistry, structure-activity studies, and the prospect of genetic modification, has opened a promising route to the development of better and more effective drugs from Chinese herbs, or the capability to change them into newer types with greater activity.

6.3 IMPACT OF THE POLICY ENVIRONMENT ON TRADITIONAL MEDICINE

As a result of the implementation of the traditional medicine policy, laws and a series of effective measures to promote traditional medicine, over 50 years, the practice developed greatly. Three aspects were identified and analysed

Firstly, through the combination of Chinese and Western medicine, traditional Chinese medicine and pharmacology have had an important influence in the field of public health and on the development of medical science in general. There is evidence of extensive technological and scientific achievement in Chinese culture. Efforts made to integrate traditional Chinese medicine with Western medicine have proved truly worth while. For example there is enhanced efficacy of disease treatment regimes for diseases such as analgesia, acute abdominal conditions, burns, injury of bones and joints, anal fistulas, lithiasis of the urinary tract, cardiovascular diseases, cataract, and respiratory diseases in infants. The effect of the combined treatment is much better than that of either system applied alone. There are also encouraging results from scientific research on the combination of Chinese and Western medicine. Applying modern scientific knowledge and technology, has contributed to the understanding of the hypotheses on which traditional medicine is based. These include the theory of "yin-yang", visceral manifestations, vital energy and blood, meridians, the method of promoting the blood circulation and relieving stasis, reinforcing vitality, etc.

Based on past experiences of the integrated health care system, it is believed that traditional Chinese medicine will continue to develop steadily through the judicious application of modern science and technology. The combined treatment of certain intractable conditions such as malignant tumours, cardiovascular and degenerative diseases and senility is likely to be more efficacious. The nonsurgical treatment of certain diseases such as acute abdominal conditions could be popularized so that it could alleviate patients' suffering and reduce medical expenditure. At the same time, the mechanism of its therapeutic effect and basic theory could be further elucidated.

Secondly, as a result of the inclusion of traditional Chinese medicine in official health care and the enhanced efficacy of the combined health care treating systems, traditional Chinese medicine became an active participant in health care services, industry, training, research and development. Over half of the Chinese population use traditional herbal prescriptions, particularly when modern medicines did not produce the desired result. By the late 1990s, about 280,000 traditional medicine practitioners had been invited to work in the state and collective medical organisations such as hospitals, medical schools and research institutes. Chinese medicine and Chinese *materia medica* had become a part of free medical care. In the hospitals of Western medicine, departments of traditional medicine together with its pharmacies and wards have all been accommodated. China now has over 552 hospitals of traditional medicine above the county level and almost all the hospitals of modern medicine have set up departments of traditional medicine. The larger hospitals with better facilities have even instituted research laboratories to explore the problems relating to the integration of traditional Chinese medicine with modern medicine. By the end of 1979, 91 county and municipal hospitals had been established in 102 municipalities and counties in Hunan province, not including the provincial hospitals and the general hospitals where traditional Chinese medicine has the chief position. These traditional hospitals have assumed a great many medical functions. For example, in the traditional hospital of Chang De, the number of outpatients had by 1995 reached 3,700,000, while 20,880 patients had been hospitalised since its establishment.

The educational and training curriculum for traditional Chinese medicine was also strengthened. By mid 1990s there were 24 institutions of higher learning for traditional medicine with 18,000 students, and 18 secondary schools with 10,000 students. Moreover, the students in the Western medical colleges are also obliged to pursue a course in traditional medicine. Faculties of traditional Chinese medicine have been established in 11 Western medical colleges. In addition, traditional medicine practitioners also received appropriate training in both Western and traditional methods of treatment. About 1,600,000 trained traditional medicine practitioners have greatly contributed to the medical service in the rural areas, which have an estimated population of 800 million thus increasing access to health care services.

Thirdly, the market value of its products has increased immensely. The production of Chinese herbal medicines has increased, and has gradually developed into an industrial system in the last 30 years. The staff engaged in purchasing, processing and supplying medicinal herbs by the 1990s totaled 220,000. The area under cultivation of medicinal herbs had reached 400,000 hectares. The amount of medicinal herbs purchased totals 13 million tonnes. By then, there were more than 800 pharmaceutical factories with 80,000 workers in them, which produced some 2000 varieties of medicinal herbs. With increasing modernisation in the pharmaceutical factories, the quality of traditional medicines greatly improved.

The training of traditional doctors brought about positive fundamental changes in both the social status and academic position of traditional medicine practitioner. The condition of the traditional medicine hospitals also improved tremendously.

The Chinese integrated healthcare system has not only contributed to the development and posterity of the Chinese people but have also had an important influence in medical practice in other countries. This is evidenced by the diffusion of its goods and services into the world market. For instance, the development of one of the richest pharmacopoeia in the world, a encyclopaedia of medicinal plant products has had a significant impact in contemporary medical care all over the world. The *"Tang's Newly Revised Materia Medica"*, the earliest pharmacopoeia promulgated by the government has had a great influence on medical practice in Japan and Korea. See Appendix 6.1 for a list of literary works on Chinese medicine that have influenced medical practice worldwide.

The market value has greatly increased. According to WHO Fact Sheet no. 134, (1996) the value of Chinese medicine has greatly appreciated. For example, in China in 1956, the average cost of herbal medicines per person and per year was 0.49 Yuan; in 1978, it was 2.14 Yuan; in 1986, 4.66 Yuan and in 1993 it rose to 13.0 Yuan. In 1993, the total sales of herbal medicines amounted to more than 14 billion Yuan, not including US$400 million worth of exports. Many Chinese medicine enterprises have been established world wide where they are recognised by the Official health care including medical insurance in western countries, in particular for those disease conditions that modern medicine has failed to manage.

In developing countries such as Kenya, Chinese medicine has also captured a market in particular for the management of problem diseases. This exemplifies the market demand for their innovations.

6.4 CHINESE MEDICINE IN KENYA

The second part of the exercise therefore focussed on the performance of Chinese medicine in Kenya. A survey on Chinese medicine clinics was conducted to determine the economic performance of products of traditional bioinnovation, through the integrated health care system, in Kenya's modern economic space. First, the technological inputs attributed to traditional medicine into the whole health care system are outlined. To determine the contribution of Chinese medicine to health care in the city, data was collected on the ten most prevalent diseases encountered by the Chinese doctors and the management regimes prescribed. The success rate and cost implications for the management of the disease cases were also documented. The results of their analyses are presented below in sections 6.4.1 and 6.4.2.

Secondly, results of discussion on the factors that have contributed to the successful introduction and spread of Chinese medicine were undertaken. The reasons for their preference by the Nairobi urbanites were documented. The strategies adopted by the Chinese medicine practitioners to enhance their performance in the Kenyan market were also determined. This was aimed at providing lessons for the Kenyan health administrators and traditional medicine practitioners. Results of the discussions are presented below in section 6.5.

6.4.1 Technological Analysis

As mentioned above, there are various technologies available in the market including modern, Chinese and traditional medicines. Results of a survey on the extent to which modern Chinese medicines contributed to the amelioration of the burden of disease in Nairobi follows.

Burden of Disease

The description of the burden of disease in this study was limited to the experiences documented in official health care and Chinese medicine facilities.

Official Health Care

By 1997, the Nairobi populace was served by a total of 380 government health care facilities including 47 hospitals, 36 health centres and 297 health sub-centres and dispensaries. Table 6.1 and Figure 6.1 show the growth of health care facilities in Nairobi as developed by the Government from 1982 to 1997. The ratio of health institutions to 100,000 population was approximately 16.4 as of 1990 or 1: 6,000. Table 6.2, Figure 6.2 and Appendix 6.2 on outpatient morbidity defines the burden of disease in Nairobi Province as reported in the government health facilities from 1990 to 1997. An average of 1,266,269 disease cases are reported each year. This also represents the level of demand, from government health care facilities, for effective and affordable drugs.

The ten most prevalent disease conditions diagnosed and managed include respiratory diseases, malaria, skin diseases, urinary tract infections, diarrhoeal diseases, eye infections, rheumatism, ear infections and accidents. These conditions account for 78.79 per cent of the total cases. Put together, respiratory diseases and malaria cases account for 48.96 per cent of total cases reported.

Based on population estimate of 1990, these statistics suggest that the disease incidence managed by government health facilities add up to 0.8414. This means that in a population of 10,000 about 8,414 people will consult the facilities once per year for any one of the disease conditions. Of these, 4,120 will consult on account of respiratory or malaria disease conditions.

Chinese Medicine

There are about 40 Chinese medicine clinics established in Nairobi. A total of 13 randomly selected clinics located in various divisions in Nairobi were studied. Results of disease incidence diagnosed and managed in the clinics are presented in Appendix 6.3, Table 6.3 and Figure 6.3. Column one of Table 6.3 presents a list of the ten most prevalent disease conditions diagnosed in the clinics. Column two presents annual estimates of number of cases diagnosed for all the forty clinics. These estimates have been extrapolated on a *pro rata* basis from data collected from the sample of thirteen clinics. Column three presents proportions of each disease condition as percentages of the total incidence per year.

The clinics' prevalence statistics indicate that the Chinese clinics take care of at least 146,127 disease incidences per year or 11.54 per cent of those reported in government health care facilities. These disease cases represent those who may have either failed to get effective treatment for problem diseases or in the absence of Chinese medicine, would have gone to other modern medicine facilities. The number of disease cases per facility is 3,654 per year. This ratio, when compared to that for a government health care facility in Nairobi, of 3,332.3 per year is about 10 per cent more. This represents a relatively higher dependency on Chinese medicine and consequently demand for their products.

The ten most prevalent conditions include AIDS/HIV, diabetes, asthma, skin infections, high blood pressure, fibroids, arthritis, headache, tuberculosis and liver disease. These account for 86.66 per cent of the total disease incidence. The most prevalent condition is HIV/AIDS which accounts for 18.23 per cent of the total. Other disease conditions accounting for more than 10 per cent include diabetes, asthma and skin infections. Altogether, these account for 61.49 per cent of the total.

A comparison is made between the disease profile for official health care and Chinese medicine services. There are striking differences in the profiles with particular regard to the proportions of problem diseases and treatable disease burden. It is evident from the survey that about 64.36 per cent of the complaints reported in the Chinese medicine clinics belonged to the category of diseases that modern medicine does not have effective treatment for. In official health care facilities these problem diseases account for less than 0.5 per cent.

Table 6.1: The growth of government health care facilities in Nairobi, 1982 to 1997

Year	Number of hospitals	Number of health centres	Number of Health sub-centres and dispensaries	Total
1982	17	8	62	87
1983	17	7	71	95
1984	17	8	86	111
1985	27	15	116	158
1986	30	15	136	181
1987	30	17	134	181
1988	30	18	135	183
1992	38	75	134	247
1993	39	92	173	304
1994	42	30	285	357
1996	45	36	292	373
1997	47	36	297	380

Source: Health Information system Ministry of Health

Figure 6.1 The growth of government health care facilities in Nairobi, 1982 to 1997

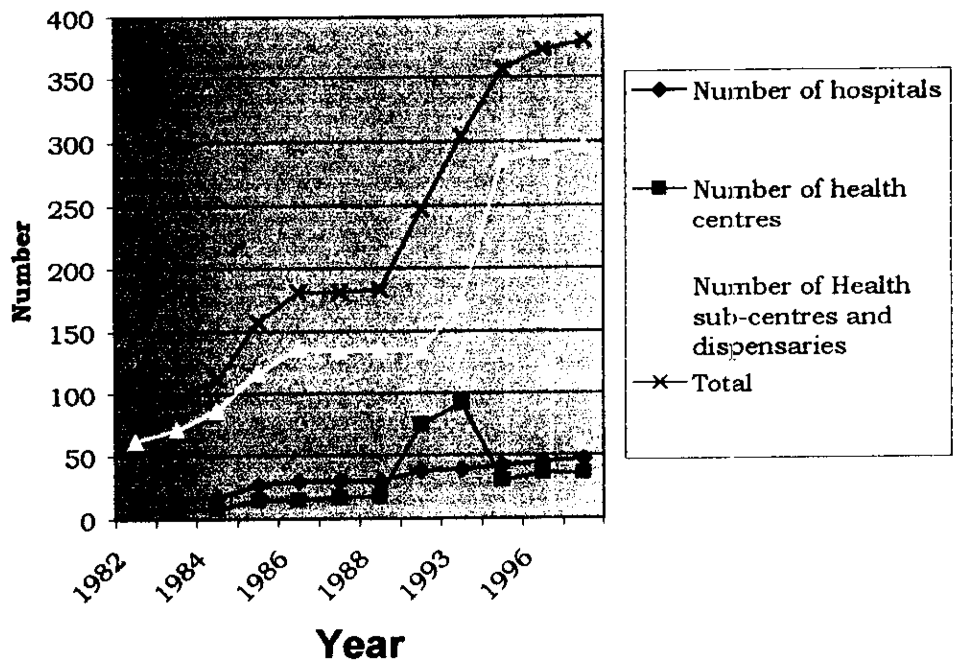


Table 6.2 Summary statistics on annual outpatient morbidity diagnosed in government health care facilities in Nairobi, 1990 to 1997

Disease Condition	Annual Incidence	Percentage (%)	Incidence per Capita
Respiratory Diseases	310,518.73	24.52	0.2063
Malaria	309,491.10	24.44	0.2057
Skin Diseases	115,921.70	9.15	0.0770
Urinary Tract Infections	57,810.57	4.57	0.0384
Intestinal worms	57,275.57	4.52	0.0381
Diarrhoea diseases	52,507.57	4.15	0.0349
Eye Infection	31,236.00	2.47	0.0208
Rheumatism	27,744.29	2.19	0.0184
Ear Infection	20,591.29	1.63	0.0137
Accidents	14,589.86	1.15	0.0097
SubTotal	997,686.68	78.79	0.6630
Others	268,582.32	21.21	0.1785
TOTAL	1,266,269.00	100.00	0.8414

The population of Nairobi is estimated at 1,504,900

Source: Health Information System Ministry of Health.

These include HIV/AIDS, diabetes, high blood pressure, asthma, fibroids, and liver disease. Experiences were documented of cases where high blood pressure patients resorted to Chinese medicine after having consulted modern medicine for many years without remission. However, Chinese medicine provided an effective cure.

An analysis on the top 50 per cent of the disease burden in both health care arrangements reveals that while 49.5 per cent of the burden of disease in official health care accounts for diseases of the respiratory system and malaria, most of which are treatable, in Chinese medicine the top 48.43 per cent accounts for problem diseases including HIV/AIDS, diabetes and asthma. In the burden of disease, problem diseases in official health care account for less than 21.21 per cent (AIDS/HIV and Diabetes). This demonstrates the unique role that Chinese medicine clinics play in the management of problem diseases which official health care fails to manage. These Chinese medicine clinics therefore complement official health care services.

Management Regimes

Data on management regimes applied for the top five disease conditions are presented in Table 6.4. Column two presents the treatment approaches applied. See Appendix 6.4 for some of the Chinese medicine products in the Kenyan market. The treatment regimes applied reflect various levels of integration between modern and traditional medicine. Dependent on the disease condition the drugs prescribed include modern medicine (MM), traditional medicine (TM) or a combination of both (MM+TM). While the effective management of diabetes required the combination of modern and traditional medicine, all the rest were effectively managed by traditional medicine only. This reflects a larger allocation of the disease burden to traditional medicine technologies than in the official health care system (see Table 6.5).

Table 6.3 a) Disease incidence as diagnosed in Chinese medicine clinics in Nairobi. Top ten diseases in order of decreasing incidence

Disease Condition	Annual Incidence	Percent (%)
HIV/AIDS	26,641.42	18.23
Diabetes	24,812.31	16.98
Asthma	19,313.61	13.22
Skin Infections	19,086.39	13.06
High Blood Pressure	12,951.48	8.86
Fibroids	7,668.639	5.25
Arthritis	7,242.603	4.96
Headache	3,700.422	2.53
Tuberculosis	2,556.213	1.75
Liver Diseases	2,658.461	1.82
Subtotal	126,631.55	86.66
Others	19,495.35	13.34
TOTAL	146,126.90	100

Table 6.3 b) The top 50 percent of the disease burden

Chinese Medicine		Modern Medicine	
Disease Condition	**Percentage (%)**	**Disease Condition**	**Percentage (%)**
HIV/AIDS	18.23	Malaria	24.22
Diabetes	16.98	Respiratory Diseases	24.52
Asthma	13.22		
Total	48.43		48.74

Figure 6.2 a) Disease incidence as diagnosed in Chinese Medicine clinics in Nairobi. Top ten disease conditions in order of decreasing incidence

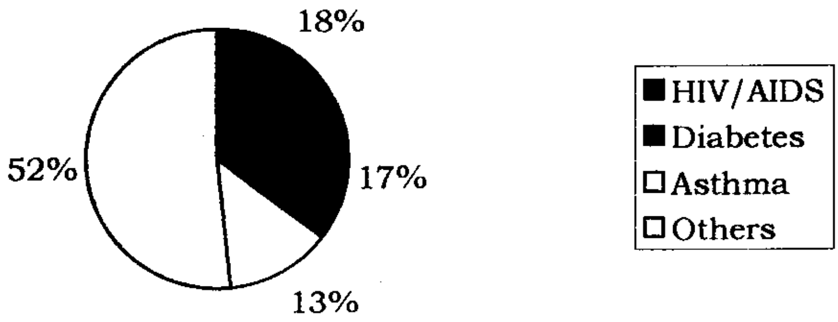


Figure 6.2 b) Disease incidence as diagnosed in Government Health facilities

6.4.2 Economics

In addition to the collection of data on health care technologies, data was also collected on the economic implications of the Chinese medicine system. The interviews focused on the market status of products of modern and traditional medicine in the modern economic space. In particular, data on market allocation and value were documented and analysed.

Market allocation

Table 6.5 presents proportions of disease burden allocated to either modern and traditional management approaches, based on the five most prevalent disease conditions recorded in Chinese medicine clinics. An analysis of the management regimes reveals that the proportion of the burden of disease allocated to traditional medicine varies with the disease. It ranges from 12.60 per cent for high blood pressure to 25.91 per cent for HIV/AIDS disease cases, while for modern medicine it ranges from 0.00 for all the conditions except for diabetes whose allocation is 12.07 per cent. The total allocation to traditional medicine for these disease conditions adds up to 87.93 per cent. This represents the proportion of disease conditions managed by traditional medicine either in part or in whole. About 75.86 per cent of the conditions required the application of traditional medicines only. About 24.14 per cent required the combination of both modern and traditional medicine technologies. None (0.00 per cent) required the application of modern medicine technologies alone. The system therefore allocates a larger share of space to traditional medicine than the official health care system does. The official health care system allocates the whole burden of disease to modern medicine.

In evaluating the performance of the Chinese medicine health care arrangement, data was collected on the efficacy of the management regimes. The data is presented in Table 6.6. For the five most prevalent disease conditions, the success rate ranges from 55 to 100 percent per disease condition.

Table 6.4 Treatment regimes for the various disease conditions diagnosed in Chinese medicine clinics in Nairobi

Disease Condition	Method of treatment
HIV/AIDS	TM
Diabetes	TM + MM
Asthma	TM
Skin Infections	TM
High Blood Pressure	TM

Table 6.5 Allocation of the burden of disease to the treatment approaches applied at the Chinese medicine clinic for the five most prevalent conditions

Disease Condition	Annual prevalence (%)	Modern Medicine (%)	Traditional Medicine (%)
HIV/AIDS	26,641.42 (25.91)	0.00	26,641.42 (25.91)
Diabetes	24,812.31 (24.14)	12,406.16 (12.07)	12,406.16 (12.07)
Asthma	19,313.61 (18.79)	0.00	19,313.61 (18.79)
Skin Infections	19,086.39 (18.57)	0.00	19,086.39 (18.57)
High Blood Pressure	12,951.48 (12.60)	0.00	12,951.48 (12.60)
TOTAL	102,805.21(100.00)	12,406.16 (12.07)	90,399.06 (87.93)

Many of the Chinese Doctors extrapolated a significant increase in business in Chinese medicine. They moved to Kenya prospecting for business and many more are expected. The case study reveals a significant increase in the number of Chinese clinics in Kenya. Between 1996 and 1999 this number has increased from less than ten to forty in Nairobi and spreading out to major towns such as Mombasa. This suggests that there is a market for Chinese herbal medicine. In particular, the demand for remedies for diseases that modern medicine has failed to manage, is the primary factor for the market demand.

Figure 6.3: Scatter diagram comparing allocation of the burden of disease tothe treatment approaches applied at the Chinese medicine clinic forthe five most prevalent conditions

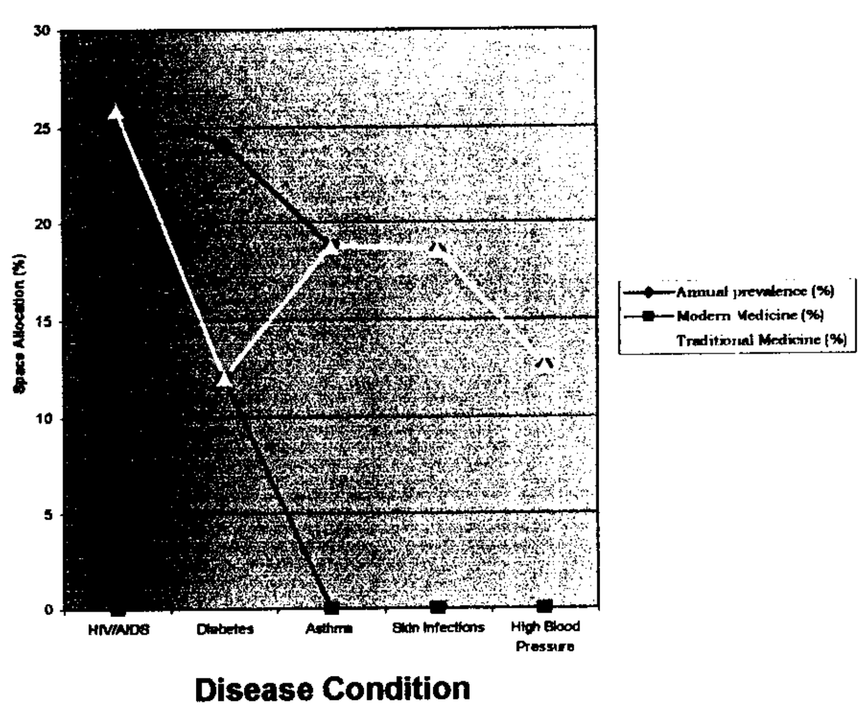


Table 6.6 Success rate for the management of the various disease conditions diagnosed in Chinese medicine clinics in Nairobi

Disease Condition	**Success Rate (%)**
Diabetes	87.5
HIV/AIDS	55
Asthma	87.5
Skin Infections	87.5
High Blood Pressure	92.5

The expansion of the market will mean an increase in the demand for Chinese Medicine products and therefore stimulate the increase in the production of these products in China, thus offering more opportunities for the Chinese innovators to develop new products. The enlarged market allocation for products of Chinese medicine is therefore set to increase the profits earned by the Chinese entrepreneurs.

Market Value

Data on cost implications for the use of the management regimes were also documented (see Table 6.7). These included the unit cost for the management of a disease case charged to a patient which is also that which is earned by the clinic. The cost of the treatment varies with the disease condition and ranges from $4.97 to $119.95. Treatment cost at a traditional medicine practitioner's ranges from $0.13 to $0.63. This means that the market share to the producers of Chinese traditional medicine is much higher than that for Kenyan traditional medicine. The gross annual income for Chinese medical clinics ranges is on the average $108,218.28 per clinic or $42.10 per disease case (see Table 6.8). There are therefore more incentives for the Chinese medicine practitioner than the Kenyan traditional medicine practitioner.

6.5 FACTORS CONTRIBUTING TO THE GOOD PERFORMANCE OF CHINESE MEDICINE IN KENYA

A number of factors were cited for the enlarged allocation and enhanced market values for Chinese traditional medicine.

The efficacy of Chinese medicine in particular for the management of problem diseases has proved the foremost reason for its popularity in Nairobi. Chinese medicine is capturing the market that has been generally unfulfilled by modern medicine. The efficacy and the derived increased popularity has proved to be a great incentive for the mushrooming of Chinese medicine clinics in Nairobi and other cities in Kenya.

Table 6.7 Unit cost of managing a disease case at the Chinese Medicine clinics in Nairobi

Disease Condition	**Cost of treatment per disease case ($)**
Diabetes	6.04
HIV/AIDS	119.95
Asthma	4.97
Skin Infections	5.33
High Blood Pressure	60.65

Table 6.8 Annual Gross Income for the Chinese medicine clinics in Nairobi

Disease Condition	Number of Cases per year	Cost of treatment per disease case ($)	Gross income US$
HIV/AIDS	24,812	119.95	3,195,638.3
Diabetes	26,641	6.04	149,866.35
Asthma	19,314	4.97	95,988.64
Skin Infections	19,086	5.33	101,730.46
High Blood Pressure	12,951	60.65	785,507.26
Total	102,805		4,328,731.1 or 108,218.28 per clinic or 42.10 per disease case

The acceptability of Chinese medicine was also due to the fact that most of the treatment regimes have undergone many years of research and development in China, are regularly monitored and approved by the Government. The fact that all doctors and the pharmacists, including Chinese and Kenya practicing in the clinics have modern medical training gave them credibility. Their presence gives the public confidence that basic health care standards were guaranteed and therefore also enhanced their acceptability among Kenyans.

Another factor that has contributed to the increased market allocation for Chinese herbal medicine has been the application of advertising their products. By using the mass media, newspapers, radio, TV, exhibitions and shows, and word of mouth, they have been able to enhance the diffusion of their products to a wider catchment. Some of them have a management unit dedicated to marketing and communication whose function is to enhance awareness both within and without the country. Their patients come from as far as Tanzania, Rwanda and Malawi.

The high value of Chinese medicine is attributed mainly to input of modern science technologies. The personnel highlighted that the combination of modern and traditional medical care has advantages for both practices. For instance, the knowledge of physiology in modern medicine is important for accurate diagnosis and therapy while the knowledge of traditional medicinal drugs adds to the diversity of technological products that can be used for the management of diseases including those that modern medicine fail to manage.

The scientific contribution to the development of Chinese medicine gives it an added credibility. These products are reported to be of relative high quality and price. Because of the value added in the processing and packaging they are more expensive than the Kenyan traditional medicine.

6.5 CONCLUSION

The study on Chinese medicine presented in this chapter provides some insights into the process of integration and the dual benefits to health care provision and the traditional knowledge system. These trends reflect a fertile market for products of traditional medicine in the modern economic space in Kenya. However, it is a strong indication that there are needs not met by official modern medicine and therefore the demand for an alternative health care system. The study basically outlines an alternative health care arrangement that brings products of traditional medicine into the same economic space as modern medicine. At the same time it points to the basic criteria for the artificial selection of traditional medicine products as well as the mechanisms for the co-evolution process and related benefits. The following two chapters, seven and eight, focus on the Kenyan situation.

CHAPTER SEVEN: KENYA CASE STUDY

PART ONE: BACKGROUND TO KENYA'S HEALTH CARE SYSTEM

7.0 INTRODUCTION

The following two chapters, seven and eight, present results of discussions and interviews on the case study on Kenya's health care arrangement. Chapter seven examines the health care policy structure including policies, laws and institutions. Chapter eight focuses discussion on health care arrangement at the local level.

Chapter seven begins by outlining the health care challenges and the policy response. The evolution of the health care infrastructure and its effectiveness at meeting the challenges is then discussed. The *status quo* of traditional medicine practice is highlighted and contributing factors discussed. In view of shortfalls in health care provision, the potential of traditional medicine is indicated.

7.1 KENYA

Kenya is located across the equator in Eastern Africa between the latitudes 4^{0} 4" N and 4^{0} 4" S and longitudes 34^{0} and 41^{0} 4" E. A map on Kenya and some landscape features is presented in Appendix 7.1. Covering an area of 569,690 square kilometers (Sayer et al, 1992), it extends from the coastal lowlands at sea level and rises to over 5,000 metres above sea level in the Central Highlands and the Rift Valley, before descending to the warm lowlands in Lake Victoria. It borders the Indian Ocean in the East, Tanzania in the south, Uganda in the west, Ethiopia and Sudan in the north and Somalia in the northeast. Kenya has an estimated population of 27.5 million people of which over 80 per cent live in the rural areas and less than 20 per cent in the urban areas (Kenya, 1997a).

7.2 HEALTH CARE CHALLENGES

A total of 77 health care personnel including various cadres, were interviewed. They included policy implementers, planners, economists, medical doctors, medical research officers, clinical officers, nursing officers, medical records officers and traditional medicine practitioners. See list of respondents in Appendix 4.2. 15 out of 77 respondents were government health officials at the Ministry of Health Headquarters, Nairobi and; District Hospitals and health care centres around the Arabuko Sokoke Forest at the Kenyan coast. Discussions with them yielded information on health care challenges, policy and development. 57 out of 77 respondents were health care practitioners including government, private medical doctors and traditional medicine practitioners. Discussions with them yielded data on technological aspects of current practice in both mainstream health care and traditional medicine. Results of discussions at the national level are presented below while those on the practices at the local level, around the Arabuko Sokoke Forest, are presented in the subsequent chapter eight.

Discussions revealed that Kenya belongs to the category of nations that officially excludes traditional medicine from participating in mainstream health care. The health care structure is thus exclusive to modern medicine only. Two major challenges affecting health care in Kenya were cited. The first one emanates from the socio-economic dynamics while the second emanates from the technological demands derived from the burden of disease. Each of them is discussed below.

7.2.1 Socio-economic Dynamics

A United Nations (UNFPA, 1994, World Bank, 1993b, World Bank, 1995a) documents Kenya as having one of the highest annual population growth rate in the world ranging from 2.90 to 3.90 per cent. Some of the demographic indicators are summarised in Appendix 7.2. At independence in 1963, Kenya's population was estimated at 8.90 million people. Within just three decades, there was an increase in absolute numbers of 18.30 million persons — approximately 200 percent — increase. These ascending population size trends are attributed to *inter alia*, a combination of factors including high fertility rates, increasing life expectancy, and; declining crude death and infant mortality rates. The latter three factors were a consequence of expansion of modern medicine health care infrastructure and medical personnel development.

Inevitably, every population growth means an increased, *inter alia*, derived burden for health care services that ought to be matched with a commensurate increase in resource allocation to health care. However, the economic resource base has always fallen short of the derived demand, owing to dynamics discussed below.

The economy has generally undergone mixed experiences since independence. The growth in (GDP) averaged 6.5 per cent over the period 1964 to 1970. However, the first oil crisis of 1972 brought an abrupt halt to this level of achievement. Consequently, the growth rate decelerated to below 4 per cent for much of the early 1970s until the unexpected coffee boom of 1976 and 1977 when the growth rate in GDP averaged 8.2 per cent. The situation worsened when the price of crude petroleum doubled from US$ 13.0 per barrel in 1978 to US$ 27 in 1979, generally pushing up the inflation rate, and the cost of imported input and raw materials resulting in the slowdown of economic growth.

For much of the early 1980s the rate of growth in GDP remained below 5 per cent and for the first time in Kenya's history, the growth rate fell below 1 per cent in 1984. This was largely attributed to the severe drought of that year. Favourable weather conditions coupled with Government budgetary discipline and improved management enabled Kenya to achieve significant 4.8 per cent and 5.5 per cent growth rates in 1985 and 1986 respectively.

Since 1990, however, the rate of growth in GDP continued to slide below 4 per cent and fell dramatically to a mere 0.4 per cent in 1992, the lowest since independence. This slowdown in GDP growth since 1991 could be explained in terms of the actual decline in real output and value added in agriculture, due to below average amount of rainfall, sluggish growth in aggregate private domestic demand and foreign exchange shortages leading to reduced imports of intermediate goods, and perhaps due to the immediate impacts of the suspension of donor aid. The Government took remedial measures to reverse this trend and by 1996 the GDP rose to 4.6 per cent. However, this growth was not sustained and by the year 2000 the growth shrunk to 1.3 per cent (Anonymous, 2000).

During the first decade or so of independence, Kenya enjoyed a single digit inflation rate, mainly due to the effects of price control system and good economic performance. However, after the first oil shock of 1973, the inflation rate rose to 17.0 per cent in 1974 and subsequently to 19.1 per cent in 1975. Up until 1997, apart from the years 1973, 1979, 1984, 1986 and 1987 the rate of inflation has ranged between 10 to 20 per cent per year with the exception of 1982 and 1992 when the inflation rates were 21.54 and 27.50 respectively, the latter being the highest inflation rate ever recorded since independence. Currently, 47 per cent of the rural population and 29 per cent of urban population live in absolute poverty.

All the respondents noted that the poor economic performance has had both a direct and an indirect adverse effect upon Kenya's supply of health care goods and services and consequently the quality of health care. There was a direct impact on the budgetary allocation to the Ministry of Health. Indirectly, the interaction between the fluctuating but declining Gross Domestic Product (GDP) and the increasing inflation rates over the years, led to inadequate drug supplies (Kenya, 1994a).

In particular, the declining trend in allocation of financial resources to the Ministry of Health's annual budget was noted to be of significant concern for the respondents. Considering the health sector in its entirety, in the financial year 1983/84 a total of almost Kshs 2.9 billion (US$217.9 million) spent on health care nation-wide (see Appendix 7.3), 42.09 per cent was spent on health care provided at the Ministry of Health, with a combined government total of 50.13 per cent.

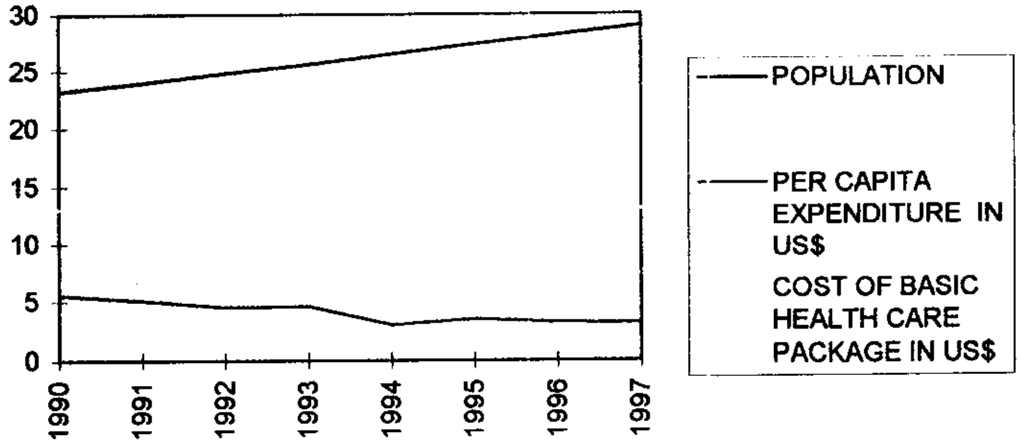
The internal allocations of Ministry of Health recurrent budgets over the period 1979 to 1997 are shown in Appendix 7.4. In the internal allocations within the Ministry of Health since 1979/80, the percentage of MoH recurrent expenditure attributable to the provision of curative services has remained at approximately 70 per cent of the total while Development Expenditures represent approximately 25 per cent of total Ministry of Health Expenditure (Kenya, 1994a). Although the Ministry of Health local currency expenditures rose, in real terms, the trend was one of decline (Kenya, 1994a). In the financial year 1983/84 Ministry of Health recurrent expenditures accounted for 8.83 per cent of the Government total for that year. There was a slight increase but from 1987/88 onwards, this percentage dropped and by 1993/94 this was only 7.65. By 1996/97 it had dropped by over one unit. As a result of these declining allocations, the real per capita recurrent expenditure declined significantly. An absolute decline of US$ 5.56 (69.33 per cent) per capita expenditure over 17 years was documented.

As indicated in Figure 7.1 the per capita expenditure on health care range of US$ 3.09 to 5.54 per year, over the period 1990 to 1997, is well below the World Bank (1995) recommended annual per capita expenditure of US$13.00. This recommended rate is the outlined annual cost for a cost-effective package of basic health services required to respond to the needs of households and reduce the burden of disease, in a well functioning health care system, in a typical low-income African country. The figure also shows that as the population increased, the per capita recurrent expenditure declined. Over the period 1990 to 1997, there was a 25 per cent absolute increase in population. Over the same period, the per capita recurrent expenditure declined by a higher margin of 44.2 per cent. This trend reflects an increasing demand for health care resources against low levels of national incremental financial resources.

As a consequence of inadequate funding, shortages of key inputs required to maintain adequate standards of care were experienced. The decline in government health expenditure was particularly true for certain categories of manpower, drugs, dressings, sera and vaccines, equipment and other essential non-pharmaceutical supplies. As a result, the Ministry of Health was faced with a crisis where available resources could not match the demand for services. This caused shortages and underutilisation of existing health, manpower and medical equipment. This situation was aggravated still further because over 70 per cent of the funds actually allocated to the Ministry's Recurrent Budget were used first and foremost to pay staff salaries and allowances. This left insufficient resources for operational expenses and in particular the purchase of drugs and dressings. These fiscal constraints were further aggravated by the 1993 devaluation of the Kenya shilling which reduced the value of the budget line items for drugs and dressings by 53 per cent.

Concurrently, the cost of modern health care continued to appreciate. The increasing cost of drugs and supplies for the amelioration of the burden of disease meant that less and less of the supplies could be purchased. For as long as these trends are not reversed, population growth and poverty continues to hamper progress towards achieving the United Nations goal of "health for all". The respondents

Figure 7.1 A graph mapping the per capita recurrent expenditure on modern health care and population growth over time period 1990 to 1997



deduced that, in particular, inadequate access to effective disease management technologies- including diagnostic tools, drugs and dressings, meant that the amelioration of the disease burden was severely constrained.

7.2.2 Burden of disease

Discussions revealed that the extent to which the disease burden was a challenge was a factor of increasing disease incidence due to emerging drug resistant disease conditions and problem diseases. Discussions on the burden of disease were focused on disease prevalence or morbidity statistics. There were two major reasons for selecting the morbidity parameter. The first was related to the fact that curative disease management is the major health care activity in many developing countries on which the greater portion of the sector's budget is spent. For example, the Ministry of Health in Kenya spends between 62.74 and 78.18 per cent (Kenya, 1994a) of the recurrent budget on provision of curative health care, particularly on drugs and dressings. Secondly, as a consequence of the first reason, medical records in government health institutions — the most accessible source of official data on mainstream health care — are focused on disease incidences. Statistics on mortality rates from local health institutions are in most cases incomplete or not available.

In this study, the epidemiological profile of Kenya was developed from national statistics on disease prevalence documented in field reports from various government health institutions, around the country, which are regularly sent to the Ministry of Health Headquarters. The reporting rate ranges from 49.2 to 73.4 per cent. The reports presented national statistics on over 36 disease conditions. Its important to note that they were based on disease cases diagnosed and managed in the government health institutions and did not include those diagnosed and managed in non-governmental institutions and alternative health care systems. Some of the treatment, particularly in rural areas, was done at home with traditional methods or with drugs from the nearest shop because the government health care facility might have been inaccessible. As a result, these cases were not included in the official morbidity statistics.

An analysis of the official outpatient morbidity figures for the years 1990 to 1997 indicate that Kenya's major health concerns can be grouped into three broad categories – including parasitic, respiratory and infectious diseases (see Table 7.1, Figure 7.2 and Appendix 7.5 (Kenya, 1984a).

Parasitic diseases

The major diseases in this group include malaria and intestinal parasites. Malaria is widespread in the Coastal region and the warm lowlands around Lake Victoria in south-western Kenya, while intestinal parasites are widespread in the country. These diseases are responsible for high morbidity and mortality rates in Kenya. Parasitic diseases accounted for over 30.0 per cent of all outpatient morbidity reported in government health care facilities over 1990 to 1997.

Respiratory diseases

These include diseases of the respiratory system, pneumonia, all forms of tuberculosis and whooping cough, which are found mainly in high altitude areas. Respiratory diseases accounted for about 26 per cent of all outpatient morbidity reported in government health institutions nation-wide over the period 1990 to 1997.

Infectious diseases

The major diseases in this group are diarrhoeal diseases including ameobiasis; enteritis, dysentery; skin diseases and; urinogenital tract infections. Infectious diseases accounted for about 20 per cent of out-patient morbidity over the period 1990 to 1997.

7.2.3 The Most Prevalent Diseases

The ten most prevalent disease cases diagnosed include malaria, diseases of the respiratory system, diseases of the skin, diarrhoeal diseases, intestinal parasites, accidents, eye infections, urinary tract infections, pneumonia and rheumatism.

Malaria is the most prevalent disease diagnosed. An average of 4,112,194 cases per year were diagnosed during the years 1990 to 1997 accounting for 27.8 per cent of all the disease cases diagnosed.

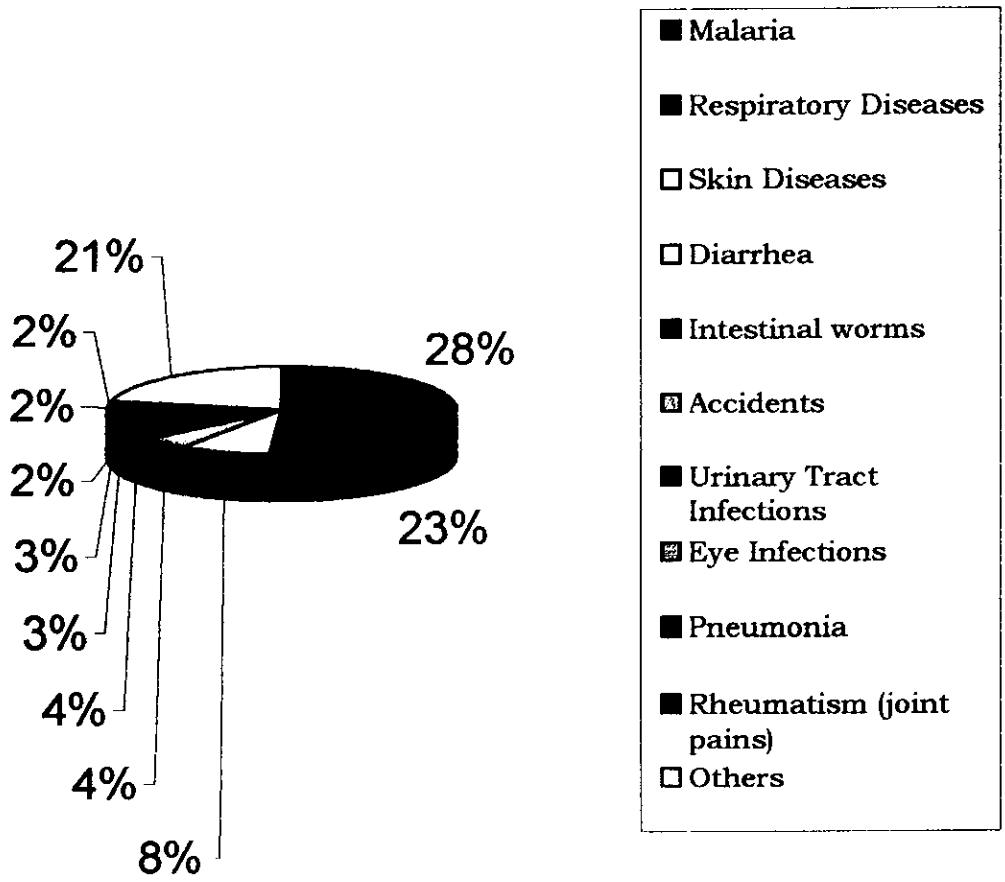
The second most prevalent disease cases are those of the respiratory system. These include mainly coughs, chest pains and bronchitis. An average of 3,428,405 cases per year were diagnosed over the period 1990 to 1997 accounting for 23.22 per cent of the outpatient morbidity.

Table 7.1: Summary of the reported official morbidity rates 1990-1997

Reported Disease	Average Outpatient Morbidity	Outpatient Morbidity Rate in percentage
Parasitic Diseases Malaria (27.85%); Intestinal Parasites (3.63%)	4,647,569	31.48
Respiratory Diseases Diseases of the Respiratory system (23.22%); Pneumonia (2.11%); Whooping Cough (0.14%); Tuberculosis (0.06%)	3,768,658	25.53
Infectious Diseases Diarrhoeal Diseases (4.44%); Diseases of the Skin (8.28%); Urinary Tract Infections (2.55%); Eye Infections (2.03%); Ear Infections (1.48%); Gonorrhea (0.96%);	2,914,172	19.74
Others	3,433,356	23.25
Total	14,767,123	100

Source: Ministry of Health.

Figure 7.2 Pie chart illustrating the disease prevalence pattern in Kenya



When combined, malaria and respiratory diseases account for over 50 per cent of all reported diagnoses in Government health facilities.

Skin diseases are the third most prevalent cases diagnosed. These include scabies, ringworm and ulcers. An average of 1,221,960 cases per year were diagnosed over the period 1990 to 1997 accounting for 8.3 per cent of outpatient morbidity. Skin diseases are followed by diarrhoeal diseases which include enteritis, dysentery and amoebic infections. An average of 655,706 diarrhoeal cases per year were diagnosed over the period 1990 to 1997 accounting for 4.4 per cent of outpatient morbidity. Intestinal parasites such as roundworms are the fifth most prevalent disease condition reported. An average of 535,375 cases per year were diagnosed over the period accounting for 3.6 per cent of outpatient morbidity.

The sixth most prevalent condition is caused by accidents. An average of 404,436 injuries per year caused by accidents were recorded over the period 1990 to 1997 accounting for 2.7 per cent of the morbidity cases. Accidents were followed by urinary tract infections, pneumonia, eye infections and rheumatism as the seventh to the tenth most prevalent disease cases diagnosed, respectively. Disease cases recorded per year over the period 1990 to 1997 are 375,862, 311,169, 300,228, and 278,945 for each disease category respectively, each accounting for approximately 2 percent of the total morbidity documented except for urinary tract infections which accounted for 2.5 per cent.

7.2.4 Re-Emerging and Problem Diseases

Another important factor contributing to the burden of disease is the emergence of drug resistant disease conditions and problem diseases. For example surveys on malaria reveal that malaria was spreading to the non endemic highland regions. A study by Khaemba et al (1994) revealed the recovery of infective *Anopheles gambiae* vector in higher altitudes which affirmed the potential for transmission in areas where epidemics had not been known to occur. Malaria re-emerged in areas previously with little or no transmission thus increasing the burden of disease attributed to malaria. The study also found out that morbidity and mortality patterns in the otherwise endemic lowlands became increasingly severe. For example, hospital records (1990-1997) of a tea company in the Kericho district, western Kenya, a non endemic area, showed malaria epidemics almost annually from May to July. An annual attack rate of 50 per cent; 857 hospitalisations per 100,000 per year; 42 deaths per 100,000 per year and; 32 per cent of deaths in hospitalised patients all caused by malaria, were reported in the hospital. A questionnaire survey (June 1997) of 244 patients hospitalised for malaria showed that only 8 per cent had travelled to an area with known malaria transmission 30 days before diagnosis.

One hypothesis for the increase in highland malaria was the increasing inefficacy of Chloroquine to cure malaria infections because of the development of drug resistant strains of malaria parasites. The period during which epidemic malaria was absent from the highlands corresponded to the time when Pyrimethamine and Chloroquine were still effective malaria treatments. In 1953, Pyrimethamine was used successfully as the first step of a large malaria control campaign in the Kenya highlands, but by 1954, rapid development of resistance was reported in several areas and more effective drugs had to be applied. The high malaria prevalence statistics and the problem of persistent drug resistant malaria parasites have made malaria an important focus for health and economic studies in tropical developing countries.

Similarly, the management of infectious diseases was also constrained by the development of drug resistant strains of pathogens. It was noted that antibiotic development and other control technologies had not kept pace with the emergence of drug resistant strains of important microbes such as *Mycobacterium tuberculosis* (Murray and Lopez, 1996).

In addition, there were problem diseases whose effective management and treatment are a technological challenge to the modern medicine. These include: chicken pox, mumps, bilharzia, cataract, whooping cough, pneumonia, hepatitis, neoplasm, meningitis, poliomyelitis, tetanus, leprosy, measles, high blood pressure, diabetes and asthma which when combined account for approximately 1.6 per cent of the total out-patient morbidity.

7.3 HEALTH CARE POLICY STRUCTURE

7.3.1 Evolution of the health policy

Analyses of discussions and interviews on health policy structure revealed that there are two major systems of health care in Kenya that contribute, albeit inequitably, to health care. The most developed system is modern medicine, mainly focused in urban areas, which is provided by the Ministry of Health, Non Governmental Organisations and the private sector. In this system, the main approach is the application of modern technologies including drugs developed by the modern science research and development system. The lesser developed system is traditional medicine which is provided by traditional medicine practitioners, mostly in rural areas. In this system, the main approach is the application of traditional technologies including herbal formulations developed by the traditional knowledge research and development system. Following is a discussion on the evolution of the modern medicine health care policy structure. Outcome of discussion on traditional medicine is presented in section 7.5.

Despite the existence of the two health care systems, discussions revealed that Kenya's policy structure has been designed exclusively for the development and provision of modern medicine services. This can be traced back to the colonial era and evidenced in post-colonial development pathway. To track the historical evidence, a number of policy documents were studied whose content was discussed with various respondents in the Ministry of Health.

When Kenya became a colony of Britain, towards the end of the nineteenth century it became a recipient of western culture. Western conceptions and practice of medicine were superimposed on the then predominant traditional system. Subsequently, health policy development focused on the promotion of western medicine.

At the time, the medical administration had three objectives (Beck, 1974).

1. Preservation of health of the European community
2. Keeping the African and Asiatic labor force in reasonable healthy conditions; and
3. Preventing the spread of tropical epidemics especially plague and malaria.

In 1908, a department of medical services was established (Milne, 1928) and church missions established departments of medical services as part of their vocation. In 1910, the Medical Practitioners and Dentists Ordinance was promulgated. The ordinance was designed to provide for registration of medical practitioners as a precondition of practice. It is important to note that by medicine and health the colonial authorities then were referring to the western variety i.e. modern medicine.

After the First World War, the medical department accepted the responsibility of providing health to the entire population (Gilks, 1922). The African population was then entitled to preventive and curative medical services (Beck, 1974). The dispensary system was introduced in rural areas, to supplement pioneering missionary efforts. The effective implementation of these new policy innovations was, however, hampered by lack of adequate funds and trained personnel. The state therefore continued to rely heavily on the efforts of church authorities to assume responsibility in matters relating to health.

After the Second World War, as a policy goal, the intention was to develop modern medical services an elliptical reference with the intention to replicate the English system. Medical progress along the lines laid down before the war continued (Adalja, 1962; Beck, 1970; Carman, 1976). In particular, priority was given to the extension of the system of dispensaries that had already been introduced. During this phase, there were two new important developments. First, medical research was introduced (Mungai, 1974). Second, the training of medical personnel was institutionalised.

When Kenya became independent, in 1963, the new government was committed to a gradual introduction of free medical care. According to the Sessional Paper Number 10 of 1965, "the declared aim of the government is to provide medical and hospital services..." It was the clear intention of the government to make steady and substantial progress towards the attainment of these objectives, consistent with the spirit of African nationalism". The independent government accepted the virtues of western medicine as inherited from the colonial administration. It was clear that policy-makers in Kenya did not wish to question the role and place of modern medicine in health delivery arrangements in the country.

Health policy in independent Kenya was first articulated in the 1966-70 Development Plan. The philosophical premise was that human health had a major role to play in economic development. In addition, it was incumbent on any government devoted to the social welfare of its people to provide adequate health services (Onyango, 1974). The emphasis in the development plan was, therefore, placed on the expansion of health services to bring health services within the reach of all people. Other areas of emphasis included expansion of existing facilities, intensification of staff training, encouragement of medical research and improvement of environmental health.

The 1970-74 and 1974-78 Development Plans continued to harp on the same theme. However, in the latter, two innovations were significant. The first, the shift of emphasis from curative to preventive medicine. Second, the declaration of a comprehensive approach to rural health. The plan declared that "the government will start implementing an integrated and comprehensive master plan for the development of health services (Kenya, 1974). The 1979-83 Development Plan revealed a decisive shift in emphasis towards technological aspects of medical services. In cognizance of constraints listed below, the plan outlined measures to overcome them. The constraints included:

1. Inadequate and uneven coverage of the population due to insufficient health delivery centers.
2. Inadequate service due to shortage of medical manpower
3. Unsatisfactory utilization of equipment and transport due to financial and managerial problems of operation and maintenance
4. Shortages of drugs and other essential supplies due to financial constraints and inadequate distribution system and
5. Inadequate flow of health information and utilization of that information

In responding to these constraints, the plan had the following objectives: i) to strengthen and carry out measures for the eradication, prevention and control of diseases; ii) provision of adequate and effective diagnostic, therapeutic and rehabilitative services for the whole population offered at hospitals, health centers, dispensaries and mobile units; and iii) promotion and development of biomedical and health services research as means of identifying improved and cost effective methods (Kenya, 1979). This plan included two innovations. First, it sought to strengthen the rural health system. Secondly, for the first time, it recognized the importance of traditional medicine. A detailed discussion on the relationship between health policy and traditional medicine is presented in section 7.5.

The 1989- 93 Development Plan included the ideals of the Alma Ata Declaration i.e. "health for all by the year 2000". It identified primary health care as the best method of achieving this goal. Secondly, it had the goal to transfer the financial burden for providing health services from the state to the individual which led to the introduction of user fees for public health care services. The 1994 Health Policy Framework set a comprehensive agenda for health sector reform. The overall goal of the health sector policy until the year 2010 is

> *To promote and improve the health status of all Kenyans through the deliberate restructuring of the health sector to make all health services more effective, accessible and affordable.*

It seeks intervention in various aspects of health including policy processes, economics of health services, financial arrangements, institutional arrangements, and personnel development. Again, here the overall emphasis is on modern medicine as demonstrated by the level of government investment *vis a vis* traditional medicine. It recognizes the fact that the government is inadequate in health care provision. In response, it seeks to create an enabling environment for increased private sector and community involvement in health service provision and finance, including traditional medicine. It also aims at strengthening health research.

The National Drug Policy (NDP) (Kenya, 1994b) was adopted for implementation in 1994. It was designed to ensure that available resources are used to develop pharmaceutical services to meet the requirements of all Kenyans in the prevention, diagnosis and treatment of diseases using efficacious' high quality, safe and cost effective pharmaceutical products.

To support the policies formulated, various pieces of legislation were developed. These include: The Public Health Act Cap 242; the Pharmacy and Poisons Act Cap 244; the Dangerous Drugs Act Cap 245; the Medical Practitioners and Dentists Act Cap 253; the Clinical Officers (Training, Registration and Licensing) Act Cap 260; the Nurses Act Cap 257; the Food, Drugs and Chemical substances Act Cap 254; and the Price Control Act Cap 504. These laws were specific for the regulation of modern medicine practice. The following section 7.3.2 focuses on laws for health care professionals — the primary carriers of knowledge and technologies in health care. In particular, it outlines how the legal framework also carved out monopoly for modern medicine practitioners at the expense of traditional medicine.

7.3.2 Legal Framework for regulation of Health Professions

Five health "professionals" are recognized by statutes in the country. They are medical practitioners, dentists, pharmacists, nurses and clinical officers. These are the only health professionals recognised by statutes. This recognition by statute is only intended to facilitate regulation. The basic strategy of professional regulation is maintaining registers of practitioners deemed competent. The efficacy of the registers is then supported by the creation of monopolies and by use of criminal law to protect professional titles. For purposes of maintaining the register, Boards or councils are created in respect of every regulated profession. The following sections describe the legal regimes regulating the five health professions.

Medical Practitioners and Dentists

Medical Practitioners and Dentists are regulated under the Medical Practitioners and Dentists Act Cap 253. This Act first promulgated during the colonial period was amended in 1926, 1948 and 1963. The Act provides for the establishment of a Board, known as the Medical Practitioners and Dentists Board which functions as the regulatory institution for the statute. It, through the board, provides for the:

i) Supervision of the training of practitioners and approval of their registration
ii) Licensing of non-qualified personnel to practice medicine or dentistry, if it is satisfied that it is in the public interest to do so,
iii) Licensing practitioners to practice privately and
iv) Discipline of practitioners.

There are elaborate qualification requirements for those who wish to be registered. A person is eligible for registration if he has a degree, diploma or other qualification recognised by the board. Foreign trained practitioners may be licensed to practise in Kenya. In addition, the person must satisfy the board that

i) After obtaining the required qualification, he has been engaged in professional training in an institution approved by the Board for a period of not less than one year,
ii) Whilst so engaged, he has acquired sufficient knowledge of, and experience, in the practice of medicine or dentistry as the case may be, and
iii) He has a good moral character and fit to be registered under the Act.

The legal effect of registration is that, the same rule entitles the person registered to practise medicine or dentistry in a salaried post under a government or local government health scheme or in such salaried posts in such institutions as the Board may from time to time approve. A person who wishes to engage in private practice must apply for additional license. Fees may not be recovered by a person not licensed to practise privately; and professional title is protected through the use of the criminal law. The Board has extensive power of discipline over practitioners. It may remove the name of a practitioner from the register or cancel any license granted to such person if

i) the person is convicted of an offence under the Act or under the Penal Code, or

ii) the person is found to have been guilty of any infamous or disgraceful conduct in a professional respect — serious misconduct judged according to the rules written or unwritten which govern the medical and dental professions.

Pharmacists

Pharmacists are recognized and regulated by the Pharmacy and Poisons Act Cap 244. The Act provides for the appointment of a Board known as the Pharmacy and Poisons Board to regulate the practice of pharmacy.

In the statutes, it is provided that a register of pharmacists shall be kept in a prescribed form. Every person who either is a registered pharmacist, or satisfies the Board that he holds a qualification, which the Board considers acceptable, is entitled to have his name in the register. The effect of the registration is that it entitles the person to carry on the business as a pharmacist. In the matters of discipline, the Board is empowered to refuse registration or delete from the register, the name of a person otherwise qualified who has been at any time convicted of a criminal offence or been guilty of misconduct. The monopoly created for pharmacists is shared in varying degrees with medical practitioners, dentists, veterinary surgeons and medical staff of hospitals.

Nurses

The nursing profession is regulated by the Nurses Act Cap 257. The Act establishes a council known as the Nursing Council of Kenya. The functions of the council include:

1) To establish and improve standard of all branches of the nursing profession and to safeguard the interests of all nurses
2) To establish and improve the standard of professional nursing and of health care within the community
3) To make provision for the training and instruction, a function exercised with the approval of the minister
4) To take disciplinary measures as may be necessary to maintain proper standards of nursing care in health institutions
5) To direct and supervise the compilation and maintenance of registers and records required to be kept under the relevant provisions of the Act and;

In accordance with the provision of the Act, nurses may be either registered or enrolled. Foreign trained nurses may be licensed to practise in Kenya. For the purposes of registration, the registrar is required to maintain five separate registers on the basis of the nurses' specialisation. Registration, enrolment or licensing entitles the recipient to professional occupational monopolies. These include the right to take and use title appropriate to the register or roll on which his/her name appears, and the exclusive monopoly to be employed as a nurse in a health institution.

Clinical Officers

Clinical Officers are statutorily regulated under the Clinical Officers (Training, Registration and Licensing) Act Cap 260. The Act creates a council known as the Clinical Officers Council whose functions include:

1) to assess the qualification of Clinical Officers
2) to ensure the maintenance and improvement of the standards of practice and to supervise the professional conduct and practice of Clinical Officers
3) to maintain the register of Clinical Officers and keep a record of all Clinical Officers registered under the Act;
4) to register and license Clinical Officers
5) to take the necessary disciplinary measures in cases of violations of professional conduct and discipline
6) to collaborate with other health professionals in furtherance of functions of the council; and

To qualify for registration as a Clinical Officer, a person has:

1) to have successfully completed a prescribed training course at an approved training institution
2) apply for registration in the prescribed form
3) to pay the prescribed fees for registration and
4) be fit to be registered

The legal effects of registration are that a person registered is entitled to render medical or dental services in any medical institution in Kenya, and becomes eligible after ten years for private practice license. Clinical Officers licensed to engage in private practice are entitled to charge fees for the medical or dental services rendered, and are required to observe the same.

To further the above health policy and legislative goals, the government focused on *inter alia* three main programmes including establishment of health care infrastructure, training of medical personnel; and supply of drugs and pharmaceutical products. Each of these are discussed in sections 7.3.3 to 7.3.4

7.3.3 Health Infrastructure

In response to the Alma Ata Declaration, the government investment was focused towards the goal of "health for all by 2000" through expansion of health care facilities. The government's intention was to provide health care free of charge and to locate a health facility within 10 kilometers of each citizen.

Health care services are provided for in the Government health care facilities which are organised in a hierarchical system from the smallest and simplest facility (dispensary) to the most complicated and sophisticated (national and teaching hospital). In between are the health centres, district hospitals and provincial hospitals. Kenya's health infrastructure can thus be regarded as a pyramid, consisting of five levels. On top of the pyramid is the Kenyatta National Hospital, under which come eight provincial centres, district hospitals in 42 district centres, and lastly health centres and dispensaries in the rural areas. Appendix 7.6 and Figure 7.3 give details of the progression in the expansion of the health care infrastructure over the period 1981 to 1997. Over this period, as a result of policy emphasis and commensurate government investment, the number of health institutions increased by 2,456 — an over 150 per cent increase. This growth was accounted for by 177 additional hospitals, 304 health centres and 1,875 dispensaries.

The growth in health care facilities especially those most likely to benefit the rural poor, more than kept pace with population growth. For instance, in the late 1980s until 1992, the growth of health facilities was ahead of population by almost 10 per cent and rose to achieve an almost 16 per cent increase by 1996. By 1997, 30 per cent of the population was within 2 kilometers of a health facility; 42 per cent within 4 kilometers ; and more than 75 per cent within 8 kilometres.

The availability of a well trained professional staff with a wide variety of skills is vital to the success of any health care system. Training of medical personnel, earlier institutionalized, led to the increased medical work force. At independence, the government inherited a staff of 6,300 (Kenya, 1984b) comprising of mainly expatriates. Through a concerted effort of recruitment and training, the government increased the number to 48,685 in 1997 as shown in Figure 7.4 and Appendix 7.7. The appendix presents the total number of registered medical personnel by category for the period 1980 to 1997. At independence there were 318 doctors and 13 dentists in Government Hospitals. This number increased to 4,078 doctors and 927 dentists in 1997. The number of nurses of various types including clinical officers and other para medical staff increased by almost twenty-fold from 2,100 at independence to 38,501 in 1997. The number of health personnel per 100,000 population increased from 27 at independence to 159 in 1995.

7.3.4 Drugs and Pharmaceutical Supplies

The curative programme is of direct importance to disease amelioration because of the high disease prevalence and therefore its relatively higher consumption of the recurrent financial allocations to the ministry — about 70 per cent. In fact, for most of

Figure 7.3 The growth of government health facilities in Kenya, 1981 to 1997

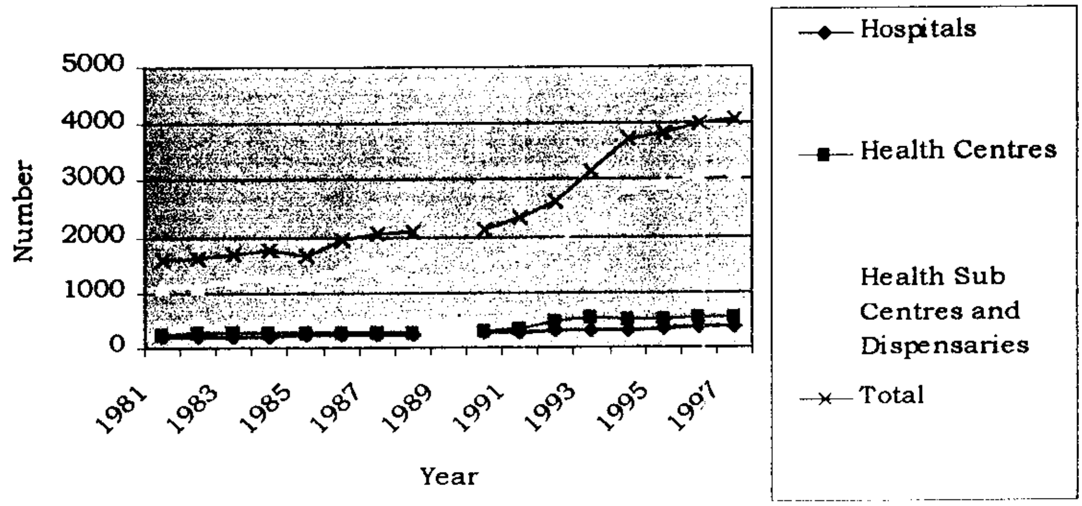
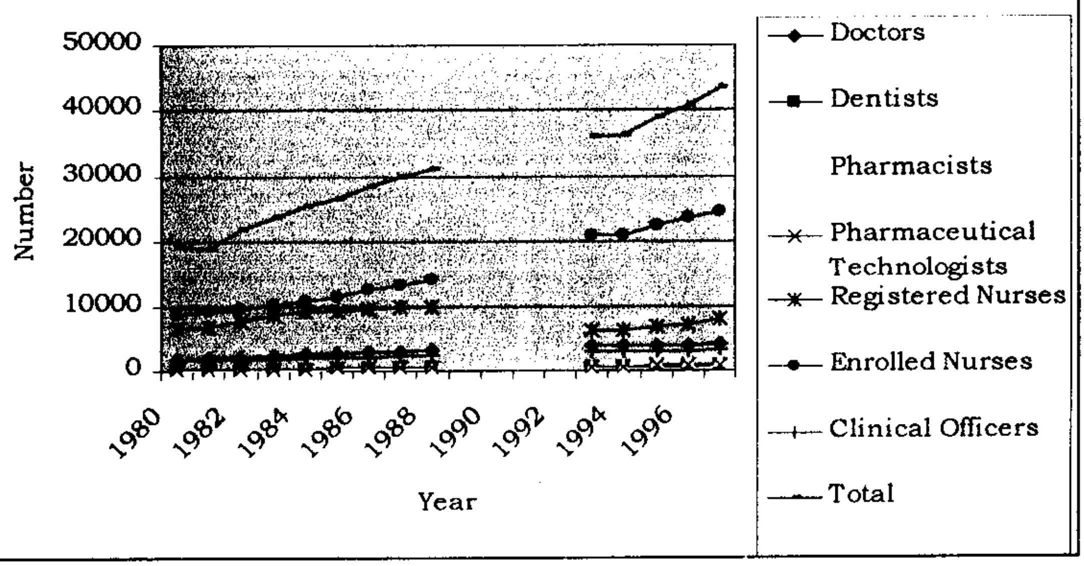


Figure 7.4 Growth of health care workforce, 1980 to 1997



those that make use of Government health services, the availability of drugs is the most important local factor determining that use.

As the health facilities network expanded, the government financial allocation also increased. Between 1983/84 and 1996/97 there was an increase of almost 600 per cent. However, in real terms the increase didn't keep pace with the increase in health care demands due to increasing population growth. As discussed earlier, the per capita expenditure declined. Currently, approximately 50 per cent of the value of all pharmaceuticals consumed in Kenya are those provided in the Ministry of Health facilities. Almost 45 per cent are provided by NGOs and the remaining 5 per cent is consumed by those who pay out of pocket in retail outlets. Owing to budgetary constraints discussed in section 7.2.1 above, the drugs supplies continued to fall short of requirements.

Over 73 per cent of supplies were imported, a situation which imposed a heavy financial burden upon foreign exchange reserves. Effects of the currency devaluation and subsequent cost inflation, in the 1990s constrained the ability of the Ministry of Health to provide its health facilities with adequate drug supplies. Estimates reflected a need for the local currency equivalent of US$25 million per year to provide adequate stocks of drugs and dressings in Government facilities. However, the devaluation of the Kenya shilling reduced the value of the budget line items for drugs and dressings by 53 per cent from US$13.6 million in July 1992 to US$ 5.81 million in July 1993. This resulted in severe drug shortages in government health facilities.

Additionally, although there were no shortages of drugs and dressings in private sector pharmacies, the prices of medicines in these retail outlets have been beyond the reach of most Kenyans. This is particularly true for the 47 and 29 per cent of the rural and urban population respectively, who live in absolute poverty. This places a heavy burden upon vulnerable groups and the solution to the problem of financial inaccessibility to essential drugs presents a serious challenge to the Ministry of Health.

Of relevance to the curative programme is medical research which is crucial to development of health care technologies appropriate to nation's health care needs. The following section 7.3.5 presents a discussion on the medical research programme in the country.

7.3.5 Research

Medical research was first introduced by the colonial authorities just after the Second World War (Mungai, 1974). In the 1966-70 Development Plan, the independent government sought to encourage medical research. The National Council for Science and Technology (NCST) was established under the Science and Technology Act, to advise the government on all aspects of science and technology. In the 1979-83 Development Plan, there was policy intention to promote and develop biomedical and health services research. It was during this plan period, in 1979, that the Kenya Medical Research Institute (KEMRI) was established through the Science and Technology (Amendment) Act of November 1979. Subsequent development plans supported the development of the medical research programme. By 1997, the budget allocation to medical research was 24 per cent of recurrent expenditure allocated to research and 3 per cent of the development research vote. Implementation of the plan also continued to strengthen the institutional arrangement.

The activities of KEMRI and other related agencies are coordinated under the Division of Research, Health Standard and Inspectorate in the Ministry of Health. This

Division, together with the National Health Research Development Centre (NHRDC) coordinates all research services in the country including the creation and implementation of health standards to ensure compliance with health laws. This involves, among others,

a) Coordination of health systems as well as clinical and biomedical research and

b) Collaborating with all health research institutions

The government continues to recognise the role of health research in supporting activities of all agencies operating within the health sector. Particular emphasis is placed in coordination of research into priority diseases and conditions and the means to combat them.

The Kenya Medical Research Institute (KEMRI)

KEMRI was mandated to conduct health science research and generate research findings to be applied towards the improvement of the health status in Kenya and elsewhere. KEMRI's research was therefore targeted towards generating new information on the prevention, control, management and treatment of diseases of public health importance in Kenya. As outlined in sections 7.2.2 to 7.2.4, the leading causes of ill health are communicable diseases — malaria, respiratory and infectious diseases. The thrust of KEMRI's research efforts is therefore on these disease conditions but not limited to them. There are eighteen research programmes on: Acute Respiratory Infections; Diarrhoea; Environmental and Occupation Health; Filariasis; Health Systems; HIV/AIDS; Human Reproduction; Hydatid; Leishmaniasis; Leprosy; Malaria; Nutrition; Oral Health; Sexually Transmitted Disease; Schistosomiasis; Traditional Medicines and Drugs; Tuberculosis; and Viral Hepatitis.

Commensurate with the health policy disposition towards modern medicine, medical research also focused on furtherance and development of modern medicine technologies. All resources including personnel, training, equipment and finances were devoted to production of knowledge and technologies for modern medicine. It wasn't until 1987 when the Centre for Traditional Medicine Drug Research was established that focuses on traditional medicine was initiated. This aspect is further discussed in section 7.5.

7.4 ANALYSIS ON THE HEALTH CARE SERVICES

Due to various constraints and obstacles, the policy framework and related programmes outlined above by and large failed to achieve their stated goals. The subtle and sometimes radical policy adjustments were introduced from time to time in the hope that they would enhance the chances of realization of stated goals. However, the programmes designed did not have a real impact on improvement of the quality of health care services. A case in point is the programme on health facilities network expansion.

Although there was an increase in the total number of facilities and personnel, an analysis of the distribution of health care services reveals that there was a bias. The services are spatially inequitable and favour urban areas where only about 15-20 per cent of the country's 27.5 million people live (see Table 7.). Consequently, the rural poor continue to have difficulty in accessing primary health care services, either because of the nearest facility's distance from their homes or they cannot pay the user charges. This is attributed to the fact that the distribution of health facilities has also not been necessarily targeted at the priority concentrations of poor households.

Rift Valley Province and Nairobi, for example, have an average of 19 and 20 facilities per 100,000 respectively. On the other hand, Nyanza and Western Provinces, with high absolute numbers of poor households, have 11 and 10 facilities per 100,000 population respectively. In the Arid and semi arid lands (ASALs), medical facilities are scarce and extremely remote often experiencing 100 per cent bed occupancy. Even among the urban set, only the primate towns of Nairobi and Mombasa enjoy accessible and available health care.

The expansion of the health care network was also not accompanied with commensurate increase in personnel and access to health care technologies. Therefore, even where facilities exist, medical service is not always available. Many of them suffer from inadequate personnel. In particular, although the ratio of health personnel per 100,000 population increased, the ratio of doctors to the population has shown little improvement since independence, partly because of the rapid population growth. Similar to the situation on facilities, the distribution of medical personnel has also been biased towards urban areas. The major urban areas of Kenya have 375 (close to 56 per cent) key Health personnel per 100,000 while the ratio in the rural areas have less than 90, a difference of about 400 per cent.

Table 7.2 The distribution of health care services

	Urban	**Rural**
Population (%)	20	80
Population in absolute poverty (%)	29	47
Key Health Personnel per 100,000	375	<90
Number of facilities per 100,000	20 (Nairobi)	11 (Nyanza) 10 (Western)

Most of the time the health facilities also suffer from shortage of drugs and equipment. Essentially, this means that the majority of the population receive unsatisfactory access to services and resort to alternative health care services.

7.4.1 Alternative Health Care Options

A survey on patterns of health services use (Kenya, 1999) documents that approximately 16 percent of all rural residents use the public hospitals compared to over 25 per cent who use public health centres and dispensaries. A total of 41 per cent consult either traditional medicine, self medicate or do not seek any form of health care.

The preference for either modern or traditional medicine varied with the disease condition. It was revealed in another survey (Lyambila, 1997) on health seeking behavior in a rural community, that out of 379 illness episodes, a significant proportion of them were managed by traditional medicine practitioners. A total of 13.3 per cent of malaria episodes were treated by modern medicine while 2.6 per cent were treated by traditional medicine; 23.1 per cent of skin diseases were treated by modern medicine while 7.7 per cent were treated by traditional medicine; 36.1 per cent of diarrhoea and vomiting episodes were treated by modern medicine while 2.8 per cent were treated by traditional medicine; 14.8 per cent of stomachaches were treated by modern medicine while 18.5 per cent were treated by traditional medicine; 15.8 per cent measles episodes were treated by modern medicine while 10.5 per cent were treated by traditional medicine; 7.8 per cent of headaches were treated by modern medicine while 3.9 per cent were treated by traditional medicine. In summary, for the management of six disease conditions, while modern medicine contributes to the amelioration of 71.7 per cent of the burden of disease, traditional medicine contributes 29.3 per cent. This is without including other treatment modes.

Although the major factor for rural Kenyans to go for traditional medicine for treatment of various ailments is the inability to access modern health facilities (Good, 1987; Good and Kimani, 1985), other factors were also cited. These include social, psychological and cultural (Sindiga et al, 1995).

7.5 TRADITIONAL MEDICINE

Traditional medicine is one of the major products of traditional institutions. Through the traditional knowledge system, various disease management regimes have been developed and used over time. Although less developed, the traditional medicine system was the main health care system before the advent of colonialism. In particular, the practice forms a significant part of traditional rural health care. For most of the rural population, it has been the only accessible health care system. For example, most of the rural population in Turkana District in northern Kenya, had little or no contact with modern medicine. This had been mainly due to the fact that modern health care facilities had been beyond reach in terms of distance, awareness and finance(Kenya, 1980). Eighty per cent of all births are delivered at home by traditional birth attendants rather than by midwives in maternity hospital wards (Sindinga et al., 1995. These services are provided mainly by traditional medicine practitioners using medicinal plants resources both of which are abundant in Kenya.

There are at least 6,000 registered traditional medicine practitioners in Kenya, a greater majority of whom are found in rural areas. This figure represents only a portion of practising traditional medicine practitioners. Many have not registered because of inaccessibility to registration facilities and illiteracy on their part. Through their practice, they manage a wide range of disease conditions. They thus contribute to disease burden amelioration and consequent economic contribution. In addition, there are many diseases that modern medicine has failed to manage — asthma, diabetes, hypertension, sterility, cancer, etc, but ethnobotanical and ethnomedical surveys among various rural communities have revealed that these can be effectively managed by traditional medicine (KEFRI, 1995). The surveys revealed that Kenya is also endowed with a wealth of genetic diversity of medicinal value.

7.5.1 Wealth of Biodiversity

As a land of great ecological and natural diversity, Kenya is home to 19 distinct biotic communities (WCMC, 1988). Forests cover about 1 per cent of total land area of which 85 per cent is indigenous. It is estimated that there are between 8,000 and 9,000 plant species (KENGO, 1989; Stuart and Adams, 1990) of which about 2,000 are shrubs and trees.

Ethnobotanical studies revealed that over 1,000 plant species are used in traditional medicine (Kokwaro, 1976, 1993, KEFRI, 1995). Market surveys also revealed that apart from local use of medicinal plants, the same also have a share of the international market. A number of medicinal plants have commercial value outside the local communities and the country. Thousands of tones of parts of medicinal plants used in traditional medicine have been participating in the international trade. Some of these are listed in Table 7.3 below. In particular, the main exploiters have been multinational pharmaceutical companies prospecting for new sources of modern drugs. The increasing bioprospecting activities suggest an enhanced international market value of biodiversity, particularly for those traditionally used to manage problem diseases. However, this economic value is not captured within the source country nor the local community, because of policy, legal and institutional gaps.

Traditional medicine and medicinal plants offer immense opportunities for the development of health care in the country. Traditional medicine offers a practical option to the government towards bridging shortfalls encountered in provision of health care services, including medical personnel and drug supplies. Medicinal plants also offer opportunities for development of local pharmaceutical industry. To harness these benefits, there is need for innovations in policy, legislation and institutional arrangements.

Table 7.3: Medicinal Plants Exports from Kenya

Species	Year	Quantity (Tons)	Destination	Product
Aloe secundiflora	1995	1,000	Middle East, China	Aloe vera Cancer
Azadirachta indica	1996	0.001	UK, USA	Medicine, malaria
Catha edulis	1995	17,000	Arabia, Yemen, Djibouti, Somalia	Stimulant, medicine
Maytenus buchananii	1976	200	USA	Medicine cancer
Prunus africana	1996	350	France	Medicine, prostate cancer
	1995	260	France	
	1994	108	France	
Tamarindus indica	1995	0.005	USA	Medicine, diabetes
Jatropha podagrica	1996	3.5	Netherlands	Medicine
	1994	7	Netherlands	
	1991	7	Netherlands	
J. multifida	1990	0.05	Kuwait	Medicine
Adenia globosa	1990	0.4	Netherlands	Medicine
Centella asiatica	1995	12	France	Medicine

Source: Kenya Wildlife Services, 1997

7.5.2 Health Care Policy and Traditional Medicine

As outlined above, in section 7.3, from the beginning of colonial occupation the official health policy was the introduction of modern medicine health services leading to the rapid marginalisation of traditional medicine. This negative policy disposition towards the practice was attributed mainly to cultural imperialism that had little understanding of traditional technologies. Instead, authorities viewed traditional as primitive.

It was clear that the official morality of the colonial power did not approve of traditional medicine and sought to crush it. Two main methods were used to crush the practice: orchestrated campaigns of a cultural-imperialist variety, and the criminal law. First, specific steps were taken to ensure that, from policy perspective, traditional medicine became moribund and marginalized. The colonial administration did not develop a legal and institutions framework for regulating traditional medicine and harnessing its benefits. The practitioners were not accorded any professional status either.

The Medical Practitioners and Dentists Ordinance was the first piece of legislation to make reference to traditional medicine. It conceived of the same as "systems of therapeutics according to native method". An important regulatory arrangement was the requirement that practitioners must be registered and licensed. The ordinance however, exempted practitioners of traditional medicine from this requirement. Thus suggesting that, the authorities did not have faith in the institutions of traditional medicine, or in its future. They assumed that it was going to disappear as the society became modernised. The ordinance explicitly discouraged the professionalisation of the institution outside the community, and the performance of acts deemed dangerous to life — a paternalistic and presumptuous generalization intended to give government officials a free hand to control traditional medicine at their discretion. There was no organized body of information collected and stored on the practice. Moreover, religious propaganda and Western missionary education spared no effort in stigmatising the practice and institutions of traditional medicine in Kenya. As a result, the practice became marginalized

Second, a specific legal arrangement was chosen to deal with the practice, which simultaneously recognized and tried to stifle it. For instance the Witchcraft Act Cap 62 of 1962 was used to criminalise the practice and to discredit its practitioners. In purporting to criminalise the practice of witchcraft, the Act adopted a vague definition of witchcraft which was apt to confuse (Mutungi, 1977). The definition did not exclude native medicine. As a result, detractors of traditional medicine tended to subsume it within the meaning of witchcraft and equally condemn its practice. Throughout colonialism, therefore, with the exception of traditional midwifery, traditional medicine was unlawful. The practice thus existed at the periphery of modern medicine and health care arrangements. Thus, independent Kenya found a struggling and marginalized institution of traditional medicine.

In the post colonial era, the independent government inherited the colonialist's legacy of non-positive attitude towards traditional medicine. The first decade following independence in 1963, was marked by official indifference towards traditional medicine. During this period, infrastructure development excluded the development of traditional medicine.

It was not until the late 1970s when it became officially accepted that the contribution of traditional medicine to health delivery arrangements was positive, at least potentially. Interest in the subject then was stimulated by the reduction in public health expenditures and the consequent inability of official health care services to provide adequate drug supplies. Traditional medicine was thereafter first comprehensively documented in the 1979-83 Development Plan which subsequently led to the introduction of administrative regulation of traditional medicine practitioners in the 1970s. From this time, it was accepted that traditional medicine was not illegal.

It was stated in the plan that a major gap of information relating to the private health sector, both traditional and modern, had existed throughout previous plans .It was then proposed that during the plan period, attempts would be made to fill these gaps. The plan identified three points of departure:

1) Collection of information to determine the importance and relevance of traditional medicine
2) Exploration of potential link between traditional medicine and government institutions and
3) The encouragement of cadres of selected traditional medicine practitioners to serve in government health institutions in other rural areas (5.37)

The plan made many assumptions about traditional medicine based on either ignorance or a preconceived idea of the role which this system of health care could play in health care. First, the planners had little idea about the meaning and concept of traditional medicine. Second, there was an unjustified emphasis on restricting traditional medicine in the rural areas when, in reality it was present in both rural and urban areas. Third, there was an assumption that traditional medicine should supplement the modern medicine in policy arrangements.

Subsequent development plans furthered the intent to recognize traditional medicine. For instance, the 1989-93 Development Plan made a commitment to the promotion of the welfare of traditional medicine practitioners. The 1994 Health Policy Framework through the National Drugs Policy also sought to encourage traditional medicines. These pronouncements for traditional medicine, respondents noted were deserved and should have been strengthened and supported with the appropriate institutional arrangement to develop the practice for the benefit of Kenyans. In particular, in the wake of declining health care funding and rising costs of health care traditional medicine could help fill the gap thus created. Most of the respondents believed that traditional medicine has an important role to play in health care because of its lower costs, easier access and efficacy.

Policies and laws are important instruments for influencing and promoting social change including institutional and economic changes. Although these policy documents may be lauded for their pronouncements, they failed to point to the role of traditional medicine in furthering the goals of health care. For example, the 1989- 93 Development Plan also included the ideals of the Alma Ata Declaration i.e. "health for all by the year 2000". It identified primary health care as the best method of achieving this goal. Whereas modern medicine does play a role, traditional medicine has a potential role as determined by the World Health Organisation (WHO). Secondly, its goal to transfer the financial burden for providing health services from the state to the individual may have been averted if the cheaper traditional medicine had been an official key player in health care provision. However, this dimension eventually served to highlight the importance of traditional medicine.

The 1994 Heath care policy framework recognised the fact that the government was ineffective in health care provision. In response, it seeks to create an enabling environment for increased private sector and community involvement in health service provision and finance. Traditional medicine has an opportunity to demonstrate its valuable involvement in health care provision to warrant more emphasis. For example, traditional medicine can contribute to the explicit strategy to reduce the burden of disease. It could also thus contribute to those cost effective and essential curative and preventive services which are provided by the Ministry of Health. Another window of opportunity for traditional medicine is through the policy intervention aimed at strengthening health research. If purposefully focused, research on traditional medicine will enhance understanding of the practice.

The National Drug Policy (NDP) which was adopted for implementation in 1994 was designed to facilitate the development of pharmaceutical services. Although here also the emphasis is on modern drugs, there is an opportunity for traditional medicine to be part of the curative health care system. The ..."traditional medicines shall be encouraged" needs to be translated into purposeful legal and institutional framework to harness optimum benefits from traditional medicine. For instance, the legal system of which a number of outdated Acts of Parliament exist may be adjusted and or require subsidiary legislation to fulfill health care goals. They need to be consistent with current policy intentions, without ignoring legislative needs for the development of traditional medicine.

With reference to legislation, the constitution provided for personal freedom and human rights (Ghai and McAuslan, 1970). Freedom of associations was provided for under the Societies Act. Registered Traditional medicine practitioners could form and join associations of practitioners. However, the requirement by the Ministry of Health for traditional medicine practitioners to be registered is not referenced in any law invoking such requirement. The purpose of the registration is also not stated and criterion for the qualification of registration is also not provided in policy or law. In 1977 the Medical Practitioners and Dentists Act was substantially amended. The amendment repealed the provision that exempted the practitioners of traditional medicine from the compulsory registration requirement. Technically, it appeared that the practice was illegal unless the practitioner was registered by the Board. The Witchcraft Act was not amended and its negative impact persisted.

7.5.3 Research

The Government focus on research and development on traditional knowledge and or medicine has also been marginal. Research on traditional knowledge has been scanty and mostly supported by external donor funding. Most efforts in public institutions are allocated a meager proportion of total research budget, if at all. As a result the scale of the research has been limited to individual efforts. Examples include the Ethnobotanical and ethnomedical surveys in the Plants for Life sub-programme at the Kenya Forestry Research Institute (KEFRI) and the Medicinal Plants Project at the National Museums of Kenya. Taxonomic, phytochemistry and ethnopharmacological studies are also undertaken through students' projects at the Public University Departments of Chemistry, Botany and Pharmacology. The most explicitly focused institution has been in medical research by the KEMRI, under the Centre for Traditional Medicines and Drugs Research.

The Centre for Traditional Medicine and Drugs Research at KEMRI

The Centre for Traditional Medicine and Drugs Research was set up at KEMRI in 1987. This was in cognizance of the reliance on traditional medicine by the rural population and its potential to contribute to health care. It was deemed pertinent that for the practice to be considered for integration into health care the practice be well understood. In particular the need for scientific validation of the herbal formulations has been the main stimulus. The center was established to undertake:

a) The rationalisation of traditional medicines in collaboration with traditional medicine practitioners and evaluation of plant drugs using phytochemistry, pharmacology and toxicology.

b) Development of formulations of herbal remedies such as antischistosomal agents of plant origin

c) Studies on sociocultural and anthropological aspects of traditional medicine

d) Experimental pharmacology and toxicology studies- biopharmaceutics and relevant pharmacokinetics, clinical drug trials

e) Studies on agents for the control and management of HIV/AIDS/STI

f) Quality assurance of drugs — drug quality control and surveillance

The studies carried out have managed to establish the scientific basis of the biological activities of some medicines used by traditional medicine practitioners. Medicine which have shown potential in treatment include those for asthma, migraine, psoriasis, allergies, hypertension, malaria, fertility regulation/ contraception and HIV/AIDS. There are at least 12 formulations with potential for the market one of which is currently under clinical trial. In drug formulation studies, a technique known as freeze drying offers chemical stability and biological activity to herbal formulations. From this technique, it is possible to administer traditional medicines in presentable form as capsule or tablets. This offers an opportunity to add value to traditional medicines.

Researchers at the centre observed that the scope for traditional medicine is great and its potential not fully exploited. For optimum exploitation there is need for more investment on the part of the government.

More funding is needed for extensive and intensive research and development. There is need for policy support to promote the development of traditional medicine to a standard commensurate with modern medicine. Linkages with private sector industries to further develop and diffuse the technologies developed will be instrumental. This aspect is particularly crucial for its acceptance by the modern medicine fraternity most of whom are skeptical of its efficacy. For example under the current laws traditional medicines are not registered as drugs and cannot be used in a registered health institution. An institutional arrangement for its research and development will enhance its understanding and stimify misunderstandings between the modern and traditional medicine professions.

Technological policy support is needed to stimulate the development of traditional medicine technologies. In particular the protection of intellectual property rights has been wanting. For example while the government is keen to enforce intellectual property rights — patents, plant breeders' rights, copyright, trademark for innovations developed through modern science — there has been no effective legal instrument to protect the intellectual property of traditional innovators.

The Industrial Property Act Cap 509 of the Laws of Kenya, that could protect the intellectual integrity of traditional people disqualifies traditional knowledge and products from patenting because of the criteria used to define innovations. The only instrument available for protecting traditional knowledge is trade secret. This has affected the development of local herbal formulations. For example the development of the KEMRON, Pearl Omega and many other herbal remedies for the management of HIV and AIDS could contribute to the amelioration of the AIDS scourge if the local innovators could be given a conducive environment that provides protection and legitimacy to traditional medicine.

Despite the inadequate support from the Central Government, research projects reveal that traditional medicine continues to play an important economic and social role in health care, particularly in rural areas. Studies reveal that traditional medicine is even expanding to urban areas. Traditionally based therapies are thriving because they fill a void for services that are in demand where modern health care has failed to deliver. Although uncoordinated, ethnomedical studies are bringing forth a knowledge base on traditional medicine that offers potential for development of cost-effective efficacious remedies. The policy process ought to incorporate this emerging knowledge and streamline the relevant policies appropriately.

7.6 CONCLUSION

The evolution of the health policy throughout the pre- and post-independent Kenya, did not respond to the health care needs of the rural population. All the health care programmes infrastruture development, medical personnel development and drug and dressings supplies were biased against rural areas. As a consequent of this bias, the absence of modern health care services gave the opportunity for traditional medicine to persist. This was not just because of its low cost and ease of access but efficacy properties. The practice thus persisted in the rural areas. Unfortunately, because of its location in the rural areas, the practice was ignored by policy and therefore remained undeveloped.

Although traditional medicine was discouraged and marginalised, western medicine remained inadequate and inaccessible to the majority of the population. Traditional medicine therefore survived and remained the most important health care system in Kenya (Good and Kimani, 1985; Katz and Katz 1981). Its survival was a function of its resilience. Recent decades have however witnessed a decline in the quality of health care services in both rural and urban areas and a growing recognition of the potential of traditional medicine to contribute to health care. While this may be lauded, the recognition has not translated into concrete positive steps. Policy abstention persists thus excluding it from participating in mainstream health care and the modern economic space. The practice and its products are thus undervalued, offering little incentives to sustain the development of the practice. On the other hand, the country's rich genetic resources of medicinal value are apparently attracting high market values in international trade. The negative impact of this policy structure on economics of traditional medicine is further elaborated in Chapter 8.

The authorities cannot afford to continue to ignore the practice. The benefits need to be harnessed nationally to contribute to the declining health care services. The technological coevolution model that integrates modern and traditional medicine is proposed. To achieve this there is need for innovation in policy, legislation and institutional arrangements. For this reform to be initiated, policy demands a rationale for its integration into health care. Can traditional medicine meet the health care needs as required of modern medicine services? The answer to this question is discussed in the next chapter which examines some aspects of the practice at the local level. As shall be shown in the Chapter Eight, research therefore becomes crucial in generating the required knowledge to inform the policy process.

CHAPTER EIGHT

KENYA CASE STUDY: PART B

8.0 INTRODUCTION

This chapter presents results of discussions on health care arrangement, among the *Giriama* living around the Arabuko Sokoke Forest. It follows on from discussion on health care policy presented in Chapter Seven above. This part of the study is aimed at determining first, the impact of the health policy structure on traditional medicine and secondly, the competence of the traditional medicine system to co-evolve with the modern medicine system.

The chapter begins by providing background information on the local study site focusing mainly on the reasons for its selection as the study site. The biodiversity wealth of the forest, and the traditional people in the study site are described. The health care options in the area are identified and outlined, discussion of which leads to the determination of the impact of the policy structure of traditional medicine. In particular, the effectiveness of the health care arrangement at providing economic incentives for sustaining the traditional medicine practice is examined. Secondly, the scientific and economic capacities of traditional medicine are determined with the view to establish the rationale for artificially selecting traditional medicine products into the modern economy.

8.1 THE ARABUKO SOKOKE FOREST

Arabuko Sokoke forest is the largest indigenous coastal forest in Kenya. It is also the largest coastal forest remaining in Eastern Africa. It lies at the northern end of a remarkable arc of special forest which stretches south along the Tanzanian coast to Mozambique. The forest derives its name from the Wasanya (the forest dwelling community) word *Arabuko* which means a place of thin elephants because elephants visit pools of water in the forest at night, especially during the dry season. S*okoke* is the 'Wasanya' word for dense shady thicket which describes the vegetation characteristics of dark red soils that dominate inland.

The forest spreads over Kilifi and Malindi Districts[1] which were formerly in one district. Covering an area of 372 square kilometers (Fanshawe, 1994), it lies between the latitudes 3° 10" S and 3° 25" S and longitudes 39° 40" and 40° 00" (see Appendix 7.1). It stretches over 10-25 m above mean sea level. Activities in the forest are guided and managed by the Arabuko Sokoke Forest Management Team comprising: the Forest Department, Kenya Forestry Research Institutes (KEFRI), Kenya Wildlife Services (KWS) and the National Museums of Kenya (NMK). This forest has 43 km^2 existing as a

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[1] These two districts were until 1997 administrative divisions in one district known as Kilifi

nature reserve and is one of the key areas for protecting forest diversity. Established by the Forest Department, in the Ministry of Environment and Conservation, no disturbance is allowed in this nature reserve. For management purposes the area is divided into 8 outposts each guarded by a forest guard,. They are Gede, Arabuko, Sokoke, Dida, Jilore, Kararacha, Mida and Kakuyuni.

This forest has been a focus of study for various researchers including academicians and scientists from both natural and social sciences (Fanshawe, 1994, Blackett, 1994, Emerton, 1994, Moomaw, 1960, Robertson and Luke, 1993, Mogaka, 1991). There are various reasons for this intense focus on the forest related to its rich and unique biodiversity and its contribution to the local community's socio-economic welfare.

Firstly, because of its long geographical isolation from the rest of the coastal forests, it has developed distinctive plant and animal communities. The forest comprises an ecosystem of great diversity, containing many rare species of birds, mammals, butterflies, amphibians and plants.

At the habitat level, four forest habitats, each with a unique species profile (see Table 8.1), are distinguished. These are *Cynometra manilkara* forest, *Brachystegia*

Table 8.1 Description of habitats within the Arabuko Sokoke Forest.

Habitat	Area in km^2(%)	Species Composition
Cynometra manilkara	220 (> 50%)	*Cynometra wescheri/webberi* Bak. f. , *Brachyleana hutchinsii* Hutch./ *huillensis* O. Hoffm, *Encepharlatos hildebrandtii A. B. & Bouche* (cycad), *Pavetta* sp., *Crenaspora* sp., *Canthium* sp.
Brachystegia woodland	70 (19 %)	*Brachystegia spiciformis* Benth, numerous cycads, lots of understory, < 50%, *Adansonia digitata* L.
Afzelia	50 (13%)	*Afzelia cuanzensis* Welw, *Trachylobium verrucosum* (Gaertn.) Oliv. synonym *Hymeneae verrucosum* Gaertn., *Julbernadia magnistipulata* (Harms) Troupin .
Lowland forest	<20 (5 %)	*Sterculia - Chlorophora* Memacylon forest, *Sterculia apendiculata* K. Schum, *Combretum schumanii* Engl., *Sorindeia obtusifoliolata* Engl., *Lannea stuhlmanii* (Engl.), *synonym L.*

	schweinfurthii (Eng.) Engl. *Lecaniodiscus fraxinifolius* Bak., *Diospyros* sp.

Source: Moomaw (1966)

woodland, *Afzelia* forest and lowland rainforest. These habitats support diverse flora and fauna and contains wildlife communities of international importance, particularly birds and mammals. Collar and Stuart (Fanshawe, 1994) consider Arabuko Sokoke the second most important forest for birds of continental Africa. The *Cynometra manilkara* forest which covers over half of the forest reserve (220 square kilometers) holds a wide range of species and is the stronghold for the Sokoke Scops Owl. The *Brachystegia* or miombo woodland is one of Africa's important vegetation types. It covers eighteen percent (70 square kilometers) of the forest reserve and supports the widest range of birds. The remaining *Afzelia* and lowland forest habitats occupy smaller areas of the forest reserve — thirteen and five percent respectively. Although these have structures similar to the *Cynometra* forest habitat, each has distinctive characteristic species.

The forest is home to about 600 plant species, over 100 of which are medicinal (Mutta, 1987); 230 species of birds and; over 250 butterfly species. In terms of biodiversity conservation, it is therefore one of Kenya's most valuable forest areas.

Secondly, the forest is a source of livelihood for the local communities. It provides the Giriama and the Wasanya with firewood; building poles for domestic and the tourism industry; timber for commercial trade; carving wood for the tourism industry; medicines for local consumption, research and trade; water and; the biological resource for community butterfly farming. Various ethnobotanical studies undertaken on this forest by Mutta (1987, 1996) and KIFCON have also revealed that the local communities continue to build a traditional knowledge base on uses of the biodiversity through a dynamic traditional research and development system. This wealth of traditional knowledge on the associated biodiversity in the forest make the forest a fertile site for studies. For instance scientific and economic validation of these aspects has become a dominant preoccupation for socio-economists working in this forest.

Thirdly, these studies on the forest have also become urgent because of the diminishing natural resource base attributed to increasing demographic pressures for agricultural land and over-exploitation of the commercial species. As a consequence of the pressures, there has been an increased demand for fast growing commercial species. In response to the increased demand policies, strategies and programs for research and development were until recently, focused on exotic species and expansion of artificial plantations.

Although no cutting is allowed in the 43 km^2 nature reserve, the rest of the indigenous forests were destroyed to make way for expanding exotic plantations.

Vegetation surveys reveal that all the four habitats continue to be modified by the cutting of saplings and small trees in particular to meet the demand from the building industry as well. In Rippley and Bond, 1971, A. D. Forbes, Watson stated that about half of the Sokoke forest was destroyed between 1961 and 1971. Areas referred to are south and east of the gazetted forest reserve. Similar areas to the west continue to be cut and settled. The whole area to the east of the Mida-Jilore tract is potentially threatened and especially high rainfall areas occupied by lowland rainforest.

These trends have been at the expense of indigenous species, including medicinal plants, which the local communities rely upon. At loss is also the associated traditional knowledge which continues to play an important role in health care in rural areas but whose value and contribution is little understood by policy makers. As a result of lack of adequate understanding of the role and value of traditional knowledge and biodiversity in health care, policies on health care have tended to marginalise traditional medicine.

It is therefore paramount that more research is done to increase understanding of the role played by indigenous forests and the associated traditional knowledge with the view to build a case for its broadened utilisation and to contribute to the development of appropriate and supportive policies.

8.2 THE GIRIAMA

The study was done among the Giriama who are the main inhabitants around the Arabuko Sokoke forest. Once exclusively occupied by the Wasanya, the Giriama have since dominated the forest and its environs. Field study in a tribal area was selected because it offers first hand information (Rao & Hajra, 1986). However, prior understanding of their cultural background is vital for gaining entry into the community and confidence of the target group. I interacted with the traditional medicine practitioners among the Giriama who belong to the broader tribal group Mijikenda to which I also belong.

The Mijikenda all share a common and in many ways remarkably consistent tradition of origin: that they came from Singwaya, a place in the north, in Somalia whence they were driven by a war with the Galla, a pastoral group who played the role of destructive villains in many historical traditions and written histories of the East African coast. From Singwaya, the Mijikenda came south and settled in the Kenya coast hinterland in Kilifi and Kwale Districts (Parkin, 1991).

The Giriama are the largest cluster of the Mijikenda (Brantley, 1981). Numbering approximately 165,000 in 1999 and occupying almost 6,475 km square. Mostly in scattered patrilineal, patrilocal homesteads, today they are the major population in

Kilifi District, Coast Province (Brantley, 1981; Parkin 1991). They dominate the woodland plateau in Kenya's immediate coastal hinterland between the town of Mombasa and the Malindi/Mambrui complex, in Kilifi and Malindi Districts.

Their homesteads are linked primarily by footpaths. A network of dirt roads joins small administrative centres such as Ganze, Hadu, Kinarani and Vitengeni. The only semi urban population is at Kaloleni in the southwest, where cash crops foster a concentrated residence pattern. They are agriculturists, pastoralists, laborers, fishermen, hunters and traders. Their economy is based on their own grain. They cultivate the traditional staple crops of millet (*mawele*), sorghum (*mtama*), eleusine (*wimbi*), cassava, beans (*kunde*), sweet potatoes, pulses (*pojo*) and yams and they also grow tobacco and castor beans. At Kaloleni and in the government settlements, coconut trees are cultivated for *tembo* (palm wine) or corpra (for oil) and scattered cashew trees offer cash income. A significant proportion of them continue to rely on the Arabuko Sokoke forest for medicines, food, wild fruits, firewood, construction timber and poles.

The majority of the population speak kiGiriama rather than kiSwahili, though the languages are extremely close linguistically. Although some of the younger generation have adopted western dress, most Giriama still wear imported cloth wrappers; the elders wear a waist cloth and carry a walking stick; Giriama women still wear the traditional short, layered skirts which resemble ballet tutus *mahando* (once made of grass, these are now made of cotton cloth). Today, the Giriama are represented in local government by appointed chiefs, but some daily government is still conducted by local councils of elders (Brantley, 1981).

8.3 IMPACT OF THE HEALTH POLICY STRUCTURE ON TRADITIONAL MEDICINE

As indicated in Chapter Seven above, the current legal and economic arrangements on traditional medicine are inimical to its development. For instance, the persistent policy of legal abstention mean that the practice continues to be disadvantaged. The lack of an effective regulatory system creates an environment that is at best passive to the development of traditional medicine technologies. One pervasive impact of the policy and legal *in vacuo* state has been the flourishment of the institution and its practice outside any legal framework. The absence of standards for vetting has led to incidences of quackery. The absence of ethical standards has also led to incidences of abuse of patients' rights. These incidences have only served to shroud an otherwise reliable practice with skeptism.

The current institutional arrangements have also frustrated the institutional and professional development of traditional medicine. Despite its current contribution, traditional medicine is still treated with great disdain and skeptism by mainstream health care. It is officially administered under the Ministry of Culture and Social Services and receives much less financial and technical support than modern medicine. For example in the Coast Province, there is only one District Cultural Officer who is responsible for the administration of the practice of traditional medicine for the whole province. There are no recurrent funds specifically allocated by the Government to this assignment. As a result, it remains undeveloped.

Traditional medicine is thus alienated; its role in mainstream health care marginalized and its participation in the modern economy limited. The exclusivity of the policy structure has thus led to the undervaluation of products of the practice. An examination of this aspect was undertaken on traditional medicine products in the study site to determine the impact of the exclusive health care structure on their economics.

The impact on economics of traditional medicine products were determined among the *Giriama* living around the Arabuko Sokoke Forest at the coast. Two aspects were examined: the allocation of the burden of disease to traditional medicine *vis a vis* modern medicine, and the cost implications for the regimes applied for the five most prevalent disease conditions in the area.

Using a pretested questionnaire, a total of 63 respondents including modern and traditional medicine practitioners and hospital administrators were interviewed. The overall objective was to determine the economics of traditional medicine under the current health care arrangement. First, the health care arrangement was defined subsequent to which the disease prevalence pattern was developed. The management regimes applied were documented and economic analyses undertaken.

8.3.1 The Health Care Profile of the Local Communities

There are eight administrative locations bordering the Arabuko Sokoke Forest (see Figure 8.1). East of the forest are Gede and Roka locations which border the Indian Ocean to the east. North of the forest is Ganda location, west of the forest are Jilore, Mwahera and Vitengeni locations and south of the forest are Sokoke and Ngerenya locations.

Health Care Facilities

A survey of the locations revealed that there are two dominant health care practices including modern and traditional medicine. The distribution of the health care facilities, per location and the population size each serves is presented in Table 8.2 and

Figure 8.1. The survey revealed that there are nine government health care facilities offering modern health care services, and a total of 103 traditional medicine practitioners offering traditional medicine services to the local communities.

The modern health care facilities include two referral District hospitals in Kilifi and Malindi and seven other government health facilities, including six dispensaries and one health center. Seven out of the eight locations, have each a health care facility. However, Dida Dispensary in Sokoke location was closed down due to lack of essential supplies of drugs and dressings. Therefore, two locations namely Sokoke and Mwahera do not have government health care services. For those living in these locations, they have to travel to other locations for government health care services. The ratio of a population to a government health care facility is therefore 129,581/6 (21,597) approximately 1: 20,000 or 4.6 facilities to a 100,000 population. In addition, the survey also revealed that those facilities that were operational were not without problems. More often than not, the dispensaries experienced drug shortages and the only drug available most of the times was Panadol, an analgesic. This means that the patients have to purchase drugs from chemists and private clinics with cash out of their pocket or seek alternative services such as traditional medicine.

The traditional medicine services were primarily offered by 103 traditional medicine practitioners practising around the forest from which they sourced medicinal plants. The ratio of the population to a traditional medical care point is therefore 129,581/103 (1,258 to one traditional medicine practitioner) or 79.5 traditional medicine practitioners to a population of 100,000.

Subsequent to the identification of the health care facilities, the disease prevalence pattern among the local communities was determined. Detailed interviews were undertaken in all the locations with health care personnel from both practices with the objective of identifying the disease conditions encountered and the proportion of the disease burden managed by traditional medicine.

Burden of Disease

A total of twelve medical personnel working in the eight government health facilities and a sample of 51 traditional medicine practitioners were interviewed. First and foremost, discussions were held with staff in the referral hospitals to generate data on disease prevalence at the district level. The five most prevalent disease conditions were then determined on which detailed surveys at the location level focused.

Table 8.3 and Figure 8.2 present some statistics on the leading causes of diagnosis asreported by the Ministry of Health institutions in Kilifi District, over the period 1995 to 1997. Figures in column 2 of the table are derived from the medical records departments of Kilifi and Malindi District Hospitals

Table 8.2: Healthcare facilities available around the Arabuko Sokoke Forest, including modern and traditional medicine.

Location	Population (1998 estimates)[2]	Name of government healthcare facility	Number of TMPs
Gede	25,555	Gede Dispensary	10
Ganda	10,757	Kakuyuni Dispensary	9
Jilore	5,597	Jilore Dispensary	10
Ngerenya	22,199	Ngerenya Dispensary	8
Sokoke	13,847	Dida Dispensary (But closed down)	7
Vitengeni	14,319	Vitengeni Rural Health Centre	25
Roka	22,521	Matsangoni Dispensary	23
Mwahera	14,786	No government health care facility	11
TOTAL	129,581	6 operating facilities	103
HEALTH FACILITY PER POPULATION RATIO (Per 100,000)		1: 21,597 (4.6)	1: 1,258 (79.5)

Source: Central Bureau of Statistics Malindi and Kilifi; Kilifi District Hospital 1996 annual report and; interviews

The figures represent the number of disease cases diagnosed and treated at the District Hospitals, dispensaries and health centres located in Kilifi District (which by then included all the health facilities in Malindi and Kilifi Divisions). An average of 392,821 diseases cases were reported every year. The five most prevalent conditions include: malaria which accounted for about 39 per cent of the total disease prevalence; diseases of the respiratory system accounted for 26 per cent; diseases of the skin accounted for about 11 per cent; diarrhoea accounted for about 6 per cent and intestinal worms accounted for 5 per cent. These conditions accounted for 86.7 per cent of the total disease cases reported from all the health institutions in the then Kilifi District (see Appendix 8.1). Although the pattern of disease prevalence is similar to the national disease profile (see chapter seven), the proportion for malaria is much larger attributed to the fact that malaria is endemic to the Coast Province.

2 Extrapolated from 1989 figures

Table 8.3: Some annual statistics on leading causes of diagnosis as documented by the Ministry of Health institutions in Kilifi District, 1995 to 1997

Disease Condition	Average[3]	Incidence per unit population	Percentage(%)
Malaria	152,235	0.1887	38.75
Diseases of the Respiratory System	101,829	0.1262	25.92
Diseases of the skin	41,749	0.0518	10.63
Diarrhoea	25,069	0.0311	6.38
Intestinal worms	19,773	0.0245	5.03
Urinogenital Tract Infections	15,308	0.0190	3.90
Anaemia	12,582	0.0156	3.20
Accidents (including burns and fractures)	8,726	0.0108	2.22
Ear Infections	7,332	0.0091	1.87
Eye Infections	8,217	0.0102	2.09
TOTAL	**392,821**	**0.4869**	**100**

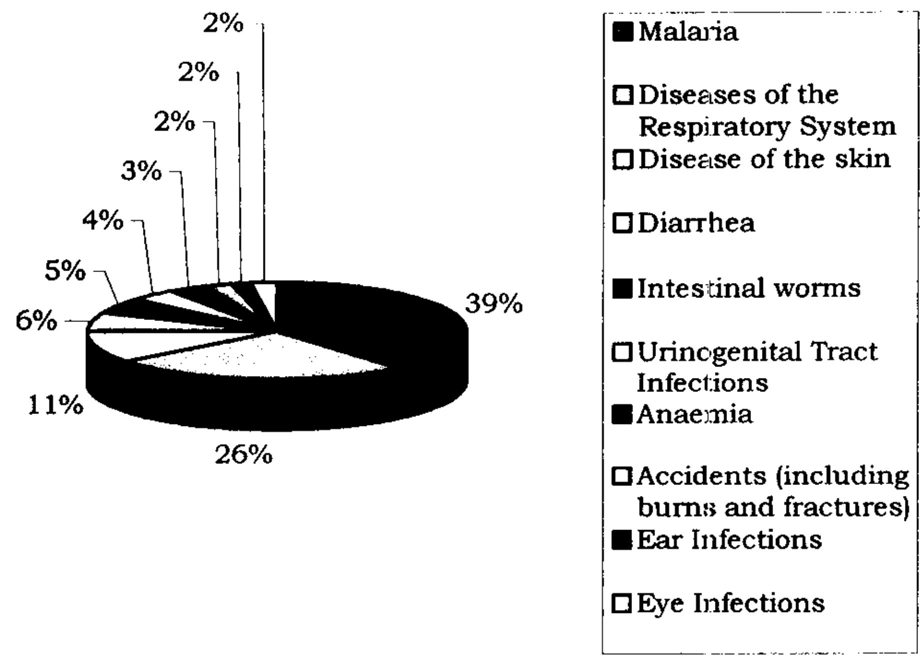
The population of Kilifi District was 806,780 (1999 estimates)

Disease incidence per unit population in column 3 of the Table represents the frequency of the respective disease incidence occurring in a person per year. For example a total disease incidence per population of 0.4869, which is approximately 0.500 means that on the average one individual may experience one disease incident in two years or in a population of 1,000 a total of 487 persons will consult a health care facility once per year. This value is valuable in determining the per capita health care requirements for a particular community and hence the appropriate per capita recurrent expenditure allocation. In-patient morbidity and mortality statistics in Malindi District Hospital presented in Appendices 8.4 a) and b) echo the dominance of malaria and diseases of the respiratory system.

The disease prevalence pattern at the location level was determined through discussions with six medical staff including nurses and clinical officers working in the local dispensaries and a sample of the traditional medicine practitioners practising around the forest. The respondents gave data based on daily and monthly returns and records of patients diagnosed and managed at the particular facility as documented in their respective registers. Annual data were subsequently computed.

[3] The average figures are calculated from official outpatient morbidity statistics for Kilifi District for the years 1995 to 1997 presented in Appendix 8.3.

Figure 8.2 Pie chart showing disease prevalence pattern in Kilifi District



As much data, on disease prevalence around the forest, as was locally available, was documented in the six local health care facilities. Missing data and further details were documented from the Medical Records Department in Kilifi and Malindi District Hospitals and the results compiled into morbidity statistics in Appendices 8.5 (a) to (h). Summary of the statistics are presented in Table 8.4 (a) and (b). The interviews focused on the five most prevalent disease conditions as pre-determined at the district level. However, preliminary surveys with the traditional medicine practitioners revealed that urinogenital tract infections were very prevalent while intestinal worms did not feature prominently. This category of disease was therefore included as the fifth most prevalent condition in place of intestinal worms.

Table 8.4 (a) focuses on the total annual morbidity statistics reported in the government health facilities around the Arabuko Sokoke forest. A total of 78,260 disease cases, are on the average, diagnosed and treated in the dispensaries and health centres per year. This represents approximately 23.3 per cent of the total disease out -patient morbidity statistics attributed to the same conditions in Kilifi District. The most prevalent disease is malaria which is responsible for about 48 per cent of all the disease cases in the area. Malaria is followed by diseases of the respiratory system which represents 30 per cent of the disease cases, which is followed by skin diseases representing 11 per cent, which is followed by diarrhoea which represents 7 per cent and finally by urinary tract infections which represents 3 per cent.

Table 8.4 (b) presents disease incidence per unit population for each disease in every location. The data in this table has been translated into a line graph (see Figure 8.3). The total disease incidence as diagnosed and managed by government health care facilities adds up to 0.6039 (Table 8.4 (a)) which means that on the average, every year, out of ten individuals about 6 will seek medical care because of either of the five disease conditions once or out of 1,000 individuals, 604 will consult a government health care facility once. This level of disease incidence is approximately 24 per cent higher than the District's average annual disease incidence for the same disease categories.

In general, the disease incidence tends to be higher in the north and east than in the south and west. The highest disease incidence of 1.5 is in Jilore location followed by Gede (1.0), Ganda (0.90) and Roka (0.70) and Vitengeni (0.70) locations. The lowest disease incidence is in Ngerenya location (0.40). Various factors could explain this pattern including altitude, sociocultural factors, sanitation, access and availability of the services. A more detailed investigation on these and related factors could help explain this pattern. But pertinent to this study is the access and availability. For instance the high disease incidence in Jilore could be due to the use of facilities by those in the neighbouring Mwahera location as well, who don't have access to health care services.

Malaria is most prevalent in Gede and Ganda locations and least prevalent in Ngerenya location. Diseases of the respiratory system are most prevalent in Jilore and Ganda locations and least prevalent in Roka location. Skin diseases are most prevalent in Jilore and least prevalent in Vitengeni location. Diarrhoea is most prevalent in Jilore and least prevalent in Ngerenya. Urinary tract infections are most prevalent in Jilore location and least prevalent in Ngerenya location. Except for malaria, Jilore experiences highest incidences for all the disease conditions. On the other hand, Ngerenya experiences the lowest disease incidences for all the conditions except skin diseases.

This pattern of disease incidence represents the relative demand for the specific drugs supplies for the various disease management, per location, and could guide the optimum allocation of resources to the various locations.

Discussions with the traditional medicine practitioners revealed the disease prevalence pattern as diagnosed and managed by the traditional medicine system.

Table 8.4 (a) Total Official Morbidity around the Arabuko Sokoke Forest

Disease Condition	Annual Prevalence	Incidence Per Unit Population*	Percentage (%)
Malaria	37,827	0.2919	48.33
Respiratory Tract Infections (RTI)	23,537	0.1816	30.08
Skin Diseases (SD)	8,782	0.0678	11.22
Diarrhoeal Diseases (DD)	5,613	0.0433	7.17
Urinogenital Tract Infections (UTI)	2,502	0.0193	3.20
TOTAL	78,260	0.6039	100.0000

* The population was 129,581

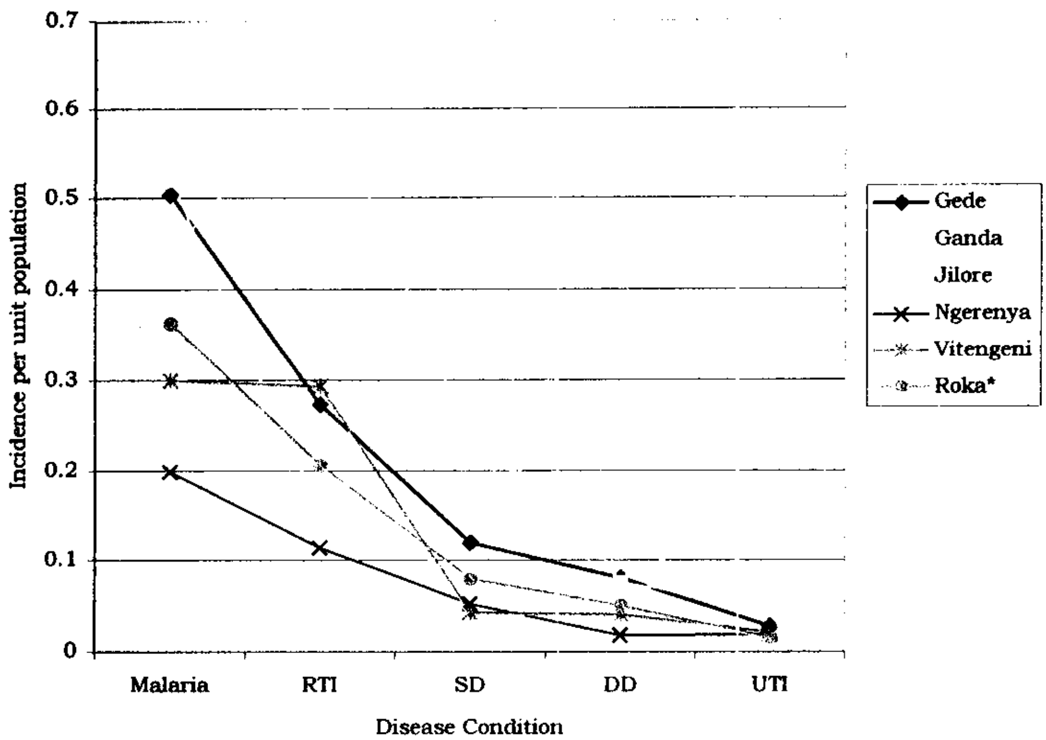
Table 8.4 (b) Disease incidence, per unit population, diagnosed in government health facilities around the Arabuko Sokoke Forest

Disease Condition	Gede	Ganda	Jilore	Ngerenya	Vitengeni	Roka*
Malaria	0.5044	0.5204	0.4399	0.1995	0.2993	0.3626
Respiratory Tract Infections (RTI)	0.2734	0.1542	0.6269	0.1152	0.2929	0.2055
Skin Diseases (SD)	0.1201	0.0812	0.2310	0.0525	0.0420	0.0790
Diarrhoeal Diseases (DD)	0.0803	0.0757	0.1206	0.0182	0.0395	0.0491
Uronogenital Tract Infections (UTI)	0.0274	0.0463	0.0465	0.0190	0.0206	0.0146
TOTAL	1.0057	0.8778	1.4649	0.4043	0.6943	0.7108

* please note the absence of columns for Sokoke and Mwahera as these locations do not have government health care facilities. The incidences in these locations are documented in facilities in the neighbouring locations.

A random sample of 51 traditional medicine practitioners was selected from all the eight locations for interviews. Data was generated on their individual specializations with the view to determine their expertise and the number of cases they diagnose and manage. The proportion of expertise on the various diseases was determined from the sample and the ratio used to estimate the total number of cases managed by the traditional medicine practitioners in each location, over a time period.

Figure 8.3 Scatter diagram with smooth lines comparing disease incidence per unit population as diagnosed in government facilities around the Arabuko Sokoke Forest



Data was recorded on the five most prevalent diseases pre-determined above. Because of the varied specialisation among the traditional medicine practitioners, any expertise in diseases other than the five were also noted. As mentioned above, an analysis of the disease prevalence pattern experienced by traditional medicine revelaed that urinogenital tract infections were very prevalent and had therefore to be included in the five most prevalent diseases in the study.

Out of the 51 traditional medicine practitioners interviewed, forty two of them keep count of their patients and came up with estimates of disease cases per day, week or season. Some of them kept records because it was a requirement by the Department of Social Services to submit monthly reports in order to qualify for a practice license. Six of them did not keep records and could not recall the count of patients and number of disease cases they diagnose and treat. Three of them were involved only in diagnosis through the practice of divination. One practitioner in Gede Location was a licensed trader who harvests various medicinal plants from the forest and sells them to other practitioners in Malindi and Mombasa (see Appendix 8.4).

The estimate number of disease cases managed by the practitioners in the eight locations were estimated as determined by the number of practitioners able to manage the five most prevalent diseases. Among the 42 practitioners who were interviewed, a total of 9,298 disease cases were diagnosed and managed per month (see Appendix 8.4 (b)). Average disease cases managed by a practitioner per month for each location were calculated and recorded in Appendix 8.4 (c). Appendix 8.4 (d) column 2 presents the proportion of the practitioners with the various expertise for the all the locations around the forest. Columns 3 to 10 presents the estimate number of practitioners with the various expertise for each location. The product of the average disease cases per practitioner per month in each of the location in Appendix 8.4c), and the estimate number of practitioners with the various expertise in each of the locations in Appendix 8.4 (d), columns 3 to 10, represents the estimate total for disease cases per month for each of the eight locations as presented in Appendix 8.4 (e). These figures are extrapolated into annual estimates by multiplying by 12. In total, an estimate of 140,541 diseases cases are diagnosed and managed by traditional medicine practitioners in the eight locations (see Table 8.5 a) and Appendix 8.4 (e)). About 36 per cent of the disease cases are attributed to malaria; 8 per cent to respiratory tract infections; 24 per cent to diarrhoeal diseases; 4 per cent to skin diseases and 28 per cent to urinogenital tract infections.

The annual disease incidence per unit population was calculated for each location and disease by dividing the total disease incidence by the population for each location (see Table 8.5 (b)). The overal disease incidence diagnosed and managed around the Arabuko Sokoke Forest by traditional medicine is about 1.0846 which is exclusive of the disease incidence diagnosed and managed by the government health care facilities. This figure indicates the contribution by traditional medicine to the amelioration of the burden of disease. This figure means that the people around the forest on the average one individual will visit the traditional medicine practitioner once per year for either one of the five most prevalent diseases or out of 1,000 individuals 1,085 disease incidences of any of the five prevalent diseases will be diagnosed and treated by a traditional medicine practitioner.

The graphical presentation of morbidity per unit population reported by traditional medicine in Figure 8.4 reveals that the disease incidence tends to be higher in the west and south, suggesting a higher reliance on traditional medicine in these locations as opposed to incidences reported by modern medicine facilities which tends to be higher in the north and east. The highest disease incidence is in Vitengeni followed by Mwahera and Jilore. The least disease incidence is in Ngerenya. The higher reliance in the south and west is because of the easier access to traditional medicine and related to the abundance of traditional medicine practitioners. For example the ratio of traditional medicine practitioners doctors to 100,000 population is highest in Jilore and Vitengeni and lowest in Ngerenya whereas in Mwahera there is no government health care facility.

Disease Management Regimes

There are two main technological products for the management of the disease conditions outlined above. These include modern drugs applied exclusively in the modern medicine health facilities, and traditional medicines applied exclusively by the traditional medicine practitioners. Table 8.6 lists the various treatment regimes currently applied by the two practices in the study area. Column 2 of the table presents the types of drugs applied in the government health care facilities for the various disease conditions. They include, among others, antimalarial drugs, antibiotics, antifungal drugs, analgesics and antipyretic drugs. All of them are modern drugs developed and promoted through the modern science research and development protocols. They are recommended by the WHO and constitute the essential drugs list prepared by the Ministry of Health. Column 3 presents traditional management regimes. They include mainly medicinal plants identified by the traditional medicine practitioners and classified into genera and family, the dominant families are included in the parenthesis. The various plant species either singly or in combination are employed to manage the various disease conditions. None of them are officially recognized by the Ministry of Health and their use may be illegal.

Table 8.5 a) Total Morbidity as diagnosed by the Traditional Medicine Practitioners around the Arabuko Sokoke Forest

Disease Condition	Total	Incidence per unit population	Percentage (%)
Malaria	50,341	0.3885	35.82
RTI	1,1574	0.0893	8.23
SD	5,540	0.0428	3.94
DD	33,255	0.2566	23.66
UTI	39,833	0.3074	28.34
TOTAL	140,542	1.0846	100.000

Figure 8.4 Scatter diagram with smooth lines comparing disease incidence per unit population as diagnosed by TMPs around the Arabuko Sokoke Forest

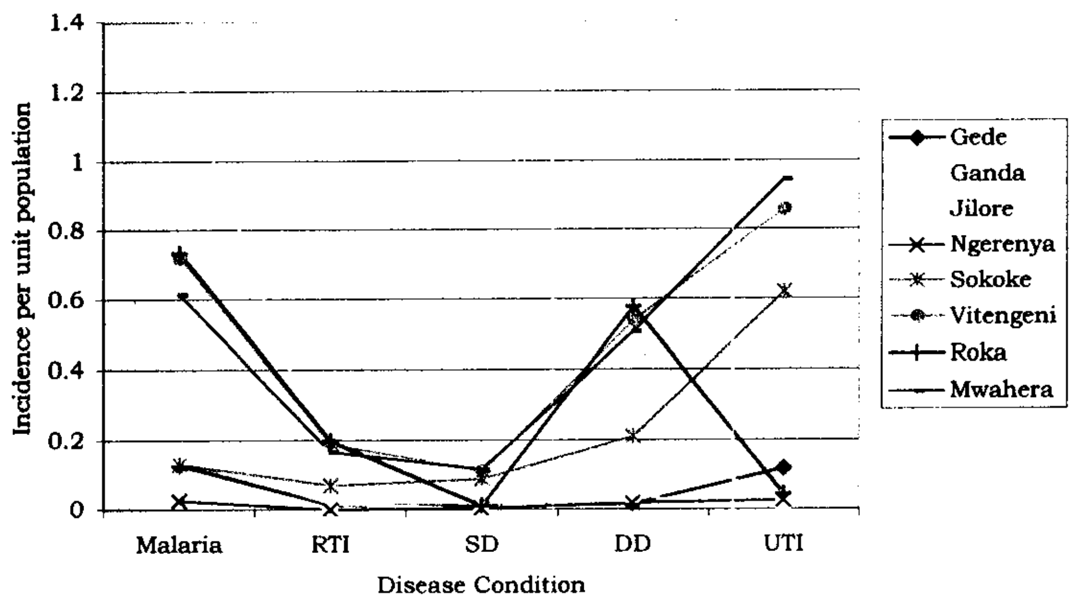


Table 8.5 b): Disease incidence, per unit population, diagnosed by the TMPs around the Arabuko Sokoke Forest

Disease Condition	Gede	Ganda	Jilore	Ngerenya	Sokoke	Vitengeni	Roka	Mwahera	Total Estimates
Malaria	0.1288	0.1512	1.2667	0.0272	0.1300	0.7189	0.7343	0.6153	0.3885
RTI	0.0141	0.0169	0.0731	0.0027	0.0690	0.1358	0.1982	0.1678	0.0893
SD	0.0089	0.0062	0.0627	0.0055	0.0866	0.1097	0.0109	0.1188	0.0428
DD	0.0162	0.0388	0.1626	0.0209	0.2076	0.5360	0.5770	0.5076	0.2566
UTI	0.1185	0.00656	0.0474	0.0281	0.6172	0.8584	0.0443	0.9474	0.3074
TOTAL	**0.2865**	**0.2197**	**1.6112**	**0.0845**	**1.111032**	**2.4081**	**1.5670**	**2.3569**	**1.0846**

8.3.2 Economics of Traditional Medicine

Market Allocation

The utilisation of traditional medicine as suggested in chapter seven above is higher in the rural areas than in the urban areas. Focus on economics of traditional medicine was therefore confined to a rural area, the Arabuko Sokoke Forest. Based on data presented in Tables 8.2, 8.4 a), b), 8.5 a) and b) above, on the average, the traditional medicine plays a larger role in health care as far as coverage and amelioration of the disease burden is concerned.

According to Table 8.2 there are 79.5 traditional medicine practitioners to a population of 100,000 and 4.6 modern medicine government health facilities for the same. The coverage by traditional medicine is 17 times as great as the coverage by government modern medicine (4.6 facilities to 100,000). This suggests that traditional medicine is more accessible than modern medicine and has therefore a higher probability of being utilised. For example, in Mwahera and Sokoke locations where there is no government health care facility there are seven and eleven traditional medicine practitioners respectively. The only available health care for the poor in these locations is traditional medicine. The total population to health care point (including both modern and traditional medicine services) ratio is therefore enhanced to 1,188 to one health care center.

Table 8.7 presents proportions of disease burden allocated to either modern and traditional management approaches, based on the five most prevalent disease conditions in the area. In effect, data in Table 8.7 are sums of corresponding data in Tables 8.4a) and 8.5 a), representing total disease incidence experienced by the community. An analysis of the management regimes reveals that the reliance on either modern and traditional medicine depends on the disease. The proportion of the burden of disease allocated to traditional medicine ranges from 2.53 per cent for diarrhoea to 23.01 per cent for malaria or 33 to 94 per cent per disease condition. The proportion

Table 8.6 Management Regimes for the five most prevalent disease conditions as applied by the two health care practices.

Disease Condition	Modern Medicine	Traditional Medicine
Malaria	First line of treatment: Chloroquin, Panadol Piriton. Second Line of Treatment: Fansidar Third line of treatment: Quinine	71 species (51 taxa, 25 families 42 genera) (Annonaceae, Euphorbiaceae and Rubiaceae)
Respiratory Tract	Antibiotics. Antibacterial. Analgesics.	23 species (16 taxa, 13 families, 15

Infections	Antipyretic. Rest. Fluids. Decongestant. Steam inhalation. Surgical drainage. Expectorant. Oxygen. Antituberculosis drugs. Proper nutrition. Antihistamines.	genera) Rubiaceae
Skin Diseases	Antibiotics. Antifungal drug. Application of moist heat. Surgical incision and drainage. Antimony preparations. Sterilising open wounds. Whitefield ointment.	18 species (16 taxa, 12 families, 14 genera) Fabaceae, Tiliaceae, Vitaceae
Diarrhoeal Diseases	Antibiotics. Antibacterial. Antifungal drugs. Antiprotozoal. Analgesic. Antipyretic.	25 species (23 taxa, 14 families, 20 genera) Annonaceae, Euphorbiaceae, Anacardiaceae
Urinogenital Tract Infections	Antibiotics. Antimicrobial drugs. Antibacterials. Antiprotozoal. Analgesic. Increased fluid intake. Removal of obstructions.	22 species, (19 taxa, 14 families, 19 genera) Fabaceae, Rubiaceae, Vitaceae, Annonaceae

allocated to modern medicine ranges from 1.14 per cent for urinary tract infections to 17.29 per cent for malaria or 6 to 67 per cent per disease condition. The burden of disease attributed to malaria and diarrhoea were almost equally shared between modern and traditional medicine, 43: 57 and 50: 50 respectively. The highest reliance on traditional medicine was for urinogenital tract infections. About 94 per cent of the infections were diagnosed and managed by traditional medicine. The highest reliance on modern medicine was attributed to diseases of the respiratory system. About 67 per cent of the incidences were diagnosed and managed by modern medicine. For skin diseases traditional medicine contributed more, about 70 per cent.

The total allocation to traditional medicine for these disease conditions adds up to 64.23 per cent. This represents the proportion of the disease conditions managed by traditional medicine exclusively. The total allocation to modern medicine adds up to 35.77 per cent. This represents the proportion of the disease conditions managed by modern medicine exclusively. These statistics indicate that traditional medicine does contribute significantly to the health care system in the locations around the Arabuko Sokoke Forest and that the two medical practices are complimentary.

Table 8.4 a), b) 8.5 a), b), 8.7 a), b) indicate that the total disease incidence adds up to 1.645 per unit population. This means that out of 1000 individuals there will be about 1,645 disease incidences occurring per year managed by either modern or traditional medicine. Out of 1,645 individuals 1,041 (63.3 per cent) of the diseases incidences will be managed by traditional medicine while 604 (36.7 per cent) of the disease incidences will be managed by modern medicine. This is illustrated by the Traditional Medicine incidence curve being higher than the one for official modern medicine (Figure 8.5).

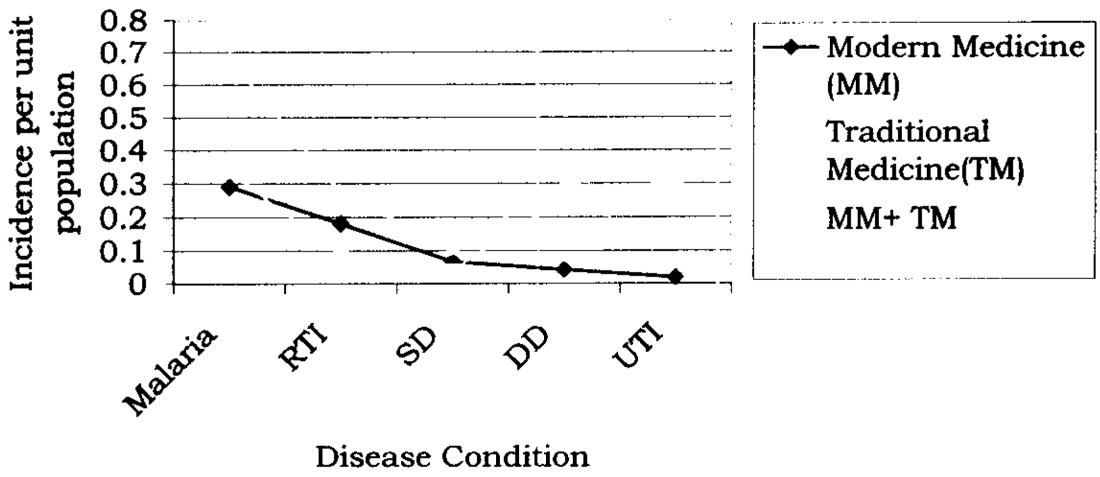
Table 8.7a) Allocation of burden of disease to treatment approaches for the five most prevalent disease conditions around the Arabuko Sokoke Forest

Disease Condition	Annual Prevalence (%)	Modern Medicine (%)	Traditional Medicine (%)
Malaria	88,167 (40.30)	37,827 (42.90) (17.29)	50,341 (57.10) (23.01)
Respiratory Tract Infections	35,110 (16.05)	23,537 (67.04) (10.76)	11,573 (32.96) (5.29)
Skin Diseases	14,322 (6.55)	8,782 (61.32)(4.01)	5,540 (38.68) (2.53)
Diarrhoeal Diseases	38,868 (17.76)	5,613 (14.42) (2.57)	33,255 (85.56) (15.20)
Urinogenital Tract Infections	42,334 (19.35)	2,502 (5.91) (1.14)	39,832(94.09) (18.21)
TOTAL	218,801 (100.00)	78,260 (35.77)	140,541 (64.23)

Table 8.7 b) Allocation of burden of disease, per disease incidence, per unit population to the treatment approaches for the five most prevalent disease conditions around the Arabuko Sokoke Forest

	MALARIA	RTI	SD	DD	UTI	TOTAL
Modern Medicine (MM)	0.2919	0.1816	0.0678	0.0433	0.0193	.6039
	(42.90)	(67.04)	(61.32)	(14.44)	(5.91)	(35.77)
Traditional Medicine(TM)	0.3382	0.0893	0.0428	0.2566	0.3074	1.0846
	(57.10)	(32.96)	(38.68(	(85.55)	(94.09)	(64.23)
MM+ TM	0.6804	0.2710	0.1105	0.3000	0.3267	1.6885

Figure 8.5 Scatter diagram with smooth lines comparing disease incidence between the treatment approaches for the community around the Arabuko Sokoke Forest



Towards the west and north, modern and traditional medicine contribute equally. In these locations the official modern medicine is more accessible than in other locations. Towards the east and south as modern medicine services became less accessible traditional medicine was more accessible and therefore played a larger role in the amelioration of the burden of disease.

The above findings suggest that traditional medicine plays a larger role in health care management in the area than modern medicine. In determining the market share however, its not just the allocation that is a determining variable, the market value is another important variable. Subsequent to the determination of the disease burden allocated to traditional medicine, the market value of the allocation was therefore also determined. This was achieved through determination of the cost of the technologies used for the management of the disease conditions. These were recorded as the costs incurred by either the provider or the consumer for the drug used to manage a particular disease condition per incidence.

Market Value

A comparison of costs of management of various disease conditions under various treatment regimes revealed that traditional medicine services attract the lower income than official modern medicine services (see Tables 8.8 and 8.9 below). For the same disease condition, the economic value of traditional medicine ranges from 18.21 for malaria 86.81 per cent for urinogentical tract infections of the total value of the particular condition. The total cost of managing malaria (40.30 percent of the disease burden) adds up to 61.18 percent of the total cost for all the diseases. Out of the 61.18 percent, the burden managed by traditional medicine (23.01 percent) (57.10 per cent) attracts 11.14 percent (42.90 per cent) of the cost, while burden managed by modern medicine (17.29 per cent) attracts 42.97 per cent of the total cost. On the other hand, for urinogenital tract infections (19.35 percent of the total disease burden) attracts 10.40 per cent of the total cost for all the diseases. Out of this 10.40 per cent the portion of disease burden managed by traditional medicine (18.21 percent) (94.10 per cent) attracts 9.03 per cent while the portion managed by modern medicine (1.14 per cent) (5.91 per cent) attracts 1.38 per cent of this. For the total disease prevalence, the value of traditional technologies, managing 64.23 per cent of the disease burden, is 36.45 per cent of the total while that for modern drugs, managing 35.77 per cent of the disease burden is 63.55 per cent. Therefore, although traditional medicine manages the larger share of the burden of disease it fetches less than modern medicine and therefore a lower market share.

Table 8.8 The cost, in US$, of management regimes for the five most prevalent disease conditions in the Arabuko Sokoke Forest

Disease Condition	**Modern Medicine (Government of Kenya rates)**	**Traditional Medicine**
Malaria	1.57	0.50
Respiratory Tract Infections	0.75	0.63
Skin Diseases	0.25	0.13
Diarrheal Diseases	0.75	0.13
Urinogenital Tract Infection	0.75	0.31

US$1.00= KES 80.00

Column 2 represents the cost o modern drugs to the community- that would be paid by the patients if the government charged for the drugs only. What the government pays/ allocate

Column 3 represents the cost of traditional medicine chargeable to patients by traditional medicine practitioners

Table 8.9 Aggregate costs for disease management by either medicine system for the five most prevalent disease conditions around the Arabuko Sokoke Forest

Disease Condition	Modern Medicine (%)	Traditional Medicine (%)	Total Economic Value (% of Total)
Malaria	59,388 (70.23)	25,170(29.77)	84,558 (61.18)
	(43.93)	(18.62)	
Respiratory Tract	17,653 (70.77)	7,291 (29.23)	
Infections	(13.06)	(5.39)	24,944 (18.24)
Skin Diseases	2,196 (75.30)	720 (24.70)	
	(1.63)	(0.53)	2,916 (2.16)
Diarrhoeal Diseases	4,210 (49.34)	4,323 (50.66)	
	(3.11)	(3.20)	8,533 (6.31)
Urinogenital Tract	1,876 (13.19)	12,348.02 (86.81)	
Infections	(1.39)	(9.13)	14,224.15 (10.52)
TOTAL	85,323 (63.12)	49,853.02 (36.88)	135,176 (100.00)

Columns 2 represents the total cost of disease management by modern medicine by the Ministry of Health. It represents how much the government pays for the drugs to the community.

Column 3 represents the total cost of disease management by traditional medicine. It represents the contribution by the community to their health care per year.

The total costs have been computed as the product of the unit cost (Table 8.8) and the disease prevalence managed (Table 8. 7) by either system.

The figures in the first parenthesis represent the per centage of the cost for the management of a particular disease condition by either system based on the subtotal cost for the management of the particular condition. Per centage cost based on the total cost for all the disease conditions are listed in the second parentheses.

Traditional medicine practitioners charge much less because their legal standing is clouded with confusion. Under the Witchcraft Act, genuine practitioners could be mistaken for witch doctors and therefore criminalised. Under the Medical Practitioners and Dentists Act, unless registered they have no right to charge for their services. They therefore have no incentives to add value to their products. Perhaps because of its low economic value there has been no incentive for developing an effective system to provide traditional innovators with legal incentives. This has led to the plunder of the intellectual property rights of traditional medicine practitioners by pharmaceutical companies and medical researchers. This has in effect led to overexploitation of genetic resources, its loss and that of traditional knowledge. As shown in Chapter Seven, biopiracy continues to deny both local innovators and the government, of equitable economic benefits.

Kenya cannot afford to continue to ignore the development of traditional medicine. Discussions with a section of the government health personnel revealed that they appreciate the current and potential role of traditional medicine in health care and are concerned about the loss of biodiversity and traditional knowledge. However, they indicated, there is need for deeper understanding of the practice with the view to justify its integration into mainstream health care. Even without the justification, as hypothesized in this study, the technological co-evolutionary model also demands that for the model to be effective, the two technology systems must be competent to co-evolve. In the following section 8.4 the fitness of the traditional medicine technology system to co-evolve with the modern system is examined.

8.4 RATIONALE FOR THE ARTIFICIAL SELECTION OF TRADITIONAL MEDICINE PRODUCTS INTO THE MODERN ECONOMY

This case study is therefore also aimed at establishing the rationale, including scientific and economic, for the selection of traditional medicine into mainstream health care. This part of the study was designed to test the second hypothesis that the traditional medicine knowledge system could have the technological competence to co-evolve with the modern medicine system.

As discussed in Chapter Three above, core to technological co-evolution of two technology systems, is the interdependent evolution of the systems occurring as a result of interaction over a long period of time. For effective interaction the two technology systems must meet the criteria necessary for Darwin's model of natural selection. These include:

i) Variation:

There must be high variation, among the products, necessary for evolution by natural selection and can be passed on to the next generation;

ii) Overproduction:

It must produce more products than will survive to maturity;

iii) Survival to reproduce:

At least some of the products must possess capacity to survive and reproduce.

iv) Competence:

The products must posses the most favorable combination of characteristics that give them ability to compete with one another for the limited resources available for them i.e. "survival for existence" and;

In this section, technological dynamics of the traditional medicine knowledge system are analysed for these properties to illustrate its competence at co-evolving with the modern medicine knowledge system.

8.4.1 Technological Dynamics

Based on the ethnobotany survey, a total of 169 plant species were documented in the Arabuko Sokoke Forest to be used locally in ethnomedicine. A total of 82 taxa belonging to 39 families were documented and taxonomically identified (see Appendix 8.5).

As shown in Table 8.6 above, a total of 51 species within 42 genera are traditionally used for the management of malarial and malarial symptoms. A total of 16 species within 15 genera are traditionally used for the management of both upper and lower respiratory tract diseases. For skin diseases, 16 species within 14 genera were documented. For diarrhoeal diseases, 23 species within 20 genera were documented. For urinogenital tract infection, 19 species within 19 genera were documented.

There were two sets of analyses. The first set was done to determine the variability, over productivity and persistence of technologies used to manage malaria and malarial symptoms. Malaria was selected because it was the most common disease condition for which information on technologies for its management was easily accessible. Results of these analyses are presented in Section 8.4.2. The second set was done to determine the competence of traditional technologies for the management of the five most prevalent disease conditions. Results are presented in sections 8.4.3 and 8.4.4

8.4.2 Variability, Productivity and Survivability

To determine the variability, productivity and survivability of the traditional medicine technology system, various types of data were documented. These included the plant species used, the year it was first used by the particular practitioner and what other medicinal uses the plant species is applied for. The data is summarized in the Tables 8. 10, 8.11, 8.12 and 8.13.

Diversity

A total of 71 plant species including 51 taxa in 25 families were documented to manage malaria and malarial symptoms (see Table 8.10). Among these, most of the families (17) or 65 per cent are represented by single species. Compared to the number of modern drugs of five, traditional management regimes represents a higher diversity.

The most dominant families which have more than 3 species represented include Annonaceae, Euphorbiaceae, Rubiaceae, and Verbanaceae.

Table 8.10 List of plant species used to treat malaria and malarial symptoms

	FAMILY	SCIENTIFIC NAME
1.	AMARANTHACEAE	*Psilotrichum scleranthum* Thw Kabarutitsaka (Gir)
2.	ANACARDIACEAE	*Anacardium occidentale* L. Mkanju, Mkorosho (Swa)
3.	ANACARDIACEAE	*Heeria mucronata* Heeria =Ozoroa Mkayukayu (Gir)
4.	ANNONACEAE	*Annona chrysophylla* Pers. Chrysophylla=senegalensis *A. senegalensis* Pers. Mutakuma (Gir), Mtomoko tsaka (Gir)
5.	ANNONACEAE	*Artabotrys monteroae* Oliv. Mbulushi (Gir)
6.	ANNONACEAE	*Polyalthia stuhlmanii* (Engl.) Verdc Mwangajini (Gir)
7.	ANNONACEAE	*Uvaria acuminata* Oliv. Mrori (Gir) Murori (Gir)
8.	ANNONACEAE	*Uvaria lucida* Benth Mdzaladowe (Gir)
9.	ANNONACEAE	*Xylopia arenaria* Engl. Mbarawa (Gir)
10.	APOCYNACEAE	*Carisa edulis* (Forssk.) Vahl Vujeyatsi (Gir)
11.	BOMBACACEAE	*Adansonia digitata L.* Mbuyu (Gir) (Swa) Muyu
12.	COMBRETACEAE	*Combretum illiarie* Engl. Mshinda alume (Gir)
13.	COMBRETACEAE	*Terminalia spinosa* Engl. Mwanga (Gir)
14.	COMMELINACEAE	*Commelina* sp./ *C. bangalensis* Dzadza (Gir)
15.	COMPOSITAE	*Pluchea dioscoridis* DC Munyinywa (Gir)
16.	COMPOSITAE	*Vernonia hildebrandtii* Vatke

17.	EUPHORBIACEAE	*Acalypha fruticosa* Forssk.
		Mlazakoma (Gir)
18.	EUPHORBIACEAE	*Croton menyhartii* Pax.
		Muyama wa nyika (Gir)
19.	EUPHORBIACEAE	*Croton pseudopulchellus* Pax.
		Myama (Gir) Muyama (Gir)
20.	EUPHORBIACEAE	*Croton talaeporus* Radc.-Smith
		Msunduzi (Gir)
21.	EUPHORBIACEAE	*Flueggia virosa* (Willd.) Voigt
		Securinega virosa (Willd.) Baill.
		Mkwamba (Gir)
22.	EUPHORBIACEAE	*Phyllanthus muelleranus* (O. Kuntze) Exell
		Katore (Gir) Mkasisi/ Mkasiri (Swa)
23.	EUPHORBIACEAE	*Suregada zanzibariensis* Baill.
		Mdimu tsaka (Gir)
24.	FABACEAE	*Dichrostachys cinerea* (L.) Wight &Arn
		Mkingiri (Gir)
25.	LABIATAE/LAMIACEAE	*Hoslundia opposita* Vahl
		Mtserere (Gir)
26.	LABIATAE	*Ocimum gratissimum* L. f.
		Mvumba-manga (Gir)
27.	LABIATAE	*Ocimum kilimandscharicum* Gurke
		Mrahani (Gir)
28.	LEGUMINOSAE	*Cassia abbreviata* Oliv.
		Sub family CAESALPINIOIDEAE
		Mhumba (Gir) Muhumba (Gir)
29.	LEGUMINOSAE	*Tamarindus indica L.*
		Mkwaju (Swa)
30.	LILIACEAE	*Asparagus* sp.
		Mwanikanzovu (Gir)
31.	LINACEAE	*Hugonia castaneifolia* Engl.
		Mkuro (Gir)
32.	MALPHIGIACEAE	*Acridocarpus zanzibaricus*
		(Bojer, ex Loud.)
		Mboho, Mbohoboho (Gir)
33.	MALVACEAE	*Gossypioides kirkii* (Mast.) J. B. Hutch.
		Mpambamwitu (Swa)
34.	OLACACEAE	*Ximenia americana* L.

		Mtundukula (Gir)
35.	RHAMNACEAE	*Scutia myrtina* (Burm. F.)
		Mnyahi (Gir)
36.	RUBIACEAE	*Aganthisanthemum bojeri* Klotzch
		Mkaithima (Gir)
37.	RUBIACEAE	*Chassalia umbraticola* Vatke
		Mbanjekuro mkubwa (Gir) Kabanjekuro (Gir)
38.	RUBIACEAE	*Gardenia volkensii* K. Schum
		Mkimwemwe (Gir)
39.	RUBIACEAE	*Pavetta stenosepala* K. Schum
		Mpepo (Gir)
40.	RUTACEAE	*Fagara chalybeum* (Engl.) Engl.
		Fagara+Xanthoxylum
		Xanthoxylum chalybea
		Mdungu (Gir) Mjafari (Swa)
41.	SAPINDACEAE	*Allophylus africanus* P. Beauv
		Mnyangakitswa (Gir)
42.	SAPOTACEAE	*Manilkara mochisia* Mnyago/ Munago (Gir)
43.	TILIACEAE	*Grewia ectasicarpa* S. Moore
		Mkirindi (Gir)
44.	TILIACEAE	*Grewia holstii* Burret
		Mbavung'ombe (Gir)
45.	TILIACEAE	*Grewia plaghiophylla* K. Schum
		Mkone (Gir)
46.	VERBANACEAE	*Avicennia marina*
		(Forssk.) Vierh.
		Mtsui (Gir)
47.	VERBANACEAE	*Clerodendrum acerbianum*
		(Vis.) Benth. & Hook. f. Mkwembe (Gir)
48.	VERBANACEAE	*Clerodendrum hildebrandtii* Vatke
		Mkulausiku (Gir)
49.	VERBANACEAE	*Premna chrysoclada* (Boj.) Gurke
		Mvuma (Gir) Muvuma (Gir)
50.	VERBANACEAE	*Premna hildebrandtii* Gurke
		Mrusapungu (Gir)
		Muvuma (Gir)
51.	VITACEAE	*Rhoicissus revoilli* Planch
		Munywamadzi (Gir)

Table 8.11 Commonality of the use, among the traditional medicine practitioners, of plant species for malaria and malarial symptoms

Number of plant species used (includes unidentified spp)	Number of Traditional medicine practitioners using the plant species
61	1 to 5
15	6 to 10
9	11 to 15
4	16 to 20
0	21 to 25
1	26 to 30

Utilisation

The distribution of the rate of species utilization shows that there are those that are commonly used, by more than 15 practitioners; those that are moderately used, by five to 15 practitioners, and those that are less commonly used, by 5 practitioners or less (see Table 8.11). The most commonly used species include *Ocimum gratissimum*, *Clerodendrum incisum* Klotzch, *Croton pseudopulchellus* and *Uvaria acuminata*. Five more species are used by between 11 and 15 practitioners. These include: *Suregada zanzibariensis*, *Croton menyhartii*, *Uvaria lucida* Benth, *Grewia plaghiophylla*, and *Acalypha fruticosa*. Six more species are used by between six and ten practitioners. These include: *Cassia abbreviata* Oliv., *Fagara chalybeum*, *Chassalia umbraticola* Vatke, *Premna chrysoclada* (Boj.) Gurk *Manilkara mochisia* (Bak.) Dubard and *Hoslundia opposita* Vahl. These 15 species are the essential ingredients for the various formulations prepared by the practitioners for the management of malaria and malarial symptoms. Much more diverse are the 61 species used by five or less practitioners, in various formulations either singly or in combination.

This range of commonality of uses illustrates the level of diffusion of the technologies used to manage malaria which may also indicate level of maturity. For example those species most commonly used, by more than 15 practitioners, represent a high degree of diffusion of those technologies and therefore must be have proven reliable and effective in the disease management. They thus form essential ingredients of the various formulations. They are also technologically mature. The second group of plants used by between six and ten practitioners have gone through some level of diffusion having proven effective for some period and practitioners are gaining confidence in their use. These species are most likely to persist and attain maturity.

Those not so commonly used, by one to five practitioners, represent a lower diffusion level. They could be new innovations under experimentation by the individual practitioners. This group of plants shows a high level of diversity some of which will persist in the use while some may be discarded with time depending on their performance. Some may also be performing various functions, superfluous or otherwise. Table 8.11 also illustrate the temporal development of the regimes. At the bottom of the table are the 61 species, subsequently, less species are more commonly used. The higher diverse species group may represent a pool of technologies at the exploratory or experimental phase at which many species are introduced for trial in the search for more effective formulations but in the longer term, the effective species are selected and diffused while the rest get discarded.

Duration of utilisation

Tables 8.12 a) and b) and Appendix 8.6 shows how this trend may have evolved. In terms of clinical experience there is a range of species that have been introduced at various times and have persisted through different levels of duration. The range of clinical experience by the various practitioners of between three and 97 years categorizes the innovations into recent innovations (up to ten years), innovations that are on trial (from one to two generations) and innovations that have achieved technological maturity having persisted for over two generations and diffused into many practitioners' treatment packages. Due to the fact that only species currently in use were documented it is not possible to determine which species may have been introduced and then discarded. Most of the species are used by more than one practitioner for the same use suggesting consensus on the efficacy of the remedy and therefore reliability.

There are 39 species that have been on clinical trial for between three and 30 years (additions since 1969) that include new innovations and have yet to be passed on to the next generation. Their effectiveness will increase their reliability and confidence by the practitioners to continue to use them. It would be interesting to find out the performance of these new innovations over time. About 41 species have been used for up to 60 years. These species have been effective for now two generations and may be passed on to the next generation if their effectiveness is not surpassed by the new innovations. There are six plant species that have been used for up to a decade. These species include *Acridocarpus zanzibaricus* (Bojer ex Loud) A. Juss (used by three practitioners), Mhepe (used by one practitioner), *Manilkara mochisia* (Bak.) Dubard (used by 15 practitioners), *Scutia myrtina* (Burm. F.) kurx (used by five practitioners), *Uvaria acuminata* Oliv (used by 30 practitioners) and *Hoslundia opposita* Vahl (used by 15 practitioners). Three of these species are used by at least 15 practitioners suggesting a significant degree of diffusion. The other three have not been as highly diffused and could be a preserve of some practitioners. It would be valuable to identify the pharmacological properties of these species. These species have achieved technological maturity, their use having persisted over three generations and been diffused to a high proportion of practitioners. This shows a succession of the management regimes. There are those that will be discarded and there are those that will persist over generations. In the search for more effective formulations some new ones will be introduced for experimentation. Therefore at any one time the composition of the set of species in use is a variation of a previous set.

Table 8.12 a) Development of management regimes for malaria and malarial symptoms over time

Time period in use (year)	Year	Number of new additions	Rate of Introductions (%)
0 – 10	1902 to 1911	6	
10 – 40	1912 to 1941	4	40.00
40 – 70	1942 to 1971	51	80.95
70 – 100	1972 to 2001	23	26.74

Table 8.12 b) Persistence of use of management regimes for malaria and malarial symptoms

Time Duration (Years)	Specific date	Number of introductions	Persistence
0 – 30	Since 1969	39	Less than one generation
30 – 60	Additions between 1939 and 1969	41	Over one generation
60 – 90	1909 to 1939	-	
Over 90	Before 1909	6	Over 3 generations

These statistics illustrate the dynamics of innovations and the productivity of the traditional knowledge system. It shows that not all species introduced may persist to technological maturity. Depending on their capacity to compete with current and new innovations, they may continue to be used or they may be discarded. As some species are introduced some are discarded and the practitioners are in continuous search of more effective plant species in particular as resistant strains of malarial parasites evolve. The more effective species are thus diffused into the market.

Mutliple and cross applications

In analyzing the technological dynamics of the traditional knowledge system, it is evident that many of the species have other applications for the amelioration of other diseases of economic importance (see Table 8.13). At the family level, an analysis of the ethnobotanical data reveals four plant families with plant species used in the management of diseases in more than two categories. Plant species documented in the Euphorbiacea and Rubiaceae families are used in the management of diseases in three different disease categories, while those in Annonaceae and Fabaceae families are used in the management of two different disease categories.

At the species level, at least 22 (43 per cent) different species, have other applications. Most of these species have more than one use. About ten species are also used for respiratory tract infections, seven for also skin diseases, thirteen also for diarrhoeal diseases and eight for urinogenital tract infections as well. One species, *Fagara chalybea* in the Rutaceae family, is used in the management of all the five disease

Table 8.13 Multiplicity of uses for the plant species used to manage malaria and malarial symptoms

Xx	Plant Species	Ethnomedical Use
1.	AMARANTHACEAE *Psilotrichum scleranthum* Thw Kabarutitsaka	SD, RTI, UTI
2.	ANNONACEAE *Annona senegalensis* Pers. Mutakuma (Gir)	DD
3.	ANNONACEAE *Polyalthia stuhlmanii* (Engl.) Verdc Mwangajini (Gir)	DD
4.	ANNONACEAE *Uvaria acuminata* Oliv. Mrori (Gir) Murori (Gir)	DD, UTI

5.	ANNONACEAE *Uvaria lucida* Benth. Mdzaladowe (Gir)	DD
6.	ANNONACEAE *Xylopia arenaria* Engl. Mbarawa (Gir)	RTI
7.	BOMBACACEAE *Adansonia digitata L.* Mbuyu	SD
8.	CAESALPINIOIDEAE *Cassia abbreviata* Oliv. LEGUMINOSAE Sub Family Mhumba (Gir) Muhumba (Gir	UTI, RTI
9.	EUPHORBIACEAE *Croton menyhartii* Muyama wa nyika (Gir)	RTI
10.	EUPHORBIACEAE *Croton pseudopulchellus* Pax. Myama (Gir) Muyama (Gir)	DD
11.	EUPHORBIACEAE *Phyllanthus muelleranthus* (O. Kuntze) Exell Katore	DD
12.	FABACEAE *Dichrostachys cinerea* (L.) Wight & Arn Mkingiri (Gir)	SD
13.	LABIATAE/LAMIACEAE *Hoslundia opposita* Vahl. Mtserere (Gir	DD
14.	LEGUMINOSAE *Tamarindus indica* Mkwaju	DD
15.	RUBIACEAE *Aganthisanthemum bojeri* Klotzch Mkaithima (Gir)	RTI
16.	RUBIACEAE *Chassalia umbraticola* Vatke Mbanjekuro mkubwa (Gir) Kabanjekuro (Gir)	RTI
17.	RUBIACEAE *Gossypioides Kirkii* K. Schum Mpambamwitu (Swa)	DD, RTI
18.	RUTACEAE *Fagara chalybeum* (Engl.) Engl. Fagara+Xanthoxylum	SD, UTI, RTI, DD

	Xanthoxylum chalybea Mdungu (Gir)	
19.	TILIACEAE	SD
	Grewia ectasicarpa S. Moore Mkirindi (Gir)	
20.	TILIACEAE	SD, DD
	Grewia plaghiophylla K. Schum Mkone (Gir	
21.	VERBANACEAE	DD, RTI
	Premna chrysoclada (Boj.) Gurke Mvuma (Gir)Muvuma Gir)	
22.	VITACEAE	UTI, SD
	Rhoicissus revoilli Planch Munywamadzi (Gir)	

categories. *Psilotrichum scleranthum* in Amaranthaceae is used in the management of malaria, respiratory diseases, skin diseases and UGTI. *Cassia abbreviata* in Leguminosae is used in the management of malaria, URTI, and UTI; *Gossypioides (Gossypium) Kirkii* and *Premna chrysoclada* in Verbanaceae, are used in the management of malaria, URTI and diarrhoeal diseases; *Uvaria acuminata* is used in the management of malaria, diarrhoea and UGTI; *Xylopia arenaria* in Annonaceae, *Chassalia umbraticola* and *Croton pseudopulchellus* in Euphorbiaceae are used in the management of malaria and URTI; *Adansonia digitata* in Bombacaceae, , *Dichrostachys cinerea* in Fabaceae, and *Grewia ectasicarpa* in Tiliaceae are used in the management of malaria and skin diseases; *Annona chrysophylla, Artabotrys monteroae, Polyalthia stuhlmanii, Uvaria lucida* in Annonaceae, *Tamarindus indica* in Caesalpiniaceae, and *Phyllanthus muelleranthus* in Euphorbiaceae, are used in the management of malaria and diarrhoea; *Acridocarpus zanzibaricum* in Malphighiaceae, *Clerodendrum acerbianum* in Verbanaceae; *Scutia myrtina* in Rhamnaceae are used in the management of malaria and UTI. This cross application and multiplicity of uses illustrates the over productivity of the traditional knowledge system. The overproduction of the traditional knowledge system is further illustrated by the high number of species of 71 plant species as opposed to modern medicine where only a handful of drugs are currently in use (see Table 8.14).

In summary, the variation of the products of the traditional knowledge system is illustrated by the diversity of the plant species in use including fifty-one different taxa in 47 different genera in 26 different families and multiplicity of applications. On productivity, the set of the plants in use today was developed from a diverse set of plant species that have been on trial and through testing these have been selected while some were discarded. The ability of the traditional knowledge system to survive to produce is illustrated by the diverse age of innovations including continual introduction of new innovations which shows the capacity of the knowledge system to respond to new disease challenges just as the modern knowledge system is continuously preoccupied with developing new drugs for new disease challenges.

8.4.3 Competence

Scientific

To determine the competence of traditional medicine technologies scientific data including phytochemical and pharmacological properties of the management regimes for all the five disease conditions were collated. They were documented to particularly respond to various hypotheses based on disease pathology outlined below. The hypotheses are based on the premise that for traditional medicine technologies to co-evolve with modern medicine technologies, they could be having similar properties. The competence of the species at competing with modern medicine drugs is indicated by the high proportion of patients treated per year discussed above, and the chemical and biological profiles of the plant species used in relation to the disease pathology.

In modern medicine, depending on the pathology of the disease, a drug with a counter effect is prescribed (see Table 8.14) which presents the modern medicine management regimes for the five most prevalent diseases, their chemical constituents and mode of activity. In the government health facilities the drug is selected from a diversity of pharmaceutical products depending on the severity of the disease condition. The relationship between the disease' pathology and the mode of action of the drug

applied for the various diseases is discussed below. This is done so as to establish the relationship between the cause of the disease and the remedy, the basis of which forms the core of the hypotheses to test other disease management options.

Table 8.14 Disease symptoms, pathology and management regimes applied including modern and traditional medicine approaches

Disease Condition	Symptoms	Pathology	Modern Medicine	Traditional Medicine
Malaria	Recurrent episodes of chills, fever, headache, anemia, Muscle ache, enlarged spleen.	Infection illness caused by *Plasmodium* protozoa through the bite of an infected *Anopheles* mosquito or through blood	Chloroquine an ameobicidal Quinine derivative Combination of Quinine- a Cinchona alkaloid, Sulfonamides (antibacterial drugs) and other drugs First line of treatment:	71 species (46 taxa, 19 families 42 genera) (Annonaceae, Euphorbiaceae and Rubiaceae)

		transfusions or hypodermic needles *Plasmodium falciparum*	Chloroquin, Panadol (analgesic, antipyretic) Piriton (antihistamine) Second Line of Treatment: Fansidar (a combination of antimalarial Pyrimethamine and antibacterial Sulfadoxine) Third line of treatment Quinine a Cinchona alkaloid	
Diseases of the Respiratory System	Common cold, pharyngitis (sore throat), rhinitis (tonsillitis), sinusitis, bronchitis, pneumonia, tuberculosis	Infection by streptococcus *S. pyogenes* a gram positive coccus, allergy, change in atmospheric pressure Infection by bacteria *Pneumococcus*, viruses, fungi rickettsia Caused by acid fast bacteria in the genus Mycobacterium	Antibiotics: Penicillin, Erythromycin Analgesics Rest, Fluids, Decongestant, steam inhalation, surgical drainage Fever and pain reducers, expectorant, oxygen. Antituberculosis drugs e.g. Isoniazid, proper nutrition Antibiotic, antihistamines drugs. Septrin- a combination of antibacterials Sulphamethoxazole and Atrimethoprim; Paracetamol- analgesic, antipyretic Piriton- antihistamine Chlopheniramine maleate Antibacterial Amoxycillin	28 species (21 taxa, 12 families, 20 genera) Rubiaceae
Skin Diseases	Wound infection, boils, ulcers, ringworm, Leishmaniasis	Bacterial and fungal infection *Staphylococcus epidermitis (albus)* and S. aureus are gram-positive cocci colonists of skin. *Streptococcus*	Antibiotics, applications of moist heat, surgical incision and drainage Antimony preparations. Sterilising open wounds, antibiotics such as	20 species (18 taxa, 12 families, 16 genera) Fabaceae, Tiliaceae, Vitaceae

		pyogenes is gram-positive coccus. Caused by *Leishmania tropica* parasite	Chloramphenical-broad spectrum antibiotic Whitefield ointment and antifungal keratolytic benzoic acid salicylic acid	
Diarrhoeal Diseases		Viral or bacterial infection, food poisoning, disorder of the colon gastrointestinal tumour, metabolic disorder. Caused by *Escherichia coli* gram-negative bacteria. *Salmonella enteritis* cause food poisoning, *Salmonella enteriditis* causes gastroenteritis, *S. typhi* causes enteric fever. Caused by protozoa or chemical irritants	Antibiotics and antifungal drugs- Tetracycline (antibiotic) Flagyl- antibacterial, Metronidazole antiprotozoal, paracetamol (analgesic, antipyretic); Chloramphenical-broad spectrum antibacterial and antibiotic	20 species (18 taxa, 8 families, 15 genera) Annonaceae, Euphorbiaceae, Anacardiaceae
Urinogenital Tract Infections	Cystitis, urethritis, pyelonephritis, gonorrhea, syphilis, chills, fever, pain, urinary frequency	Bacterial, fungal infection, stones, tumor, trauma. Caused by bacteria, viruses, fungi, protozoa, and ectoparasites. *Neisseria gonorrhea*, (Gram negative) *Treponema pallidum* bacterial pathogens	Antibiotics, increased fluid intake. Antibacterials, pain relievers. Antimicrobial drugs, removal of obstructions. Gentiamycin- a broad spectrum antibiotic in the Aminoglycoside family; Metronidazole – antibacterial and antiprotozoal; Antibiotics- Septrin, Amoxil and Tetracycline	24 species, (20 taxa, 11 families, 20 genera) Fabaceae, Rubiaceae, Vitaceae, Annonaceae

An analysis of the pathology of the diseases reveals that pathogenic microbes are the most dominant disease-causing agents and as discussed below antibiotics are playing a major role in the amelioration of the diseases. Based on the disease pathology disucussed (in Section 8.3 and illustrated in Table 8.14) under the chemotherapy treatment method, it is hypothesised that :

a) Plant species used to manage malaria and malarial symptoms could be containing chemical compounds with either one or more of the following properties: ameobicidal, antibacterial, analgesic and antipyretic properties.
b) Plant species used to manage diseases of the respiratory system could be containing chemical compounds with either one or more of the following properties : antibiotic, antibacterial, analgesic and antipyretic.
c) Plant species used to manage diseases of the skin could be containing chemical compounds with either one or more of the following properties: antifungal and keratolytic.
d) Plant species used to manage diarrhoeal diseases could be containing chemical compounds with either one or more of the following properties: antibiotic, antibacterial, antiprotozoal, analgesic and antipyretic.
e) Plant species used to manage urinogenital tract infections could be containing chemical compounds with either one or more of the following properties: antibiotic, antibacterial and antiprotozoal.

By the same inference, it is hypothesised that each of the families Euphorbiaceae, Rubiaceae, Annonaceae and Fabacea which are used in a wide category of diseases could be containing a diversity of chemical compounds with a broad range of biological properties. At the species level, *Fagara chalybea* in Rutaceae used to manage all the disease categories could be containing a diversity of chemical compounds with a broad range of biological activity or chemical compounds with broad range of biological activity; *Psilotrichum scleranthum* , *Uvaria acuminata, Cassia abbreviata,* ; *Gossypioides (Gossypium) kirkii, Annona chrysophylla, Artabotrys monteroae, Polyalthia stuhlmanii, Uvaria lucida, Premna chrysoclada, Tamarindus indica, Phyllanthus muelleranthus, Croton pseudopulchellus, Xylopia arenaria, Dichrostachys cinerea,; Adansonia digitata, Grewia ectasicarpa, Acridocarpus zanzibaricum ; Scutia myrtina; Chassalia umbraticola; Clerodendrum acerbianum* used in the various diseases caused by microbial pathogen could be containing antibiotics.

To test these hypotheses the chemical and biological properties of the traditional management regimes are investigated and discussed in Section 8.4.2

Chemical and Biological Properties

In this study, the determination of chemical and biological properties of the plants used in traditional medicine was based on various phytochemical and pharmacological studies on the plants by various scientists in research and academic institutions. These are documented in the Dictionary of Natural Products of the Chapman and Hall/CRC chemical database. The Dictionary contains a comprehensive structure database of 150,000 natural products.

All the species used in traditional management of the five categories of diseases were subjected to chemical and biological analysis. The results are presented in Tables 8.15 a) and b) and discussed below.

Phytochemistry

Phytochemical data was available on 61 genera (87 per cent of the total number of genera documented). There was no corresponding data on nine genera. The number of natural compounds so far identified in the various genera ranges from one to 395

Table 8.15 a) Summary of Phytochemical and Ethnopharmacological data on documented medicinal plant species

Disease Condition	Desired Mode of Activity	Number of identified species	Number of genera studied and documented in the DNP	Number of genera with biologically active compounds	Rate of corroboration
Malaria	Ameobicidal, Antimicrobia, Analgesic, Antipyretic	51 species (42 genera in 25 families)	38	31	13 out of 38 (34.21%)
Respiratory Tract Infections	Antibacterial, Analgesic, Antipyretic, Antihistamine, Antibiotic	16 (15 genera, 13 families)	12	12	5 out of 12 (41.67%)
Skin Diseases	Antifungal, Antiprasitic, Keratolytic	16 (14 genera, 12 families)	11	9	2 out of 11 (18.18%)
Diarrhoeal Diseases	Antibacterial, Antibiotic, Antiprotozoal, Analgesic, Antipyretic, Broad spectrum antibiotic	23 (20 genera, 14 families)	18	16	13 out of 18 (72.22%)
Urinogentic	Broad spectrum	19 (19	16	15	10 out of 16

al Tract Infections	antibacterial, Antibiotic, Antiprotozoal, Antifungal	genera, 14 families)	(62.5%)

Table 8.15 b) Genera documented with positive corroboration

Disease Condition	Some documented Genera	Phytochemical data Number of compounds identified	Pharmacological activity
Malaria	*Anacardium*	28	Antimicrobial
	Artaboptrys	18	Antimalarial
	Croton	61	Analgesic
	Fagara	74	Antimicrobial (2), analgesic
	Gardenia	67	Antimicrobial
	Hoslundia	8	Antimalarial
	Phyllanthus	97	Antimicrobia
	Pluchea	99	Analgesic
	Polyalthia	112	Analgesic
	Terminalia	65	Antimalarial
	Uvaria	109	Analgesic
	Vernonia	231	Antiprotozoas
	Xylopia	80	Antipyretic
Respiratory Tract Infections			
	Azadirachta	143	Antimicrobial
	Cissampelos	32	Antibacterial
	Fagara	74	Analgesic, Antibacterial
	Heeria	2	Antibacterial
	Xylopia	79	Antibacteria (4)l, Analgesic, Antipyretic,
Skin Diseases			
	Carissa	12	Antifungal
	Fagara	74	Antiparasitic, Analgesic, Antimicrobial
Diarrhoeal Diseases			
	Acridocarpus		Antibacterial
	Annona	260	Antibacterial

	Artabotrys	18	Antibacterial
	Connarus	2	Antibacterial
	Croton	61	Antibacterial, Analgesic,
	Fagara	74	Antimicrobial (2)
	Heeria	4	Antibacterial
	Hoslundia	8	Antibacterial (2)
	Lannea	6	Antibacterial
	Mundulea	23	Antibacterial
	Phyllanthus	97	Antimicrobial, Antibacterial
	Uvaria	109	Analgesic, Antibacterial
	Xylopia	80	Antibacterial, Analgesic, Antipyretic,, Antibacterial (3),
Urinogenital Tract Infections			
	Abrus	72	Antibacterial, Antifungal
	Antiaris	32	Antibacterial
	Dalbergia	225	Antibacterial (3), Antifungal (4), Mycobacterial
	Fagara	74	Antimicrobial (2)
	Heensia	4	Antibacterial
	Lannea	6	Antibacterial
	Pristimera	5	Antibacterial
	Psychotria	36	Antibacterial
	Salacia	37	Antifungal
	Uvaria	109	Antifungal, Antibacterial

compounds per genus.

The spread of the data may be divided into quarters. The first quartile of 15 genera contains between one and six compounds and add up to 42; the second quartile of 15 genera contains between six and 18 compounds per genus adding up to 157 compounds; the third quartile of 15 genera contains between 23 and 60 compounds per genus adding up to 538 compounds; most of the compounds in the last quartile which represents genera with the highest number of compounds per genus of between 99 and 398 adding up to 1,899. This high concentration of phytochemical compounds in these genera used in the management of the five most prevalent diseases could help scientifically explain the reason for their selection by the traditional medical practitioners. In the following section, a further analysis is done on the biological activity of the compounds found in the same genera.

Since most of the modern medicine disease management regimes have antibiotic properties as the mode of activity it could be hypothesized that the traditional management regimes for the same disease could have similar biological properties. This hypothesis is tested in the following section.

Ethnopharmacology

An analysis of the biological activities of the compounds was undertaken to determine whether there is a relationship between the traditional use of the plants and the biological activity of the chemical compounds identified in the various genera. For each disease category, corroboration is established based on disease pathology, the desired biological action as practised by modern medicine and the biological activity of the plants used in traditional medicine.

For malaria, 51 species within 42 genera are traditionally used for the management of malarial and malarial symptoms. Out of 38 genera studied, 31 (81 per cent) contain compounds having various types of biological activity. Based on the hypothesis that these plants could have compounds with ameobicidal, analgesic, antipyretic and antimicrobial activity, it was found that 13 (34 per cent) of the genera have a positive corroboration.

For respiratory diseases, 16 species within 15 genera are traditionally used for the management of both upper and lower respiratory tract. All the 12 genera (100 per cent) studied, contain compounds with various biological activity. Based on the hypothesis that these plants could have compounds with antibacterial, analgesic, antipyretic, antihistamine, and antibiotic activity. it was found that 5 genera (42 per cent) have a positive corroboration.

For diarrhoeal diseases, 23 species within 20 genera were documented. Out of the 18 genera studied, 16 (88 per cent) genera contain compounds with various biological activities. Based on the hypothesis that these plants could contain compounds with antibacterial, antiprotozoal, analgesics, antipyretic, broad spectrum antibacterial and antibiotic activity, it was found that 13 (72 per cent) genera have positive corroboration.

For skin diseases, 16 species within 14 genera were documented. Out of 11 genera studied nine genera (82 per cent) contain biologically active compounds. Based on the hypothesis that these plants could contain antifungal, antiparasitic, and keratolytic properties, it was found that two genera (18 per cent) have positive corroboration.

For urinogenital tract infections, 19 species within 19 genera were documented. Out of 16 genera studied, 15 (94 per cent) contain biological active compounds. Based on the hypothesis that these plants could contain broad spectrum antibacterial, antibiotic, antiprotozoal and antifungal properties, it was found that ten (63 per cent) have a positive corroboration.

In summary, 29 genera utilised in 42 applications out of 61 (48-79 per cent) show positive corroboration, thus significantly demonstrating the scientific basis for the selection of traditional remedies into mainstream health care. A total of 8 taxa out of 20 (40 per cent) documented to manage various diseases caused by microbial pathogen contain antibiotics.

Consideration was also given to the country's poor and declining economy. Economic implications of mainstreaming traditional medicine therefore become very crucial. In the next section 8.4.3, various economic attributes of traditional medicine technologies are discussed.

Economic Analyses

In effect, the government needs to budget for the need to provide health care services for the management of 78,260 disease incidences reported in the government health care facilities or approximately US$ 13.00 X 129,581 = US$ 1,684,553.00 per year around the forest.

The Table 8.16 below presents cost implications per disease. Column 2 presents the cost implications for the management of the disease cases reported in government health care facilities. The government spends a total of $85,322, about 5 per cent of the recommended allocation, every year, to provide for medical services and products for the five most prevalent diseases around the Arabuko Sokoke Forest while column 3 presents cost estimates for the management of the extra burden of disease reported by the traditional medicine practitioners that would have been met if traditional medicine did not exist and had to be borne by the government. This estimate is a cost reduction in the local health care budget of $143,916 and is the current contribution of traditional medicine and represents in part the opportunity cost for loss of traditional knowledge and biodiversity in the area.

The 33 to 94 per cent per disease condition (or 3 to 23.per cent of the total), contribution means reduced costs to the government's health budget and focusing on

Table 8.16 Estimated annual costs, in US$, for the amelioration of the burden of disease around the Arabuko Sokoke Forest

Disease	**Cost in US$ for modern medicine management of diseases (% per disease condition)**	**The reduced cost due to the participation of traditional medicine (opportunity cost)**	TOTAL
Malaria	$59,388.39(42.90%)	$79,035.30 (57.10%)	$138,422.9
Respiratory Tract Infections	$17,652.75 (67.04%)	$8,680.05 (32.96%)	$26,332.8
Skin Diseases	$2,195.38 (61.32%)	$1,384.92 (38.68%)	$3,580.42
Diarrheal Diseases	$4,209.75 (14.42%)	$24,941.07 (85.56%)	$29,150.82
Urinogenital Tract Infections	$1,876.13 (5.91%)	$29,874.24 (94.10%)	$31,750.37
TOTAL	$85,322.52 (37.22%)	$143,915.60 (62.78%)	$229,237.30

its wider utilisation and development will save the government more funds. For example if the traditional therapies for malaria, whose use has persisted over generations and supported by sound clinical experience, replaced the modern therapies, the government would save a further $59,383 which could be allocated to the management of diseases that traditional medicine is not as effective such as respiratory tract infections. The statistics indicate that 94 per cent of the urinogenital tract infections are managed by traditional medicine practitioners. This shows a high level of confidence on traditional remedies and therefore the preferred method of treatment. An increase in the utilisation of traditional remedies for UTI will save the government a further $1,876. Similar experiences have been documented for the traditional remedies for skin infection and diarrhoea adding the potential savings by $2,195 and $4,210 respectively.

At the individual level, particularly when the government health care facilities do not have adequate drugs, it is much cheaper for the person to consult traditional medicine. This is particularly critical for the rural poor of which 47 per cent in Kenya are in absolute poverty. The savings range from $0.25 to $2.25 per disease case. Coupled with the accessibility, the socio-cultural inclination and the relatively low cost, traditional medicine offers the government and the people a more practical option for the rural as well as the urban population. The genetic wealth also offers the government a great opportunity to contribute to drug development and subsequent national development.

8.5 CONCLUSION

In summary, the findings of this study establish the weakness of the current health care arrangement at providing economic incentives to sustain traditional bio-innovation. Although the reliance is significantly high, the economic value remains very low. While the economic exclusion denies opportunities for national development it, by omission, creates a fertile environment for biopiracy. Secondly, it establishes the technological capacity for traditional medicine knowledge to compete and therefore co-evolve with modern medicine knowledge system.

PART THREE

SYNTHESIS

AND

RECOMMENDATIONS

CHAPTER NINE: SYNTHESIS OF CASE STUDIES

9.0 INTRODUCTION

This chapter presents a synthesis of the case studies discussed in chapters five to eight above. First, it presents results of analyses on the interactions between the health policy structure and economics of traditional medicine. In response to the first hypothesis, it examines the capacity of two different health care arrangements to generate economic incentives for traditional medicine. The arrangements include the integrated health care system in Madagascar and Chinese Medicine and the non-integrated health care system exclusive to modern medicine, in Kenya. Secondly, in response to the second hypothesis, it examines the technological competence of traditional medicine to co-evolve with modern medicine.

9.1 THE HEALTH POLICY STRUCTURE AND MARKET SHARE FOR TRADITIONAL MEDICINE

9.1.1 The place of traditional medicine

An analysis of health care systems in Madagascar, China and Kenya revealed that although they experience similar health care challenges their policy response differ significantly, particularly between Madagascar and China's health care systems and Kenya's.

All the three countries experience high population growth rates, of between 2.8 and 3.9 per cent, per annum, which imply an increasing derived demand for *inter alia* health care services. Unfortunately, however, due to the poor and declining economies of Madagascar and Kenya, budgetary allocation to health care has been low and reducing. In Madagascar, between 1996 and 1998 the health sector budget accounted for \$3.7 per capita or only 1.3 per cent of the GDP and 10 per cent of the total public budget. In Kenya, in 1983/84 financial year, the Ministry of Health recurrent expenditures accounted for 8.83 per cent of the government total. By 1996/97 financial year, it had declined by 69.33 per cent. As the costs of modern medicine services continue to escalate, these countries experience shortfalls in the provision of health care services to their populaces. Consequently, majority of the population particularly among the rural poor do not have access to official health care. Until the 1970s, official health care in both countries comprised exclusively of modern medicine services offered in government health care facilities. In Kenya, however, it is still the case today. Notably in both, the provision of health care services is largely inequitable. Majority, approximately 80 per cent, of the health care facilities and medical personnel are in urban areas. The rural population has least access to health care facilities and virtually no access to drug supplies. In Madagascar, only about 65 per cent of the population has access to a health care center less than 5 km from where they live. Since the majority of the rural population are poor they can ill afford to purchase drugs and in general cannot claim to have access to any modern medicine services. About 85 per cent of the poor in Madagascar live in rural areas. In Kenya, 47 percent of the rural population live in absolute poverty where health care services are also limited.

In China, the scenario is slightly different. Although also a developing country, its economy performs better than the other nations. However, prior to the proliferation of Chinese medicine, in the 1940s, access to official modern medicine was limited thus creating demand for alternative health care services.

The burden of disease in Kenya and Madagascar are similar in that the five most prevalent disease conditions in both countries are the same. They include malaria, diseases of the respiratory system, diseases of the skin, diarrhoeal diseases and urinary tract infections. Both countries' health care systems therefore face the same technological challenges of ameliorating these disease conditions. China included, problem diseases such as cancer, diabetes and high blood pressure posed challenges to health care systems in all the study sites. This was without including the increasing impact on the burden of disease due to recurrence of tuberculosis and high incidence of HIV/AIDS, in the recent years. To date, the modern health care systems have yet to develop remedies for these conditions.

In response to the challenges, each country adopted various strategies that have shaped the evolution of their particular health care systems. The differing policy responses and resultant health care arrangements have had differential impact on the economics of traditional medicine.

Traditional medicine has been in practice in many developing countries as a health care system particularly in the rural areas for many generations. It is an option that has proved more accessible, affordable and efficacious. The development of this practice in the study sites has particularly benefited from the rich biodiverse ecosystems about whose components traditional knowledge has accumulated. In due recognition also to the fact that in spite of foreign aid, it was not possible to secure basic needs for all the people, WHO highlighted its important. With reference to the Resolution of 1977, WHO issued guidelines for its research and development. It was then recognized that the only sure path to development in the developing world was through mobilization of each country's own indigenous resources (Sanbrook, 1983). The WHO therefore urges its members to fully utilize all available local health resources including traditional medicine (Akerele, 1987)

However, treatment of the practice by health care policies, laws, institutions and programs differs in all the study sites. The health care policy structure in Madagascar and China has been very explicit in supporting the development of traditional medicine as an option to contribute to official health care. In Kenya, traditional medicine is not officially recognized by mainstream healthcare.

In Madagascar, health care research and development policies, laws and institutions for the development of traditional medicine were mainly stimulated by the fact that the declining economy reduced the country's capacity to provide adequate modern health care for its increasing populace. At the same time, majority of its population were poor and could ill afford to pay for private health care services. The most accessible and affordable health care option was traditional medicine which before the late 1970s was largely unrecognised, least understood and unregulated. While official health care paid little attention, western drug companies had the free will to exploit the medicinal plants which had proved to be of research and economic value as potent sources of new drugs.

Under these circumstances, the government could not afford to continue to ignore the practice and sought to develop the practice so as to contribute to health care and national development. Policies were directed towards traditional medicine and an institutional arrangement designed to meet developmental needs of the practice. Research and development of medicinal plants was one of the major strategies to develop traditional medicine. In particular, research was designed to enhance understanding of the practice with the view to inform the policy process. It also served to break down institutional barriers between modern and traditional medicine. An inter-institutional committee was also established to develop a legal framework for the development of traditional medicine. CNARP, the WHO collaborating center has been actively involved in this process, in pursuance to its mandate to help develop and implement legislative framework on traditional medicine.

The favorable policy and legal environment enabled traditional medicine practitioners to practice freely and the private sector to participate in development of traditional medicine. At the community level, this policy environment also facilitated the development of the integrated health care project at Manongarivo where both modern and traditional medicine practices were employed to meet the health care needs of the *Tsimihety*. Coupled with research, lessons from the project continue to inform the policy process.

In China, the political will to bring about policy, legal and institutional change towards promotion of traditional medicine was also in response to the Chinese people's heavy reliance on traditional medicine. The Chinese people had a very strong cultural attachment to traditional medicine whose products were also more accessible, affordable and efficacious against problem disease conditions than modern medicine was. When modern medicine was introduced, there was a move by the authorities to suppress traditional medicine. The move failed because of the strong belief in traditional medicine. The policy process recognized this and devoted its energies to the development of a system that integrated traditional medicine into mainstream health care. Traditional medicine gained its legal status and through concerted interdisciplinary research efforts various innovative technologies and practices were developed.

For over five decades, traditional medicine products and practitioners were selected into the modern economy through various mechanisms. A specific policy regime was designed to give traditional medicine equal status in the health care. A legal framework was put in place to ensure that quality standards were adhered to and maintained. Education and research and development institutions in medicine were set up to contribute to development of traditional medicine through the application of modern science and technology. In the hospitals of western medicine, departments of traditional medicine together with its pharmacies and wards were all accommodated. The education and training curriculum for traditional medicine was strengthened. For example, medical schools' curriculum includes traditional medicine.

Traditional medicine thus evolved alongside modern medicine both contributing to the total official health care system. The official health care system has fully integrated traditional medicine in both the public and private domains. Through the integrated health care system, the government was able to increase access to health care services as the technologies developed diffused into the modern economy. In particular, Chinese medicine R & D system was particularly effective at developing efficacious remedies for disease conditions that modern medicine has no effective cure for. This attribute has particularly contributed to its successful diffusion into the international market, including Kenya. In Nairobi, Kenya it has become a popular option, thereby attracting a relatively high market allocation, competitive prices and higher returns to the innovators.

In Kenya, official health care policy only acknowledges modern medicine to which all investment to health care is devoted. Due to the poor economic performance, Kenya's official health care system experiences crises where available resources cannot match the demand for services. This is particularly true for certain categories of manpower, drugs, dressings and equipment. The main policy response has been towards expansion of health care infrastructure. However, these efforts have proved inadequate because the expansion was not accompanied with commensurate technological development. Most of the facilities lack effective diagnostic tools, and drugs and dressings. Access to health care services by majority of the population is at best limited. As a result of the inability to access modern health facilities, majority of rural Kenyans turn to traditional medicine for their health care needs. In urban areas the high cost of modern medicine coupled with the demand for effective cures for emerging and problem diseases have caused many patients in urban areas to consult alternative health care practices including traditional medicine and Chinese medicine. Other reasons include social, psychological and cultural. Despite the increased reliance on traditional medicine, its development remains largely ignored by the policy process.

Although traditional medicine is recognized in official documents, it has been done so in a hostile environment. The pronouncements have not been translated to its enhanced use and development. Traditional medicine is administered under the Ministry of Culture and Social services with little, if any, budget for traditional medicine. Traditional medicine is not part of official health care. Some official health care officers are aware of the role that traditional medicine could play but because of lack of adequate understanding of the practice, they hesitate to promote or advocate for its integration. The main reasons for this attitude is because the education and professional training did not focus on traditional knowledge. For instance, modern doctors still see traditional medicine as primitive as there is no training in the universities that promotes traditional medicine. It therefore remains undeveloped and in some cases discouraged by law. As a result, traditional medicine remains undervalued. Such a state exposes it to abuse by quacks and exploitation by bioprospectors who develop modern drugs from the biodiversity and don't return benefits back to the innovators. Its interesting to note that while indigenous traditional medicine is legally unrecognized, Chinese medicine has gained more acceptance among the policy makers and the public at large. The main reason cited for this bias is that Chinese Medicine has been adequately researched and modernized while the indigenous medicine is not well understood. It is claimed that efficacy aspects have not been scientifically proven.

Analyses of these policy structures discussed above and their impact on health care provision point to the fact that the artificial selection of products of traditional bio-innovation into the modern economic space provided incentives for sustaining the productivity of the traditional knowledge system. The following section examines the impact of these policy dispositions on the market share for traditional medicine products.

9.1.2 Market Allocation

The favorable policy and legal environment led to the development of a favorable market environment for traditional medicine. It offered space for traditional medicine practitioners to put their products in the modern economy, thus enlarging their market allocation. This was true for Madagascar and China.

In Madagascar, over a space of four years, a health care system emerged for the management of disease conditions that has a larger allocation for traditional medicine technologies than elsewhere. At the *Clinic de Manongarivo*, the participation of traditional medicine technologies has increased to 74.50 per cent from zero percent (see Table 9.1). This proportion is based on the five most prevalent disease conditions. The enhanced understanding through research led to the increasing acceptability of traditional medicine. It also contributed to the diffusion of traditional medicine into modern medicine doctors' prescription. The health care market has experienced diffusion of products based on traditional medicine. Traditional medicine practitioners can easily put their formulations in the market. The national research institute on natural pharmaceutics has also been able to put products of their research into the market thus earning some income to contribute to further research. The favorable market environment has led to flourishing of private companies to invest in development of natural products for both local and international markets. The market for products of traditional knowledge is enlarging as the private companies seek to expand and diversify their production. The market for such products is not yet exhausted and the demand for them is increasing, both locally and internationally. The investors have an economic interest to promote the development of traditional medicine and sustain the production of bio-innovations. However, they have yet to develop adequate benefit sharing arrangements with the local innovators.

In China, the favorable policy and legal environment facilitated the development of the traditional medicine industry. The participation of traditional medicine in official health care increased significantly. Because of the unique role they play in the management of problem diseases, their participation extended beyond its national borders. The production of Chinese herbal medicines increased and gradually developed into an industrial system and a source of employment for about 300,000. They are active participants in international health care markets where they are capturing a market that has been unfulfilled by modern medicine. For instance in Kenya, the demand for Chinese medicine is increasing. The increased demand catalysed the rise in number of clinics in Nairobi and other parts of the country. The number of clinics in Nairobi has increased four-fold in just six years because of the economic viability of their health care system. This is because it provides remedies for diseases that the Kenya's official health care system has no effective remedies. The disease burden allocated to traditional medicine in Chinese medicine clinics in Kenya is 87.93 per cent (see Table 9.1). The success rate of up to 92.5 percent has contributed to increased popularity.

In Kenya, on the other hand, the unfavorable policy and legal environment for traditional medicine means that it doesn't participate in official health care. Official allocation to traditional medicine is nil. However, because of the role they play in rural areas providing services otherwise absent, these technologies have a significant market allocation. For example, around the Arabuko Sokoke Forest this adds up to 64.23 (see

Table 9.1). Despite this, its participation in the modern economy is constrained and its value as outlined below is largely undervalued, because of the official indifference.

9.1.3 Market Value

The socio-economic status of traditional medicine practitioners and value of traditional medicines were elevated in Madagascar and China. Traditional medicine practitioners in these countries have benefited from a higher income through their contribution to official health care. Their value has also been enhanced through their training in modern medicine techniques. Because of their efficacy, their products in the market place compete with modern medicine products and attract market prices thus earning the practitioners further economic benefits.

A comparison is made between Chinese medicine and Kenya's indigenous traditional medicine in Kenya's economic context. In the market system, as the demand increases, the market price for the goods tends to increase thus increasing profits for the local innovators and therefore incentives to develop new products. The performance of Chinese Medicines which are products of such a model illustrated their profitability in the Kenyan market. Chinese Medicine products attract higher market prices than the Kenyan traditional medicine (see Table 9.2). This is particularly true for those remedies that modern medicine had no effective cure. Due to the enlarging market and higher market value, the Chinese clinics have higher returns than their Kenyan counterparts in traditional medicine, a factor that has stimulated the growth of this industry in Nairobi. The survey on the practice of Chinese medicine in Kenya reveals that on the average, one clinic earns up to US$108,218.28 gross incomes or $42.10 per disease case, which is $41.75 more than a traditional medicine practitioner earns for the five most prevalent disease conditions (see Table 9.3). This is attributed mainly to the fact that Chinese medicine captures that section of the market not adequately fulfilled by modern medicine at market rates.

Table 9.1: Market allocation, in per cent, for modern and traditional approaches in all the study sites, based on the five most prevalent disease conditions

Manongarivo Nature Reserve, Madagascar			Chinese Medicine in Kenya			Arabuko Sokoke Forest, Kenya		
	Modern Medicine	Traditional Medicine	Disease Condition	Modern Medicine	Traditional Medicine	Disease Condition	Modern Medicine	Traditional Medicine
Total (100.00)	25.52	74.50	100.00	12.07	87.93	100.00	35.77	64.23

Table 9.2 Market value, in US$, for the technologies applied in the health care arrangements in all the study sites

Manongarivo Nature Reserve, Madagascar				Chinese Medicine in Kenya		Arabuko Sokoke Forest, Kenya		
Disease Condition	MM	TM	IHC	Disease Condition	IHC	Disease Condition	MM	TM
Malaria	13.50	2.00	3.00	HIV/AIDS	119.95	Malaria	1.57	0.50
Flu	13.50	1.50	1.50	Diabetes	6.04	Respiratory T. Infections	0.75	0.63
Bronchopneumopathie	30.00	3.00	2.00	Asthma	4.97	Skin Diseases	0.25	0.13
Wound	6.50	1.00	1.00	Skin Diseases	5.33	Diarrhoeal Diseases	0.75	0.13
Diarrhoea	8.00	1.00	1.00	High Blood Pressure	60.65	Urinogenital T. Infections	0.75	0.13

Table 9.3 The aggregate values, in US$, for the technologies in the health care arrangements in all the study sites

Manongarivo Nature Reserve, Madagascar. These are market rates if either system managed the total disease burden (compares traditional and IHC)			Chinese Medicine in Kenya A fully integrated system		Arabuko Sokoke Forest, Kenya. These are the rates as the two health care systems operate in isolation		
	TM	IHC	Disease Condition	IHC	Disease Condition	MM	TM
Total	1,143.50	1,285.83	Total	4,328,731.1 or 108,218.28 per clinic	Total	85,323 (63.12)	49,853.02 (36.88) or 484.00 per TMP
Per disease case	1.79	2.01		42.10		1.09	0.35

In China, the production of traditional medicines by the private sector has continued to grow offering various incentives to the practitioners. The practitioners are thus encouraged to seek more remedies. However, in Kenya, indigenous traditional medicines are largely undervalued.

In Madagascar, the participation and increased currency of traditional technologies in mainstream healthcare increased the confidence of the traditional innovators to sustain the productivity of the traditional research and development. The IHC system earns about 12 percent more than a traditional medicine one would earn per disease case. For instance, the scientific validation of traditional remedies contributed to the increased confidence of the traditional medicine practitioners. The increased confidence in their profession has encouraged them to acquire more information on and try new plant products. At the innovators level, economic incentives for traditional medicine practitioners are evident in the integrated health care system as exemplified by Chinese Medicine and Madagascar's IHC project.

As a result of the IHC project, the traditional medicine practitioner started transmitting part of his knowledge to the population as a whole and to the medical doctors, ethnobotanists etc. The totality of his knowledge was until then transmitted only to his own son. The villagers now wish that this knowledge were transmitted to their children and grandchildren, a positive indication of their desire to conserve traditional knowledge and reduce its loss. This contrasts significantly with the situation in Kenya where economic incentives for traditional medicine practitioners are absent. They thus have no economic interest to sustain their traditional knowledge system and production of new innovations.

The first hypothesis is thus accepted. Subsequently, the following section examines the technological competence of the traditional knowledge system to co-evolve with that of modern science.

9.2 TECHNOLOGICAL COMPETENCE OF TRADITIONAL MEDICINE

The second hypothesis of this thesis states that traditional medicine technologies have the capacity to co-evolve with modern medicine technologies. The competence of products of traditional medicine was determined.

Related to the competence of the traditional knowledge system to co-evolve with the modern knowledge system are various attributes related to economics and technological dynamics. The technological and economic analyses on products of traditional medicine revealed that they could compete with modern medicine in the modern economic space.

9.2.1 Technological Capacity

This part of the exercise was designed to provide the rationale for selecting traditional medicines in Kenya. It was therefore primarily focused on traditional medicines used by the Giriama at the Kenya coast.

Technological analyses of traditional remedies used by the Giriama around the Arabuko Sokoke Forest revealed that the traditional knowledge and technologies have inherent capacity to co-evolve with modern medicine. They have clinical and biological basis for being artificially selected into the modern economy in Kenya.

Analysis of the management regimes for the five most prevalent diseases in Kilifi District reveals a higher productivity level of the traditional knowledge system. From the case studies it is evident that the products of traditional medicine are very diverse, constituting a pool of products from which one can select for use. There is a higher diversity of traditional medicine disease management options than modern medicine. Between 18 and 46 species are used for the management of malaria, respiratory diseases, diarrhoeal diseases, skin diseases and urinogenital tract infections while only a handful of drugs are available from modern medicine. The diversity is further enhanced by the cross applications for various species. At least 22 species, or 43 per cent of those used to manage malaria and malarial symptoms, have other applications. The overproduction and the variation of the products offers the traditional knowledge system competence to contribute to the mainstream health care and an enhanced probability to persist and survive to reproduce more management regimes. The products have been used over varying periods of time from as long as 97 years suggesting the persistence of these products in the field. For example, in the management of malaria there are 41 species that have been in clinical use for more than one generation. The shortest length of time recorded was seven years thus suggesting the development of new innovations adding to the dynamic variation in products. It would be interesting to find out the performance of the new innovations over time. This suggests that the traditional bio-innovation system is incremental and evolutionary the same way that the modern science innovation system is with respect to development of technologies for health care.

Phytochemical and ethnopharmacological values of the management regimes revealed the scientific competence of traditional medicine to manage the various disease conditions. In line with pharmacological tenets, chemical and biological screening of the traditional remedies is often viewed as essential in establishing the efficacy and reliability of medicinal herbs to ameliorate the burden of disease. Positive biological activity is demonstrated for between 34 and 72 per cent of the management regimes and thus the scientific capacity to co-evolve with those of modern medicine.

The capacity to persist in the modern economic space and increase the market allocation for these products has been well demonstrated in Madagascar and on Chinese Medicine. In Manongarivo, the medical doctors attested to the evidence based efficacy of medicinal plants. Two of the medical doctors have adopted the regimes in their private clinics outside of the project area. These initiatives illustrate the spread of these technologies and therefore persistence and the survival of traditional medicine products over time. In Chinese medicine, the diffusion of traditional medicines into the Kenyan market also attests to the persistence and ability to survive alongside modern medicine.

9.2.2 Economic Rationale

The economic rationale for selecting traditional medicine was also established. The case study on Kenya's health care system among the Giriama revealed that the traditional medicine system is a major contributor of health care services and manages between 31 and 94 per cent of the burden of disease. This contribution when computed into reduced cost for the local health care budget implied a cost reduction of US$143,915.60 or 1.11 per capita per year.

In addition, a health care system that integrates traditional and modern medicine, as exemplified by the Integrated Health Care Project in Manongarivo North West Madagascar, is a more cost effective system than one which does not. For the management of the five most prevalent diseases in the Ambodisakoana village, the cost in the Integrated Health Care system was approximately one fifth of the cost of modern medicine. The reduced cost of health care was due to the contribution of efficacious traditional medicines which has replaced modern drugs for the management of some disease conditions which were otherwise expensive. The system only spent funds on modern drugs for the management of disease conditions for which there was no efficacious medicinal plant. There were therefore cost reductions of up to $9.70 per disease case, savings which the community invested in other development activities.

The IHC system provides economic incentives for both the health care provider (government) and the community through the cost savings. The reduced cost of the health care services means that the government is able to spread the services further and increase access to quality health care for its populace. At the community level, the cost savings and the increased access provided incentives to sustain the knowledge system and conserve the related biodiversity.

The rationale for the artificial selection of products of traditional medicine into the modern economy is thus established and the second hypothesis accepted. It is therefore important that policy makers in Kenya put in place policies in favor of an integrated health care system.

9.3 LESSONS LEARNED

The three case studies revealed the important role played by the modern economic space, through natural selection, at providing the opportunity for traditional medicine products to compete and locate a market that increases economic returns. To initiate and catalyse the co-evolutionary process, the role of the government and policy process to artificially select these products into the modern economy was crucial. This therefore calls for policy reform in Kenya's health care system to facilitate the diffusion of traditional medicine products into the modern economy.

There are clear advantages of a comprehensive legal framework for the regulation of traditional medicine. As evident in China and Madagascar, legal regulation means legal recognition, that is, practice of traditional medicine can take place lawfully. Both practitioners and clients will be able to enforce contractual obligations and privately regulate the practice of traditional medicine. However, in Kenya, as it stands now, there is no legitimate expectation which society can legally or morally require of a traditional medicine practitioner since the law does not recognize them. The hostile legal environment evidenced by the Witchcraft Act, restrains traditional medicine practitioners from their professional development and subsequently putting their products into the modern economy. Legal reform, including domestication of WHO guidelines for development of traditional medicine, is also therefore essential.

Crucial to integrating modern and traditional medicine systems, was the pertinence of both the modern and traditional medical systems' practitioners to bury their differences and work together. For instance, the diffusion of traditional technologies into the official health care in Madagascar, required the change in attitude of the medical doctors. Discussions with the project medical doctors revealed a significant change in their attitude towards traditional medicine. They acknowledged that the formal training they received at the Medical School clearly resisted the idea of using traditional medicines and discredited their usefulness and adequacy. However, through the experiences in the project, the sceptism was wiped away. Though they at the beginning had difficulties prescribing medicinal plants without being sure of the effects, they became convinced of the usefulness of the approach because of the positive effects obtained. After working together with the traditional medicine practitioner for over two years, the medical doctors could prescribe medicinal plants based on the Clinic's reference data on local pharmacopoeia.

The development of this system therefore involved institutional change where an inter- and cross-disciplinary interactions provided the opportunity for traditional technologies to a broadened contact area for diffusion and subsequent technological development. While research institutions developed the various technologies, education institutions, also involved in research, became the media for wider diffusion and the private sector further diffused the same into the complex market environment. This contributed significantly to the enlarged market allocation for traditional medicine. This arrangement demanded reforms where both modern and traditional medicine practitioners had to make adjustments to accommodate each other. Through intellectual interactions, each profession discarded what was not necessary and kept what was useful to the people.

Training of modern doctors on traditional medicine and *vice versa* in Madagascar and China, greatly enhanced cooperation between the traditional and western-trained doctors. This was attributed to their enhanced capacity to understand each other's practices. Entrepreneurship of Chinese Medicine has also been instrumental in enlarging the market for Chinese medicine, particularly through advertising and awareness raising.

Benefits of combining modern and traditional medicine

The combination of modern and traditional medicine had a number of benefits. The benefits were enlisted in:

a) The increased quality of health care through the additive and synergistic contributions of both health care technologies and;

b) conservation of biocultural diversity.

The combination of modern and traditional medicine has advantages for health care. The crucial role of modern science and technology cannot be over emphasized. For instance the knowledge of physiology in modern medicine is important for accurate diagnosis. Because of the greater advances in technology development, modern science and technology is important to improve the quality of traditional medicines through value addition. For example the development of Chinese medicine modernized formulations has greatly benefited from modern technology.

The contribution of traditional medicine is also very vital. Collaboration with traditional medicine practitioners creates diversity of approach which turns out to be more efficient than application of pure modern medicine. Because of ease of access to medicinal plant resources, the lower costs of traditional medicines helps reduce the cost of health care.

The contribution of both technology systems has certainly enhanced the capacity of the health care system to manage the disease burden. In Manongarivo the health status of the population greatly benefited from the appropriate health care. For instance, improvements in health care was achieved through the reduction of mortality due to measles. According to the population, in 1984 measles affected many children who died from lack of medical attention. Since the establishment of the clinic, this reduced significantly because of the ease of access to health care.

The enhanced cooperation between the traditional and western-trained doctors offers the potential for development of technologies for treating intractable disease conditions. For instance, the integrated health care system led to the emerging of an R&D system that combines modern and traditional medicine. This forms a knowledge system that harnesses the strengths of both modern and traditional technology systems which could offer a powerful front for discovering new forms of remedies in particular for problem diseases such as malignant tumor, cardiovascular and degenerative diseases. This offers the opportunity for the development of an array of innovative remedies that will increase the diversity of technological products. This opportunity also offers stimulus to traditional innovators to develop new innovations that can combine with modern technologies.

Conservation of traditional knowledge

The appropriate development of an integrated healthcare system, using medicinal plants and modern medicines to meet the health need of the people, also resulted in the conservation of biological and cultural diversity.

The system did not replace the traditions and culture of the people thus sustaining the traditional institutions and knowledge systems that support the production of traditional medicines. The system helped to maintain and strengthen links between the people and the biodiversity, while at the same time enabling them to see the importance and practical benefits of such biodiversity. For example in Madagascar, some people stopped clearing primary forest areas of the Manongarivo Special Reserve for cultivation, for the simple reason that certain medicinal plants from that part of the Reserve successfully treated their diseases. The continued use of local medicinal plants also means that the productivity of the traditional knowledge system is maintained and traditional bio-innovation is thus stimulated to meet current and new disease challenges.

Undoubtedly, the biodiversity wealth plays a crucial role in health care of the rural poor. There is therefore need for a policy structure that harnesses these benefits and promotes sustainable utililisation of genetic resources. The success of integrating modern and traditional medicine is not without substantive reason. Traditional medicine has both the technological and economic capacity to meaningfully participate in the modern economy. The supportive role of modern science and technology to this effect cannot be overemphasized.

9.4 CONCLUSION

The integrated health care systems in Madagascar and China demonstrate the practicability of integrating two systems of knowledge and technology systems and illustrate that collaboration between modern medicine, modern medical doctors and traditional medicine and traditional medicine practitioners is possible and profitable. In Kenya, the absence of the co-evolutionary model means that Kenya is foregoing invaluable economic benefits. The interdisciplinary nature of the model where traditional technology development is in contact with the market offers Kenya the opportunity to enhance market share for traditional medicine. The economic benefits, of the integrated health care system offers the Kenyan government incentives to invest in the development of traditional medicine through formulation of a policy structure (policies, laws and institutions) that will promote the co-evolutionary model.

The performance of the Chinese medicine within Kenya's economic context illustrates that there is a fertile market for the system that Kenya's traditional medicine should exploit and compete for. The participation of Chinese traditional medicine in Kenya demonstrates the feasibility of technological co-evolution in the current economic environment. The case study illustrates the specific demands for alternative medicine being fulfilled by Chinese medicine. It essentially demonstrates the role that Kenyan traditional medicine could play if given the economic space. In addition, it illustrates the socio-economic benefits that local innovators could enjoy.

The rationale for the artificial selection of traditional medicine products is without doubt confirmed. Apart from the larger disease burden allocation, traditional medicine has the scientific and technological robustness to co-evolve with modern medicine. The positive outcome of research carried out in China on traditional material medica shows that they are effective against many diseases. The traditional knowledge system thus meets Darwin's criteria for natural selection. The technological co-evolution model harness both direct and indirect benefits. Direct benefits to the health care provider and the rural poor include enhanced access and enhanced efficacy for problem disease conditions. Indirect benefits through R & D enhance the productivity of the drug discovery process. Through local bioprospecting are also opportunities to contribute to national development.

The government cannot afford to neglect traditional medicine anymore. An integrated health care system, one that promotes wider utilization of traditional technologies will provide economic incentives for the traditional innovators and subsequently sustain traditional bio-innovation in Kenya.

CHAPTER TEN: CONCLUSIONS & RECOMMENDATIONS

10.0 STUDY FINDINGS

The findings of this study lead me to conclude that putting products of traditional medicine into the modern economic space provides economic incentives for sustaining traditional bio-innovation. The study shows that modernisation and biocultural conservation are not necessarily at odds with each other. In fact, integrating the modern and traditional knowledge systems led to both additive and synergistic effects of the two technology systems towards enhancing the performance of health care. There were two major findings.

The first one was that the technological co-evolutionary model through the IHC system, as exemplified by Madagascar and Chinese Medicine, was a more effective inter-technology arrangement than the non-integrated health care system at generating economic benefits for the traditional medicine system. The benefits thus derived stimulated bio-innovation. The second was that the traditional medicine innovation system is technologically fit to co-evolve with that of the modern medicine. Each of these findings is outlined below.

Integrated versus non-integrated health care system

The integrated health care system, provided the opportunity for traditional medicine products in Madagascar and China to interact with modern medicine products. Two interrelated types of benefits were noted. These included technological benefits, which led to the generation of economic benefits. In integrating the two systems of innovation, the model led to the development of an integrated innovation system to which both knowledge systems contributed. In the system, two processes were noted-divergence and convergence of approaches.

The diversity of approach created proved more efficient than the application of modern medicine. In the management of certain diseases, traditional medicine offered the most effective and therefore the preferred remedies. There were some diseases that traditional medicine could not offer effective remedies, but modern medicine was effective and the preferred.

However, there were some diseases that neither of the medicine products was effective but when combined became more effective. This convergence of the two technologies presents an emerging knowledge system that could lead to the development of innovations for *inter alia* the management of problem diseases that neither health care systems has effective remedies for. The model thus contributes to the development of a relatively unexplored syncretic technology system — a technological paradigm shift that could open up a new line of innovations.

This health care arrangement offered traditional medicine products an opportunity to interact with the market environment. Because the products met therapeutic needs of the population, their utilisation increased particularly among those who had conditions for which modern medicine was less effective. This promoted a broader utilisation of these products thus increasing its market allocation. In collaboration with modern S&T its value was enhanced and subsequently its share enlarged. The broader utilisation created a demand on the knowledge system to produce more traditional medicines thus motivating the local innovators to sustain the productivity of the traditional knowledge system. The enhanced value provides economic incentives for the same. This was illustrated in Madagascar and on Chinese medicine worldwide.

While the model enhanced the market share for traditional medicines, it also, by their participation, contributed to the development of cheaper and affordable medicine. Through provision of affordable medicinal products, the system offered more accessible health care services which would otherwise be financially inaccessible for the poor. The health care provider also benefited through budgetary savings where local resources that were much cheaper were more utilised to substitute for the expensive modern drugs. These savings were spent on the modern drugs for those diseases that no effective traditional cure was available. Thus, the resources available were optimally utilised to provide more adequate and effective health care services from both health care systems. Thus, the system generated economic benefits for traditional medicine, practitioners and the health care provider. These benefits in turn stimulated biocultural conservation and bio-innovation.

In Kenya where the IHC is absent, there is no system for harnessing such benefits. The practice of traditional medicine has no opportunity to interact with modern medicine. As a result, the practice is largely undeveloped and undervalued. The undervaluation means that traditional medicine practitioners have less economic interest to conserve traditional knowledge and the associated biodiversity. Consequently, due to the policy vacuum, the loss of the resources due to overexploitation continues unabated. It appears paradoxical that while Kenya's socioeconomic status shows a diminishing potential for providing adequate quality modern health care, the social policy response continues to denigrate traditional institutions.

As shown in Madagascar and China, essentially, the IHC system invokes all the four WHO principles guiding primary health care mentioned in Chapter Two above. That traditional medicine has great potential for health care development is a well established fact. It therefore makes economic sense for Kenya to respond to the WHO principles and invest in the technological co-evolutionary model because as also shall be shown below the rationale is well established.

Technological Rationale for the integrated health care system

The success of the model was attributable to the competence of the traditional knowledge system to actively participate in, interact in and contribute to the modern economic space. The traditional knowledge system and the products that were used in traditional medicine in Kenya, when tested, met the criteria characteristic of Darwin's mechanism for natural selection. The criteria include variability, productivity, survivability and competence. These attributes point to a traditional innovation system that is thus incremental and evolutionary the same way that the formal institutional system is with respect to development of technologies for health care. Traditional and modern medicine systems are therefore not strange bedfellows. The rationale for artificial selection of traditional medicine products into the modern economy is thus established.

In view of the findings outlined above, the two hypotheses were accepted.

These findings point to the crucial role that the government plays in the artificial selection of traditional medicine products into the modern economy. The policy response in Kenya should be towards narrowing the divide between modern and traditional knowledge systems' rewarding regimes. The government must invest in processes that enhance the integrity of traditional institutions through for instance mainstreaming traditional medicine into health care development. This can be effectively accomplished through health care policy, legal and institutional reforms.

10.1 POLICY AND LEGAL REFORMS

To foster the model in Kenya, concrete steps should be taken beginning with the creation of an enabling environment within which traditional medicine can flourish. Policy interventions are required to firstly halt and reverse processes that marginalize traditional medicine systems and secondly promote those that enhance the integrity of traditional institutions such as the traditional medicine system. Finally, those that promote collaboration and cooperation between modern and traditional medicine systems should be encouraged and developed. Policy and legal interventions in health care and research and development are discussed below.

10.1. 1 Health Care

First, the process of marginalising traditional institutions and the exclusion or non-inclusion of products of traditional medicine bio-innovation by government policies should be reversed. The current practice of policy abstention should be halted. Foremost to promoting the utilization of traditional medicine products, is to change the negative attitude, among the public and the modern medicine profession, towards traditional medicine. There is need for policies that highlight the positive attributes of the practice with the view to enhance awareness of the important role that traditional medicine could play. Since the integrated health care system has worked in other developing countries, the negative attitude towards traditional medicine is not justified. In particular, since the scientific validity of some Kenyan traditional medicines has been established. Scientific validity is one of the facts that most modern medicine professionals and policy makers indicate could remedy the current questionable medical value of traditional medicines. The education system, mass media and information systems which link the professional R &D practitioners with potential users should focus on the dissemination, transmission and communication of positive attributes of traditional medicine. The enhanced attitude will lead to wider utilization of traditional medicine and larger market share. Laws that denigrate traditional medicine should be reviewed.

Secondly, official recognition of traditional medicine as an integral institution for health care development and economy is paramount to giving the practitioners confidence in their practice and hence political space to contribute to development. It would therefore be in the government's economic interest to invest in processes that promote the diffusion of traditional medicine products into the modern economy. For example, there has been little desire within the modern medicine establishments — which control the ministry of health — to support research into traditional medicine. In view of the current and potential benefits of traditional medicine this attitude should be reconsidered in favor of traditional medicine.

A policy framework on traditional medicine that gives credence to the practice will go a long way in enhancing its capacity to co-evolve with modern medicine. Policy pronouncements, intentions and practice should effect meaningful participation of traditional medicine in mainstream health care provision and development.

Thirdly, to enhance interaction between the two technology systems, collaboration between them is crucial. When the WHO recommended the use of traditional medicine in national health care services, it strongly urged cooperation between ethnomedicine and modern medicine. The extent to which the government can ensure equitable and equal collaboration between the modern and traditional technology systems will be the extent to which Kenya shall benefit from its pool of traditional technologies and biocultural diversity.

Current markets and policies in the health sector should begin to promote the development of traditional medicine products and services in collaboration with that of modern medicine. The health sector needs to be reorganized to include traditional medicine products as formal components of national health care provision. Current investment strategies in health care development should include development of traditional medicine as well. More efforts are required to promote and develop traditional medicine as part and parcel of health care delivery system governed by the Ministry of Health. The task is to allow the two to cooperate without violating their rights or capacities. As a prerequisite to cooperation between the two systems, there should be detailed understanding of both systems and their contributions to health care at all levels of society.

10.1.2 Research and Development

Research is pivotal in accelerating the process of breaking down barriers between modern and traditional knowledge systems, in particular, through bridging knowledge gaps. The policy should consider the role of the traditional innovation system and the potential for cooperation with the formal innovation system. In Kenya, research and development (R&D) policies are seen solely in the light of formal public or private research. The dynamism of the community innovation system has often been underestimated. The need to stimulate diversity within and among different centers of research has often been overlooked. Most neglected of all has been the creation of opportunities to enable traditional innovators to collaborate with the formal sector.

Policies for research and development in health care should therefore increase their focus on traditional medicine to enhance its understanding, promote its development and enhance its capacity to collaborate with modern medicine. As exemplified by China investment in production of knowledge on traditional medicine has reaped great benefits. Kenya needs to adopt an aggressive program on knowledge production on traditional medicine. Enhanced understanding of the practice will guide the policy process towards its promotion and integration of the practice into mainstream health care.

Policy support is needed in the development of infrastructure for local and international bioprospecting. Policies are needed to facilitate the technological development of traditional medicine products for the modern economy. Policies should recognise that the traditional knowledge system has the competence to produce inventions which have a commercial impact and therefore develop a supportive system for development of traditional medicine products.

There is need to empower traditional people intellectually and technologically through education and technology transfer programmes, respectively, to build their capacity to add value to their technologies. At the same time, their capacity to interact meaningfully with the modern medicine profession and international bioprospectors will also be enhanced.

There is also need to empower them financially by providing economic incentives to process, develop and market their traditional inventions. Developing marketing policies that allow their products to get into the modern economic space will enhance the market values leading to increased incomes. It is however noted that high market prices may reduce their access by the poor. The government must develop mechanisms that balance between the private economic interests of traditional innovators and the society's interests by creating a stable system conducive to diffusion, with due attention to welfare consideration. Government subsidies to the entrepreneurs shall be essential in ensuring that the prices remain affordable.

Similarly, reciprocal adjustment by the modern medicine profession is crucial. The medicine profession should recognise the gains made through the traditional medicine and seek to build on the positive experiences. There is need for the contemporary science and technology system to also adjust their reward system to accommodate traditional innovations and innovators as key elements of the broader national innovation system. Its capacity to stimulate technological change in the traditional knowledge system needs to be enhanced. There is need for reform in intellectual property rights for traditional knowledge and innovations. Without economic incentives conservation of traditional knowledge and biodiversity is impractical and unsustainable. There is need to turn current economic pressures for conservation. The government needs to rearrange economic incentives so that traditional groups have an economic interest to sustain traditional bio-innovation.

The policy and legal reforms outlined above should be supported by an appropriate institutional framework that will promote the desired impact.

10.2 INSTITUTIONAL INNOVATION

The successful development of the technological coevolutionary model will depend upon the creative relationship that can be nurtured between two opposite poles - formal and traditional systems. New learning environments (for both traditional and formal researchers) are needed to establish the mutual understanding that can lead to negotiated programs that are arrived at jointly. New institutional structures will be necessary to give all parties the freedom to collaborate efficiently. In particular, current institutions' capacities to harness benefits of traditional medicine should be enhanced.

The structure should have within it the capacity to develop both knowledge systems. For example, where traditional medicine is more effective at managing a particular set of diseases, research and development of products managing those diseases would be more optimally effected by focusing on the traditional knowledge system. Where a disease condition is more effectively managed by the combination of both modern and traditional medicine, the research and development of the relatively unexplored syncretic technology system calls for the equitable development of both technology systems. A structure that allows for the combination of modern and traditional medicine shall contribute to harnessing the synergies of the two technology systems.

A health care system at which the two systems collaborate will facilitate their meaningful interaction. An arrangement is required that will enhance communication between the practitioners of the two systems. An integrated health care system shall appropriate tested and standardized formulations from both systems. Upon mutual understanding, the negative, elements shall be eliminated and the positive ones integrated and built upon. The traditional medicine practitioner shall have a reasonable opportunity to contribute to medical training as resource persons, in health care as consultants and in R&D as research partners.

There is need to facilitate research and development for sustainable drug development through establishing the appropriate infrastructure. There is an urgent need to link research on traditional medicine to the pharmaceutical industry to facilitate technology transfer. Advanced S&T has and continues to open up great opportunities for exploring traditional medicines. In addition, the link shall facilitate capacity enhancement for both traditional innovators and formal researchers to participate in R&D. Such an arrangement shall provide the appropriate forum to negotiate for fair arrangements between the local people and industry to enhance conservation of traditional knowledge and biodiversity.

10.3 RECOMMENDATIONS

A comprehensive policy regime that shall facilitate effective participation of traditional medicine in the integrated health care system should be developed as a matter of practical necessity. The regime should encompass economic planning, research and development and health care. Subsequently, a supportive legal and institutional framework should be formulated.

It is apparent that the role that traditional medicine plays in rural health and economy is significant and should be included in national statistical abstracts. To capture and sustain current benefits, its crucial that the national accounting systems should be enhanced to include the economic contribution of traditional medicine in national economic growth. This means that the accounting system shall be more efficient.

There is an urgent need to take stock of current contributions of traditional medicine and the associated natural resources, including scientific and economic.

Technology and resource assessments are recommended. Technology assessment should identify and establish the capacities including both human and technologies to:

a) identify useful medicinal plants. Research into documentation of medicinal plants will contribute to valuation of the traditional knowledge and natural resources. This initiative shall lead to the conservation of traditional knowledge as well as inform policies for the conservation of valuable natural resources.

b) screen medicinal plants for biological activity including phytochemistry, pharmacology, clinical and toxicity studies. These studies will contribute to advancement of understanding of how they work and indicate their potential for drug development. Biological valuation of medicinal plants is often viewed as essential in establishing their efficacy and reliability to ameliorate the burden of disease. Biological valuation therefore enhances the capacity of the traditional medicine system to collaborate with the modern medicine system.

c) process drugs including local formulations and modern drugs. In particular, standardization of the formulations essentially adds value to the products. It therefore enhances public acceptance and hence allows for their rapid diffusion in the market

d) shortfalls or gaps in expertise and equipment should be identified to indicate the technology transfer needs.

Resource assessment should establish: a) the supply and demand for natural resources of medical importance, b) current and potential economic value in both local and international markets

In particular, development of a *materia medica* [1]in traditional medicine is very crucial. The proposal for a Kenyan *materia medica* with regards to traditional medicine

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[1] The term *materia medica* (or ingredients of the medicines) refers to compilation of monograph of medicine for different diseases. Each monograph represents a given medication and specifies that name, the raw materials used to prepare the medicine, method of preparation use, mode of administration, dose and other relevant data such

is justified on the premise that it would provide data for potential candidates for processing local and new drug development. This *materia medica* would be an invaluable documentation of the cultural and traditional treatment among different ethnic groups in different geographical locations on the country. The urgency of compiling a Kenya *materia medica* is that elders who are the repositioners of such information are slowly dying. The natural resource base is being destroyed as well. There is need to compile this data and establish a policy for its sustainable development and integrity of the valuable knowledge.

An institutional arrangement that provides for the development and wide diffusion of technologies at the earliest possible stage into a broad range of environment of potential application should be set up. It should establish vital links for technology transfer and capacity enhancement for traditional medicine practitioners. A national institution for research on Science and technology that has modern and traditional technologies as key components of development including *inter alia*, for medicine should be established. An institutional set up that brings together all the technological and resources from both bodies of knowledge is needed. The set up would act as a focal point for all the institutions currently involved in research and development of traditional knowledge. A multidisciplinary team of experts should be brought together to establish a center of excellence on science and technology. A number of nodes are recommended including medicine, agriculture, nutrition, and industry, supported by environment conservation, policy and legal aspects.

The limited integrated capability characteristic of both formal and informal institutions needs to be broadened to enhance their role as traditional knowledge producers. Strategic partnerships with the private sector are recommended. Reform of academic and research institutions in Kenya should include actual technological context in which the traditional technologies will be required to function. R & D linkages with the private sector will significantly enlarge the financial base and bring on board their strengths such as market experience. The multidisciplinary character of

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as contraindication and storage.

companies leads to effective incorporation of technologies into complex systems. This should be in the spirit of joint research, joint patents, joint authorship, exchange of resources, information and technologies, on mutually agreed terms.

The R & D initiatives should be linked to an aggressive awareness program. Awareness raising among the stakeholders is important in catalyzing the socializing process. There is need for an awareness program to demonstrate that traditional medicine works. The negative attitude towards traditional medicine by the public can be reduced through education and mass awareness campaigns of its role in health care.

The health sector needs to be reorganized to include the traditional medicine system in its development programmes. A division should be established within the Ministry of Health to develop the integrated health care system. An arrangement that fosters unity, complementarity and mutual support among the two health care systems is recommended. Integrating corrects deficiencies of each and promotes the development of medical science. The integrated health care system will increase the effectiveness of health care services while providing incentives for the traditional innovators. For example through the integrated approach, it will be possible in the long-term to restrict purchase of modern medicines only to those for diseases that have no effective local treatment, thus saving precious funds that could be used in financing other national programs. The government should invoke the WHO primary health care principles and incorporate traditional medicine. The forward-looking principle of the essential drugs concept also offers the opportunity, through comprehensive R & D, for incorporation of traditional medicines.

Subsequently, clear new legislation providing for the practice of traditional medicine would create an environment for its development. Such legislation would also provide for the development of the institutionalization, professionalisation and development of traditional medicine and practitioners. First and foremost, there is need to repeal the Witchcraft Act of 1975 (revised in 1962 and 1981) which appears as Cap 67 of the Laws of Kenya which has often been used to stifle legitimate traditional medicine practice. The Act does not provide for *bona fide* manufacture, supply or sale of traditional drugs and medicine a fact which has led to their economic undervaluation and inhibits the development of traditional medicines.

The government should invest in capacity building among traditional medicine practitioners to enhance their legal and technological capacities to develop their products. There is need to professionalise traditional medicine so that it can adequately contribute to modern health care. The need to professinalise traditional medicine has been recognized and discussed in many countries (IDRC, 1980; Twumasi, 1984). Law must be made to "recognize" the professional status of traditional medicine and then provide a framework for the enjoyment of immunities and advantages associated with that of professional status (Abel, 1979). In turn, professionalisation of traditional medicine will bring the advantages of standardization of training and practices, internal autonomy and self-regulation. A comprehensive legal framework for regulation of traditional medicine similar to that of other health professionals in Kenya should be provided. It should provide for a Board or Council, a Professional Association, a minimum qualification based on systematic training, and a Code of Ethics.

A formal code of ethics, analogous to the code developed for medical practitioners and dentists, should be developed and be made legally binding on all practitioners. Board or Council may be given this responsibility in consultation with the Health Minister and the Attorney General. The professionalisation should be supported by training and research into their practice and technologies with a view to improving delivery of their services.

A strong national association of practitioners of traditional medicine is necessary to mobilise members in the Board or Council and to represent their professional interests in various fora. A new law is necessary both for compelling membership as a professional requirement, and recognizing such an association as a professional body.

Further to that, traditional innovators need to be assisted to add value to their innovations, in order to enhance their private property rights, for example through preparation of standardised and palatable presentable formulations and be assisted to market their products at a profit. Entrepreneurship should be stimulated through provision of credit facilities, tax rebates and subsidies to enable them establish their business in the market. This will ensure self-reliance in drug development for both local use and international markets. Subsequently, this will have the added benefit of increasing employment opportunities for the local community.

The government should invest in capacity building among the medical professions too to understand the traditional medicine system through education and training. Traditional medicine should be a mandatory component of medical training curricular with the view to enhance their capacity to interact with the traditional medicine system. Enhanced understanding will promote acceptance and diffusion among the medical profession.

These policies and legislations need to be strengthened by regulation and benefit sharing mechanisms for the utilization of genetic resources in compliance to requirements of Articles 8 (j) and 15 of the Convention on Biological Diversity (CBD). Kenya has contractual obligations to respond to the provision.

In view of the need to increase benefits to traditional innovators, Kenya ought to adopt and domesticate the African Model Law for the protection of rights of local communities, farmers and breeders and for the regulation of access to biological resources. The principles promoted by the law should be entrenched in appropriate legislation.

For instance, intellectual property policy should be considered within the wider context of a policy in support of national innovation. Such a policy should bear in mind the need to support and strengthen the innovative role of traditional medicine practitioners. IPR regimes must be modified to provide conservation incentives as well as for traditional innovation. The various IPR types that may have a role to play in helping traditional innovators market their products need to be amended to conform to the nature of traditional knowledge. These include broadening the definition of concepts of *inter alia* innovation to recognise traditional innovations and; legal persons to accommodate communities as legal persons.

Policies for trade in biological diversity products particularly those whose selection has been guided by traditional knowledge need to be tightened to ensure that benefits accrue to the traditional innovators as well. These efforts will stimulate sustainable exploitation of traditional knowledge and biodiversity. If nations or local communities derived greater benefits from their cultural practices and genetic resources that they harbor, it would be in their economic interest to sustain the cultural capital and slow the rate of loss respectively.

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