Why industrial revolution missed Africa:

A "traditional knowledge" perspective

Economic Commission for Africa

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A "traditional knowledge" perspective

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ABSTRACT

Traditional knowledge (TK) is a valuable source of knowledge for development in Africa. At the same time, innovation within these knowledge systems is a prime determinant of the transformation of the knowledge. Innovation enhances products and processes (quality/quantity-enhancing) in these societies. It enables economies to respond to risks and changing supply scenarios – hence sustained growth. Innovation is usually created by individuals. It must be so recognised and rewarded, otherwise, it is restricted by the owners from the general public. Lack of recognition also inhibits future innovations. In the system of protection of traditional knowledge in Africa, the customary laws, only communal ownership is recognised and very little reward exists for individual innovation. The consequence is either secrecy in the high-income sectors such as medicine or indifference in the low-income sectors such as agriculture. When the innovators die, the knowledge they generated is usually lost because they do not have incentive to make their innovations public. The result is what we call **"continuous but non-additive innovations"** as against "**continuous and additive innovations**". We explain these effects through two main models: the motivation and growth-ladder models. Two conclusions emerge from this analysis. Knowledge, generally, can be a communal property. Putting innovation, however, as a public good, at least in the period of 10–15 years, without special compensation to the innovator, is unambiguously bad for sustained economic growth and welfare promotion. A multiple protection system may be required. A geographical indication system may be used for general knowledge and patent for individual innovations.

Key Words:

I.   Introduction

The purpose of the paper is to explain some of the factors that constrain the African traditional knowledge system from supporting sustained economic growth in the region. By traditional knowledge, we mean tradition-based literary, artistic or scientific works, performance, inventions, innovations, discoveries, designs, marks, names, symbols and creations resulting from intellectual activity in industrial, scientific, literary or artistic fields (see for instance, World Intellectual Property Organisation – WIPO, 2001). Examples of traditional knowledge are the knowledge of bone setting and anti-snake venom production in Iboland, Nigeria (see for instance, Onyebuchi, 1998). According to the World Bank (1998) Knowledge matters. Understanding how people and societies acquire and use knowledge is essential to improving people's lives, especially the lives of the poorest.

Along the lines of the above, we intend to achieve three key objectives. We first define various aspects of the African knowledge system. We also explain the no-growth path of the knowledge system, using economic models. We conclude by recommending systems of intellectual property rights protection through which this system of knowledge can produce growth-enhancing effects, for the bearers and Africa.

 Intellectual property rights used to be largely a domestic issue, locally defined, with countries deciding on their levels of legal protection enforcement. The World Trade Organization (WTO) has changed all that. Countries joining the WTO now sign on to Trade-Related Aspects of Intellectual Property Rights (TRIPs). TRIPs has become a battleground between those who favour and those who oppose, the spread of global capitalism.

What TRIPs does is to extend intellectual property rights to include plant varieties, traditional resources and pharmaceuticals that were unprotected in most developing countries until the agreement came along. In the context of the trade negotiation process in the aftermath of

the Doha WTO ministerial conference, there is also a renewed focus on intellectual property. With TRIPs, developing countries no longer have the luxury of moving at their own speed. The poorest of the countries have only up to 2005 for their stay of execution of TRIPs agreement.

The consolation is that the developing world is home to a rich array of the world's indigenous knowledge and resources -- plants, animals -- and is a potential treasure trove of base-material for new drugs and crops that could do the poor much good. As the fuss over this continues, poor African countries should not be opposed to a proper patent regime. Their concern should be to seek a regime that fits their needs. Traditional knowledge and its various components may therefore have to be protected differently. Even at this, a protection system for TK should not be an end in itself. It must have a focused objective. It is through this means that intellectual property system under the TRIPs can be an opportunity rather than simply a threat.

To organize our thoughts, we flag attention to innovations. Innovations present avenues for new beginnings when economies hit dead ends. According to Aghion and Tirole (1993), innovations enable economies respond to risks and changing supply scenarios – hence sustained growth. Romer (2001), also insists that ideas, not machines make nations prosper. African customary laws do not specifically protect innovations and individual intellectual property. This has had negative impacts on the open use and continuity of innovations in the African traditional knowledge system.

As a result, innovation in the knowledge system cannot be pursued as a business and does not contribute optimally as an engine of growth. As a general rule, if allowed protection, today's innovators may proceed to the next stage of innovation without fear of encroachment by perverse outsiders. We argue that the absence of proper protection mechanism has inhibited the progress of the knowledge system.

The theories, models and case study that we apply, therefore, explain the performance of the African traditional knowledge, in the customary law system. Particular attention should be paid to the dynamics of these

models. The analysis deriving from this is quite technical and genuinely insightful on the subject. We also review the implications of customary law, as a tool for protection of intellectual property, in a growth-enhancing fashion, in African societies. The above presents a synopsis of the central argument in this paper, to which we intend to recruit the reader.

The general setting

Throughout history, risks have presented a challenge to human survival, in Africa as an ever-changing environment, diseases, famine and others existed. Traditional knowledge and the related innovations have been a valuable source of knowledge/technology for responding to these risks, ever before the arrival of the Europeans. Technology according to Aghion and Howitt (1998) is knowledge applied to the production process. In this sense, traditional knowledge (TK) is a valuable source of knowledge/technology for responding to risks, ever-changing supply scenarios and sustained development in Africa.

Traditional knowledge is a central component for the daily life of millions of people in the region. It plays an important role in vital areas such as food security, the development of agriculture and medical treatment for up to 80 percent of Africa's rural economy. It is mostly protected by a traditional customary law system. Some of the laws have well defined rights and benefit-sharing systems.

In today's world, even where these knowledge systems have sustained the indigenous societies, they have not produced the same type of industrial revolution as exists in Europe, for instance. By industrial revolution, we mean complete change by upward reversal of the condition of production. It reflects huge increase in productivity and undoubted superiority of production techniques.

Industrialization could not begin and grow without individual business owners who can take chances on something new and perceive clear rewards/incentives for taking such chance. The case of Britain illustrates this point. According to Hobsbawm (1964), Britain's industrialization in the eighteenth century began for a number of reasons. Britain possessed at virtually all levels of society a hard-working, innovative, risk-taking private sector that received strong support from the government. There existed a close tie between private initiative and creative governmental support throughout the eighteenth and nineteenth centuries.

Landes (1998), also made the argument that economic development takes place where there is cumulative technological progress. This is bolstered by profit motive, by ensuring the rights of private property, exploiting one's comparative advantage, and routinizing innovation. Landes insists that any country/society that goes against these principles loses its international competitiveness.

Apparently, something had always been wrong and requires changes, in Africa's traditional knowledge and innovations. By the analysis in this paper we try to provide the answers needed to the questions: why were others able to promote their own knowledge? Why has Africa not been able to do the same? (see Nwokeabia, 2001).

One obvious thesis is that the type of support that Britain's government provided for innovators never existed in the African customary system. The systems and societies have also not self-corrected for this. At the same time, new concerns have arisen as regards to intellectual property ownership. The world economy is rapidly globalizing. There is a renewed focus on trade negotiation on intellectual properties, in the context of post-Doha World Trade Organisation (WTO) ministerial conference. Traditional knowledge and its various components may therefore have to be protected differently. Even with this in mind, a protection system for TK should not be an end to itself. It must have a focused objective.

Thus, in the attempt to protect traditional knowledge, Africa's economic growth and development must be the priority. In this context, two obvious issues must be understood: what kind of protection exists for traditional knowledge in the region? Why has the existing protection system, if any, not supported the growth and development desires in the region? This is the object of this paper. The answers will lead to stressing the needed changes.

In most cases, individual innovators restrict their innovation from the public, in the absence of incentives. In the high-income sectors, such as medicine, the result is secrecy. In the low-income agriculture sector, the innovators are indifferent to introducing their knowledge to the public.

As such, the provision of rewards to innovators is necessary in order to get their knowledge easily and fully made public. Modelling of the effects of customary laws and the pre-existing intellectual property rights and reward and the relationship to innovation as a business and the engine of growth would minimise the lack of understanding of the way forward.

Therefore, we aim at developing a model for African TK protection laws with a very focused objective. In this case, we aim at a model protection system that supports economic and development aspirations of the region. The protection system has to also take into account the global economic village in which Africa has to operate and where competition will be free for all. There is as yet no such validated forward-looking model for the protection of TK in Africa, with clear economic growth dimensions. In this context, we will be looking at testable theoretical frameworks that explain the situation of traditional knowledge in the region.

A lot has been done recently to support this sort of argument (see for instance, Aghion and Howitt, 1998 and Thisen, 1993). Prior to recent theoretical contributions, many economists and economic models had envisaged technological knowledge as if it were an exogenous public good. It is assumed to be available to every economy as in the Solow type, neo-classical formulation (see for instance, Solow 1957), rather than understanding technology as a process, as knowledge-in-practice. Technological knowledge, however, is not something that just happens to societies/economies. It is a process that countries need to consciously and actively promote and nurture, and for which certain socio-economic preconditions must be met.

To an important extent, the current level of technological knowledge-in-use in any specific economy is path dependent, based on certain preconditions. It depends crucially on past decisions that affect current innovations and outcomes, through this lock-in path dependency. Countries and societies can do something about adverse path dependency in their use of technological knowledge by investing in complementary inputs. Recognizing individual innovations and rewarding them is a very good start for such investments. Progressive systems must

recognise individual efforts to gain specific capability. It is precisely this kind of social investment that can spell the difference between successful and less successful development over time (see for instance, Cypher and Dietz, 1997).

The decisions that states/societies make as to patents and other intellectual property rights determine along which path the economy and society will traverse in the future. In effect, individuals make decision within the confines of the parameters for economic decision-making determined by the state and within the cultural and historical confines for each specific society. Amendments in these areas are the necessary preconditions for progress in technological knowledge, for economic growth and development.

In this context, this paper is aimed at policy makers. It contributes to informed technical and public debate about policy-making concerning TK, intellectual property rights (IPRs) and sustainable human and economic development in Africa. By taking the steps recommended in this paper, it becomes possible to unlock a new range technological resources and energy which, though they may be low-end, have significant potential for the long-term development of the region. A good protection system for TK in Africa has to define where the priority/interest lies – legal or economic. Clarifying these issues is a prerequisite to the development of any possible forward-looking protection regime. It may provide a means to achieve different objectives. Basically, however, the availability of intellectual rights is useless if it does not help to advance the wellbeing of the holders and their societies. Particularly important is the protection and rewarding of innovations as a component of knowledge, as a business and the principal engine of economic growth.

Among the existing proposals on protection systems, many often fail to explain and set some economic and developmental rationale for the protection of traditional knowledge. More often at the international level, protection systems tend to be quite legalistic. Some protection systems take a passive approach, whereby protection is simply against externally driven exploitation and research (see for instance the

Organisation of African Unity – OAU model law). They simply do not deal with the knowledge, which may be very useful to the local community only. They do not consider local innovations. In the minds of the authors of the intellectual protection regimes, very little is known of the economic route of and the factors that make for the continuity of this knowledge.

Intellectual property (IP) is not only about conferring property rights. It is also about the recognition and respect for the contributions to a particular knowledge. Innovation is a very crucial component of and contribution to any sustainable knowledge. The argument we make here is that some or most innovation and creation will never find a channel for diffusion to the general public, in the absence of protection and special incentives. There are lots of conceptual and practical issues to be dealt with in thinking through an adequate protection of TK in Africa for the protection to be economically functional.

Among them are:

- ?? The definition of the subject matter and its components for protection;
- ?? Relating the definitions to the existing protection systems and the economic implications;
- ?? Extent of rights (individuals vs. communities);
- ?? Single or multiple protection regimes;
- ?? The interface mechanisms between the multiple systems if adopted.

As stated before, attention to legal protection of knowledge is not enough to overshadow the fact that there are externalities – economic and social – that are the likely result of whatever system that is adopted. Any system has implications on the progress and development of TK itself. Also, the definitions of various aspects are not always contained in the proposals. We insist that a precise definition of TK and understanding of the various components is a precondition for understanding what form of protection is applicable.

The analysis in this paper leads to a few summations. Knowledge, generally, can be a communal property. The same does not apply to innovation as a component of knowledge. Putting innovation, however, as a public good, at least in the medium-term of 10–15 years, without special compensation to the innovator, is unambiguously bad for sustained economic growth and welfare promotion.

II. Concepts and components of TK

The various concepts and components of knowledge

In this section, we deal mainly with various concepts of knowledge. A common feature of knowledge is that it has components capable of having varying impacts on the growth of an economy. One of the most crucial of these components is innovation. Innovation is important for the transformation of the existing knowledge and the society/economy in which it exists. In fact, innovative activities generate different kinds of knowledge. This section of the paper provides clarifications on concepts of aspects of knowledge, with emphasis on innovation. Such clarification is to lead to appropriateness of use of certain terms and their scopes as a basis upon which the analysis that follows can be understood.

We focus more on innovation for the simple reason that it plays a crucial role in the development of any knowledge and economic growth. As stated before, innovations provide new departures for economies at dead ends. Along this line, the fundamental question, before considering how to protect traditional knowledge, is the definition of "traditional knowledge" itself and its attributes and components. Protection essentially means to exclude unauthorised use by third parties.

Generally, knowledge is used in terms of potentially observable behaviour, as the ability of an individual or group of individuals to undertake, instruct or otherwise induce others to undertake procedures resulting in predictable transformation or put to use services and material objects (see for instance Nwokeabia, 2000). Knowledge by definition is universal. Every individual or society has its own knowledge. Within knowledge, there are certain elements of uniqueness as a result of both environmental influences and random effects – serendipity. These factors localise knowledge to either individuals or societies – hence indigenous knowledge.

TK encompasses very different types of knowledge. It includes, for example, information on the use of biological and other materials for medical treatment and agriculture, production processes, designs,

literature, music, rituals and other techniques and arts. Some TK can be used and understood outside its local/traditional/communal context.

When such knowledge has resided with a society for quite some time, it can be called traditional knowledge or tradition-based knowledge. Tradition-based knowledge by itself refers to knowledge system, creations, innovations and cultural expressions generally transmitted from generation to generation (WIPO, 2001). Categories of traditional knowledge include agricultural knowledge, scientific knowledge, technical knowledge, ecological knowledge, medical knowledge, bio-diversity knowledge and expressions of folklore. It has several attributes. The WIPO uses the term "traditional knowledge" to refer to tradition-based literary, artistic or scientific works. It includes performance, inventions, scientific discoveries, designs, marks, names and symbols, undisclosed information and all other tradition-based innovations and creations. They usually result from intellectual activity in industrial, scientific, literary or artistic fields.

The key aspect of knowledge is that it is a flow, not stock, and as such changes with time. Every change in circumstance and time brings about a change in the set of factors that define the knowledge people hold. Essentially, time brings about new experiences and improvements through serendipity and learning-by-doing. Time change can also lead to learning and forgetting. In both cases, time introduces some dynamism in knowledge. This issue of changes is very important as we consider the role of traditional knowledge. This is important because sometimes the interpretation of TK is that it is static. Our thesis is that TK is anything but static, and the rationale for this will be articulated shortly.

The dead ends and new departures: the role of innovation

According to WIPO (2001), an efficient intellectual property system that protects TK is one that promotes continued creation and innovation based on that knowledge. Innovation is in this view very crucial for the sustainable use of knowledge. In line with this reasoning, we single out innovation as the single most important aspect of knowledge.

The term innovation is usually used to describe the process whereby creative ideas/knowledge are developed into something tangible, like a new product or practice. The act of innovation begins with recognising the pungent scent of strategy decay. As stated earlier, innovative activities generate different kinds of knowledge. Any aggregate theory or analysis that fails to distinguish between the different activities is potentially misleading. Also, whether growth is enhanced might depend on the quantity of innovation an economy is able to generate.

Innovation consists of the invention of a new variety of products and process that replace the old ones and raise the technology parameters. In the words of Van Den Berg (2001), the process of economic growth is not simply a process of doing more of the same thing. It is a process of structural change that allows almost all aspects of production and consumption, hence innovation. The act of innovation is largely individual rather than social. Making innovation a business thus is motivated by the gains from previous innovations. A forward-looking system is the type that encourages the development of new forms of expressions and discoveries based on known identity of the creator that is fully rewarded.

In that sense, production, businesses, societies and economies thrive because a group of customers/consumers buy the products and services that they offer. At the same time, the consumers want the goods and services delivered at an acceptable cost and quality. The process by which producers understand and produce what consumers want can be broadly defined as innovation. Innovation in turn is driven with the help of knowledge areas of science and technology. These concepts will undoubtedly help us in understanding the models/theories upon which the analysis in the paper was anchored. Other definitions will be provided as we advance.

III. Economics of TK in Africa

This section compliments the previous sections in two ways. We present the motivation model that explains individual secrecy in the African traditional medical sector, for instance. We then present the growth-ladder model (economy-wide), explaining the steps through which additive innovations in an open system produce rapid economic progress. The African version of the growth-ladder model with effects of secrecy, indifference and continuous but non-additive innovations is presented and explained. These models help explain why African traditional knowledge systems appear static, to a mere onlooker.

In this paper, we assume that when any knowledge/technology undergoes at least three additive drastic innovations over a short period of less than 25 years, the impact on production becomes revolutionary (see also Hobsbawm,1964).

Because of the insignificance of African traditional knowledge on the livelihood of the owners, comparative to the European counterparts in the Western perception and intellectual property laws, African TK is regarded as information in the "public domain", static and freely available for use by anybody. This has resulted in an overlook and sometimes piracy of this knowledge by a number of researchers, barring any benefit to the knowledge bearers.

In some cases, the TK has been appropriated under intellectual property rights by researchers and commercial enterprises, without any compensation to the knowledge's creators and possessors. The basis for such action stems from the state of existence of the African traditional systems. Its impact on the modern African economy is quite minimal. There is no obvious transformation of either societies or products that bear these knowledge. In other words, the claimed knowledge is easily dismissed as either inactive or backward looking. We aim to bring to light some technicalities that explain the difficulties facing some of the knowledge systems. Therefore, the purpose of this section is to add the effects of African customary laws on the regional TK and its contribution to overall growth and development.

Additionally, the claim of abundance of relevant traditional knowledge raises the questions of why this knowledge did not produce the type of industrial revolution experienced in Europe, for instance. The question is: why has traditional knowledge stunted in Africa? On the one hand, exploring this question alongside each definition may reveal a bit of the imperfection of the customary system as a growth and development-enhancing protection system. On the other hand, the customary system had successfully safeguarded this knowledge to date. People as well as their ecosystems have been protected and sustained through this system for ages.

In the absence of industrial revolution required in the modern world, today, the knowledge system can actually be classified as irrelevant. Apparently, this is not true. What we will precisely do is look within theory, to see what has happened to each component of this knowledge system, either positively or negatively, that existed as a result of the protection system to support the innovation process.

Any intellectual property right system that is weak or lacks individual reward for innovation that is rooted in law and institutions will not stimulate search for innovations. The analysis will reveal what changes in the African intellectual property protection systems will now bring about a more growth-enhancing role for each component, through the protection mechanism – customary or modern IPRs. The idea is not to jettison or reject any of the system. It is rather to provide technical insights on which one works optimally for the economic and social progress of Africa. At that, we could arrive at an interface system of protection, *suis generis*, which serves the development of the region optimally in the global village. At first, we present the secrecy motivation model (s-motivation model), from which we then return to the system-wide macro model, the growth-ladder model.

The s-motivation model

In this model, the principal input/resource we consider is the human capital contributions to general production process. This explains why an

innovator in African traditional medicine may choose to remain secretive, indefinitely. So said, assume an individual's/society's fixed stock of medical practitioners has two competing uses. It can produce physical and other goods, one for one, and it can be used in research. We express the relationship as follows:

$$Y = F(L \quad ---) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (1)$$

The above represents an aggregate production function, where output (*Y*) is a function of human capital (*L*) and other factors.

L is further disaggregated into two parts:

$$L = x+n \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots . \quad (2)$$

Where *x* is the amount of labour that equals practical force and generally accessible capacity per person used in the production of physical goods, and *n* is the amount of labour used in research. When *n* amount of labour/knowledge is used in research, innovation arrives randomly at a rate expressible as *?n*, where *? > 0* is a parameter indicating the productivity of the research. The productivity of research *?n*, has a Poisson distribution.

Mathematically, Poisson process means that at the time *T*, the possibility of *?n* occurring is a random variable whose distribution is exponential with parameter *?*. The innovator may find another invention/innovation in the process of solving the particular health problem at a time unknown to him. Even by allocating a large amount of his time and resources, it is still uncertain to the innovator when the next innovation may take place.

In the above sense, the probability is that a new innovation will occur sometime within the short or long interval between *T* and *T + dt* (*T+dt* stands for change in time). The probability that an invention/innovation will occur within *dt* from now (when *T = 0*) is approximately *?dt*. In this sense, *?* is the probability per unit of time that the event will occur now, or the "flow probability" of the event. (For more on probability and Poisson distribution and arrival rate, see for instance Kmenta, 1986).

An analytical application of Poisson process and information can be read in Asea and Ncube (1996). The mathematics is not the key focus here.

Then returning to the issue of the rationale for the highly secretive behaviour of the local medical innovators, it is obvious that the individual that succeeds in innovating can monopolize the intermediate sector until replaced by the next innovator. It is the possibility of a "business-stealing effect and creative destruction as a result of openness that is of serious interest to us and of concern to the knowledge bearer, here. Through this effect, it is entirely possible for a new entrant in the innovation field to successfully destroy the surplus monopoly rent attributable to the previous generation of producers, by making their products obsolete.

Also relating this to cost of innovation, we assume that research costs/expenditures are financed at the proportional rate that is equal to the resources and labour force committed to research. Only a portion of the resources and financing is expended in order to realize research objectives. If we also measure the costs and benefits in units of final outputs, the marginal cost is the amount over and above initial investment. The marginal benefit is the product of the value of innovation (Vt) and the (private) marginal effect of research input in a sector.

As soon as this innovation is put to use, its profit yielding function makes it possible for the owner to realize more money than the invested principal. If the interest rate is constant/neutral, then the value can be expressed as:

$$V_{jmj} = ?_{jmj} \ . \ 1 - ?exp(-rT_{jmj}) \ ?/r \ > 1 \qquad @ \ T_0........................ \qquad (3)$$

Where V_{jm} is the value that represents the market worth of the **mjth** innovation. This value depends positively on V_{jm} and $?_{jmj}$. The **m** represents the medical sector.

When we include the expected net income from the use of the innovation, we get a different function, here V_{mk} is the exponentiated

profit rate at the time t_1. In the case of business stealing, therefore, the loss will then be expressed as:

$$1\text{-}?n \ - \ V_{jmj} \ = \ 1\text{-}?n\text{--}(?_{jmj} \ 1\text{-}?exp(\text{-}rT_{jmj}) \ ?/r) < \ 0 \ @ \ T\text{=}t\text{+}dt\ldots\ldots. \ (4)$$

which by virtue of the initial state of net income at time t is less then zero *(<0)*. The above equation implies that the innovator looses both his initial investment and the expected profit. The double loss of both investment cost and expected income is thus a driving force to hide the new idea or innovation in the absence of institutional and other legal support.

Thus working within the above framework, one thing is for sure: any new innovation implies serious challenge to the livelihood and means of existence of the previous incumbent in that sector who by definition will be producing inferior quality goods or services as soon as the new innovation is introduced. Letting go the innovation also implies loss of resources. It is in anticipation of the price war and the threat of obsolescence, to be associated with the introduction of the superior rival good, that the incumbent will create confusion on the value of goods and services that he produces by keeping the technical information anonymous and completely secret.

Also aware of the absence of any public institutions to protect his ingenuous intermediate product, the owner has to find a creative way to shield his monopoly earnings from imitators and the process of business/knowledge-stealing. This is more seriously re-enforced if the bearer of the knowledge were to be collecting significant monopoly rents from this innovation (high-income). In terms of application, other disguises follow in the form of incantation, masquerading, diversionary sacrifices and scare tactics. In this way, even the patients or customers who are allowed to come in close contact with the products, may not easily and freely understand which among the array of acts contributed the actual solution that they required. It thus appears magical.

In the absence of the guises and disguises, the probability increases that consumers of the medical products may initiate and increment the

frequency of do-it-yourself (DIY), thus depriving the practitioner of his income. They simply go to the bush and produce the same mixture to cure themselves without payment. This self-protective approach thus helps the innovator or bearer of the new knowledge to continue collecting his monopoly rents as well as against intruders who may steal and improve on the intermediate input and render the original idea obsolete. The main argument once again is that those working in African traditional medical sector have finite resources, just like anyone else, and interests invested in their work.

In the absence of public protection of their innovations and uncertainty associated with discovering a new solution, they hedge against getting these innovations into the public domain. The objective they achieve through this is that the general public cannot engage in imitation and do-it-yourself, thus depriving them of their monopoly rent. The process of hedging induces the distortions and magical performances associated with the activities. As explained before, in agriculture, the innovators do not hedge, but do not make effort to expose their innovations to the public domain. In this case, even when very useful knowledge exists that could help improve productivity, the innovator passively restricts this knowledge. If he were to die, the knowledge would be lost. This explains, from economic perspectives, why there is a burning need for individual incentives/rights for innovations in the African traditional knowledge systems, as against the communal approach obtained in the customary laws system. In what follows, we test the validity of the above model through a case study.

The case study is meant to achieve three distinct objectives. First, the responses from the practitioners are expected to lay special emphasis on the type of protection that they need. The second part checks on the possible impact of financial incentive on publicizing and popularizing their professional knowledge and practices. The other part of our objective is to gather as much information as possible on the in-built technologies in their practices, where this is possible. We had set off knowing that achieving this third objective could be very difficult considering that secrecy of the practices has now become a tradition.

Case study results

Statistical trends – supply side

A sample of 120 traditional medical practitioners were interviewed with the objective of discovering the constraints to the sharing of their knowledge with the whole society and advanced scientific research for the common good of the people. The survey was conducted in a town, Achi, in Eastern Nigeria. By popularization and subjection of their work to public and scientific scrutiny, whatever is good and desirable will be advanced further and added to the stock of scientific medical knowledge in the world. At the same time there could well be some dangerous practices. Those require deeper understanding and as such must be isolated and eliminated. This is the principal aim of publicizing and popularizing questions.

In spite of scarce information on traditional healers in Africa, a previous World Bank (1991) survey indicates that about 20 percent of Africans who seek medical care first consult traditional healers. Patients tend to consult traditional practitioners for chronic diseases, for diseases related to psychological or social disruption or to the reproductive system, for diseases that are slow to respond to treatment or are caused by organisms that have become resistant to drugs and for diseases perceived to be "magical" in origin.

One clear indication following from the survey, is that a good portion of the practitioners perform in their capacities as specialists working on phytotherapy, bone setting, faith healers, fetishist healers, specialized practitioners for particular diseases, birth attendants etc. In Achi, the intervention of these healers is still estimated to account for about 54 to 80 percent of all medical care. Most of those interviewed expressed doubt as to whether there would be any one keen enough to deeply understand their practices after they departed the profession.

The traditional system of medicine could be said to lack coordinated treatment of diseases. Most often than not, traditional practitioners fail

to work in teams, and as such they fail to bring together different specializations towards healing processes.

On the other hand, the traditional system of medicine is known to manage a wide range of internal diseases and infections, the great majority of everyday disabilities as well as all kinds of illnesses and symptoms known as psychosomatic reactions. From the survey, one major reservation remains that some acute and dangerous diseases may often not be precisely diagnosed and correctly cured, by an isolated healer. This again proves a major scientific shortfall in the practices. Referral services consist of the patient's decision to try another healer or doctor, if he doesn't feel satisfied with the treatment he is receiving. We present next the result of the survey. The figures show the reaction of the practitioners to external interference – leaving record and others, if provided with financial rewards. Figure 1. shows their response to the changes without the reward (ex-ante). Figure 2. shows their reactions to the same set of changes if provided rewards (ex-post).

Figure 1

Reaction of the practitioners to incentives

Ex-ante

- Relocate Clinics
- Accept External Interfrance
- Leave Record
- Join Formal Structure
- Use Modern Method
- Render Accounts
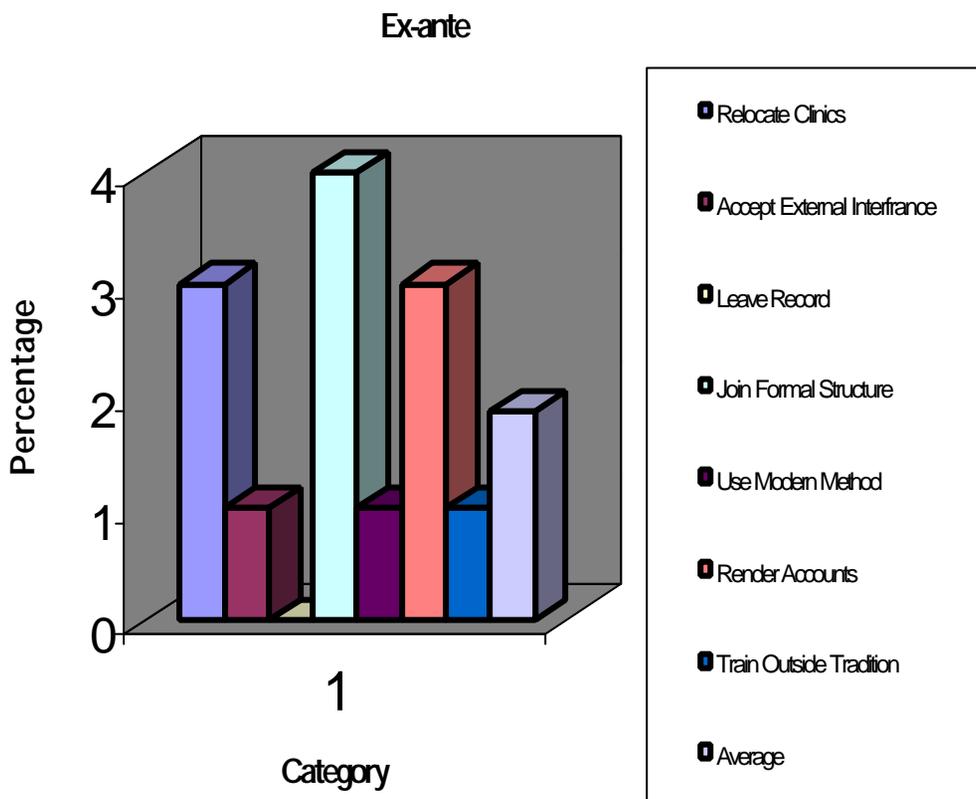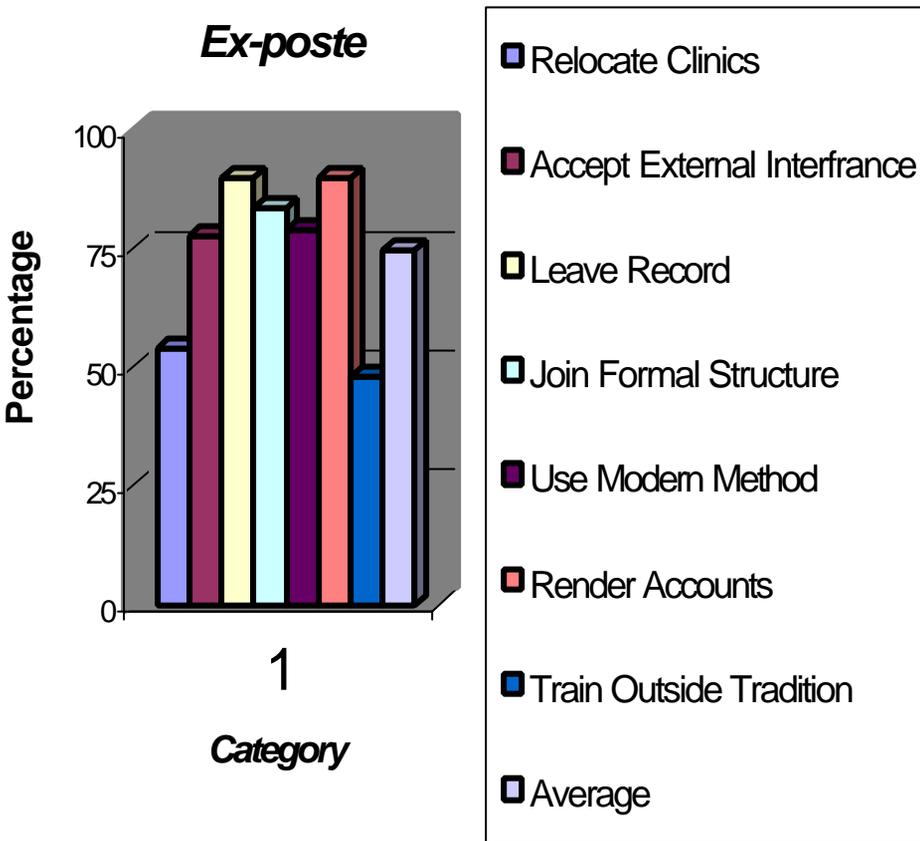- Train Outside Tradition
- Average

Figure 2

Our other results are auspicious and inviting. The case study confirmed the supposition of the s-motivation model. The model, again, supposed that in the absence of incentives/rewards, medical innovators hedge against public use of their knowledge through secrecy. Among the 120 practitioners interviewed, it is important to note that about 75 percent of them, as presented in figure 2, above, indicated willingness to yield to some form of incentive/reward as a reason to submit their practices and knowledge to scientific scrutiny and popularization.

This is quite promising compared to the average of just about 1.9 percent that will do the same without any defined incentive/reward

made available. Some 90 percent of this 75 percent believes that it will be a fantastic undertaking to have their work and achievements recorded for the coming generation, at a price. Only about 36 percent of the entire sample was committed to keeping their practices and knowledge secret on the basis of traditional requirements, no matter the form of incentives.

The growth-ladder model

In what follows, we explain the effects of the wrong motivation/secrecy motivation on the entire economy. As innovators are unable to internalise the cost of their innovations, they react selfishly and the effect is almost static on the knowledge system and overall growth. In low-income sectors, such as agriculture, the innovators are indifferent. Both affect growth negatively. By the growth-ladder model, we mean a structure that supports both quantity and quality-enhancing innovations within an economy. Quality enhancing means that a reasonable specification or change occurred thus leading to good of superior quality and the latter is a close substitute for the good of lesser quality. Goods of lesser quality tend to become obsolete when the new and better kinds are produced. Quantity enhancing, on the other hand, refers to the ability to change the units of output using the same inputs or thereabout.

In the model, sustained economic growth is explained along the path of a succession of production improvement in various sectors as a result of innovation processes. The growth arises from a random sequence of product quality and quantity innovation that themselves result from uncertain research activities. Our assumption is that innovation is a random event with some great uncertainty of its arrival. This applies in the medical sector, for instance. The probability per unit of time of arriving at an innovation is very random and in reality very small.

In the above context, we sketch a growth-ladder model with additional information on the effects of incentive structures such as patent laws, royalty payments and other individual ownership rights. In effect, we add the notions that support innovation as a business.

Figure 3

growth-ladder model.

A continuous and additive innovation growth-ladder model
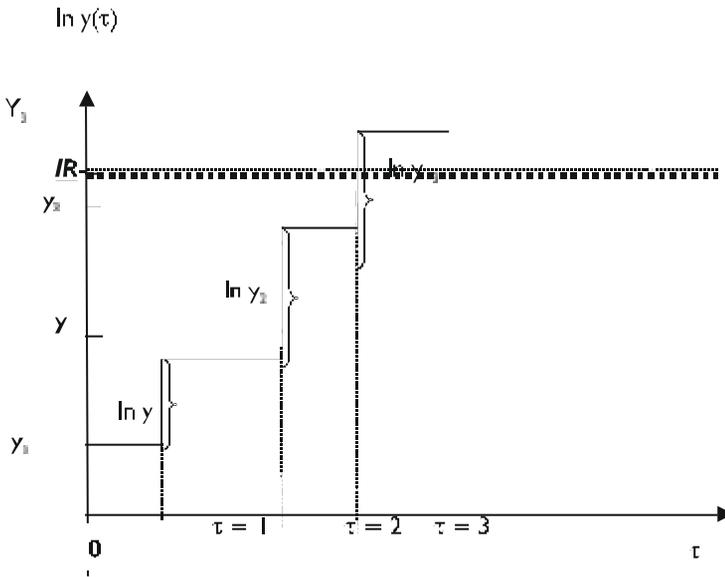
In figure 3., we show a possible positive path for the evolution of a continuously growing economy. The production/productivity starts along the quantity and quality line Y_0 at time t_0.. This is as production rises along the Y rung. The Y_0 is the autonomous production capacity available within the economy, independent of innovations. This also represents the effects and productivity of the basic knowledge required to ensure the existence of life. At time t_1 to t_2, one obtains the rung (lny_1) and so on. Thus, the time, **?** is the interval over which the highest total production Y_k is possible where $K=0,1,---k-_1$.

The model shows the interval of differing lengths for each value of **K**. The lengths are random in the model. This is the undetermined effect of each innovation on productivity. In the place of discussing the path for the individual innovator, we rather review the economy-wide effects. We will return to the individual innovator later in the analysis of the individual motivation model.

In an economy-wide analysis, this growth ladder model (figure 3.) represents the situation where there is a "continuous and additive innovations". What this simply means is that innovators at time, t_0 are fully aware of prior innovations. The previous innovations serve as precedence to current and future innovations. Thus, current innovators work from this precedence. They are also fully aware of the technical information through which the previous innovator came to the innovation. Therefore, any subsequent innovation on the product is additional (incremental) to what has already been done. The new sets of innovations on the product are either quantity addition to a quality product or quality addition to a previous high quantity product. It could also be a combination of both.

The broken horizontal line marked **IR** can be assumed to be the point of rapid increase in production and productivity that can be considered the level of industrial revolution. In this model, we assume also that when innovations are made public, they also provide further precedence for future improvements/innovations. In this context, inventors/innovators additively make their contributions in response to the need to solve a range of problems. The innovations usually expand productivity and transform societies in ways that have never been achieved before. They quickly transform the agrarian rural sector to urban lifestyle in ways that merit the use of the term revolutionary to the process of industrialization (see for instance, Hobsbawm, 1964). By the nature of previous precedence and complimentary innovations, the economies in figure 3. can quickly reach and pass the horizontal line IR.

Notice that neither the heights nor lengths of the horizontal periods are equal. The difference lies in what is called "drastic and non-drastic innovations". Some innovations are very strong and others subtle. When

the impact of an innovation transforms the pattern of production strongly, it is considered "drastic innovation". On the other hand, when the impact of an innovation is minimal and not leading to very serious change in the pattern of production, this is called, "non-drastic innovation".

In the graph, the drastic innovations lead to a higher jump in the vertical line in the graph. Subsequent innovation might turn out to be as drastic or less. Whatever happens is random and cannot be predetermined. Along the horizontal line, you get the length of time that the current innovation remains useful until the new innovation. This can be called the duration of innovation. The duration of either quantity and quality innovations are highly stochastic. Another way to describe the probability is that they could be highly serendipitous – result from unplanned events. New innovations along these lines come as a result of unpredictable random effects.

One factor that has successfully explained the rapidity of change in innovations over time is population (see for instance, Cypher and Dietz, 1997). The importance of knowledge/technology, and particularly the stock of and enrichment of human resources component have widely been identified as contributors to economic growth. In the works of Denisson (1962), technological innovations was identified as being responsible for over 40 percent of growth in the United States and the United Kingdom. The endogenous growth theories also make manifest about how the ability to apply technological knowledge varies dramatically amongst economies, so that the convergence amongst economies does not take place in the simple fashion suggested by the neo-classical growth model.

This way of looking at technology as something requiring social investment in specific human and organizational inputs, if it is to be utilized, recognizes that there can be technology gaps among economies and that each economy develops its own relatively unique technological base. Technology is specific knowledge, not general knowledge which can be applied everywhere in the same way. Each country/society must make a substantial investment in its social and human resource capital

base if it is to gain the capacity to apply technology. Therefore, we also keep in mind the role of population in generating upward growth in both technological knowledge, innovations and the overall economy.

Figure 4

? production frontiers[1] of growth-ladder models
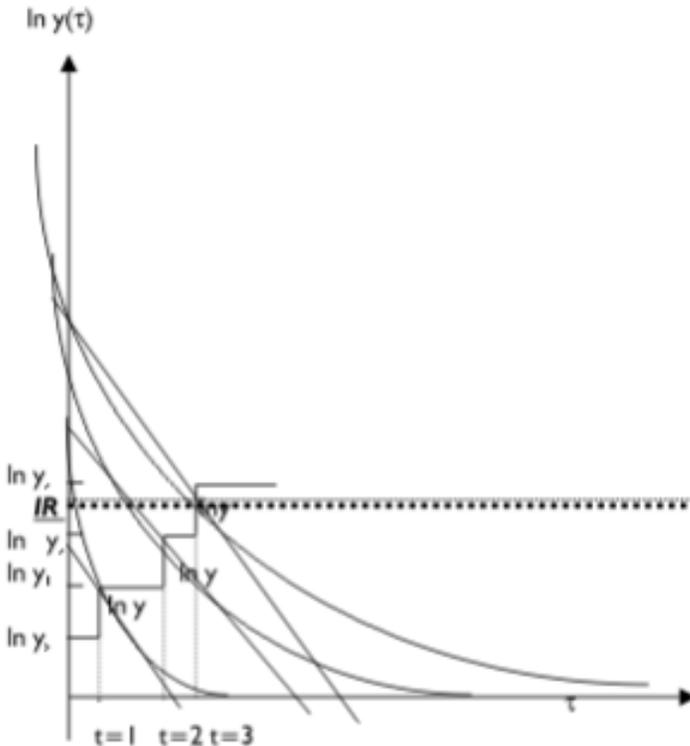
Production possibility frontier (PPF) in a growth-ladder model with "continuous and additive innovations". In figure 4., we present also the possible changes in the levels of production as a result of innovations within growth-ladder system/economy.

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[1] The change in the production possibility frontiers (ppf) assumes a constant opportunity cost between the productivity of the innovation along a time path.

Figure 5

African customary laws and the growth²-ladder model

A continuous but non-additive
innovation growth-ladder
model
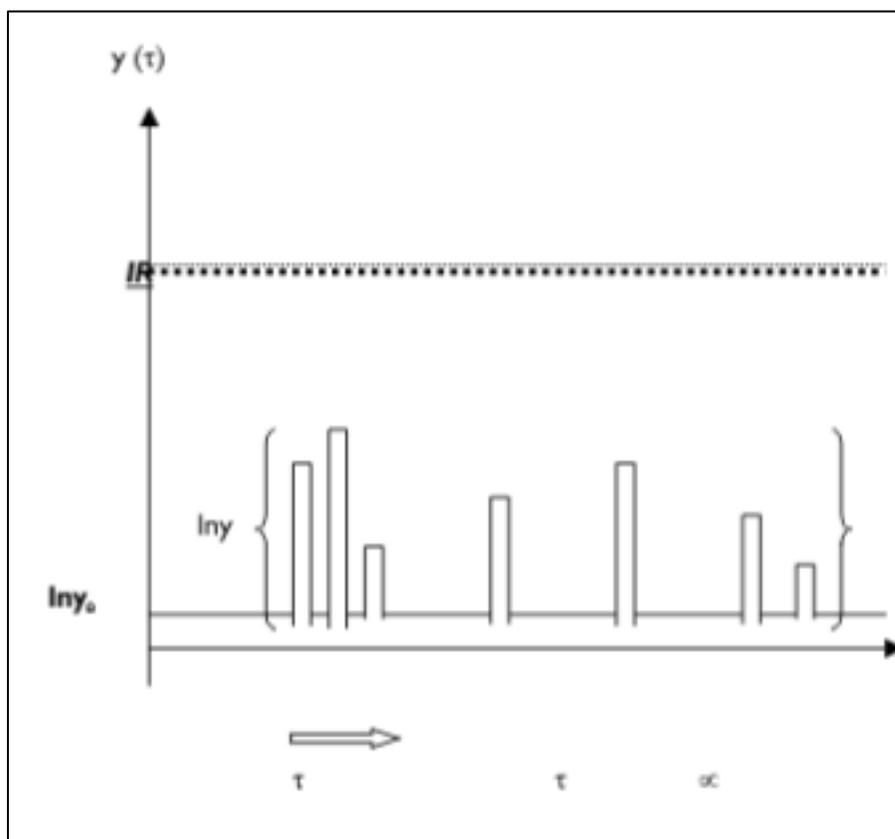
As a derivative of the growth-ladder model in figure 3., we structure the equivalent for most African societies with the traditional knowledge and innovation, in the customary law system, as the main knowledge for production.

The African growth-ladder model reflects what we call the "continuous but not additive innovations" effects. Basically, this occurs when an economy continuously has isolated individuals innovating on the same knowledge system. The resulting innovations are also used in isolation and disappear in the same pattern. The vertical blocks are representative of innovations that do not have anything to do with previous and future innovations. Notice that a combination of innovations 1,2 and 4 easily takes the economy to the high production level marked *IR*. But this will not occur in this setting.

Apparently, the current innovation does not relate to the previous innovation because of either "secrecy" or the "indifferent attitude" taken by the previous innovator about putting his innovation to public uses, in the absence of incentives. In the environment of either secrecy or indifference, the results of the innovation are very temporary until the innovator dies. When such an innovator dies the growth-effects of their innovation drops to Iny_0 because nobody knows as much as to continue the innovation. The same happens over time to other numerous and isolated innovations in the system of knowledge. One gets a continuous *Iny* that has a derivative of *Iny* ? Iny_0. Eventually, what one gets is more like a no-growth trap and a system that resembles a static or backward-looking system of knowledge. Backward looking implies that the end result of innovation is a perpetual Iny_0 in productivity. This is a very adverse/perverse condition. The consequence of continuous but non-additive innovation is that economies operating in this system fail repeatedly to reach the horizontal line *IR* ever. Previous innovations do not serve as precedence for either current or future innovations. As stated before, the secrecy or indifference approach adopted by the innovators implies that the population does not get to use and improve on the existing innovations.

As stated before, the more rapidly a technology is adapted and put to work in an economy-wide approach, the more rapid the pace of economic growth. This requires that workers and entrepreneurs in a country have hands-on experience of using such ideas in the act of producing. All things being equal, slower technological progress means slower economic growth and reduced possibilities for augmenting or creating the social mechanisms that promote greater equity and higher level of human development that technological progress makes feasible.

Society's social and economic institutions, including the existing class structure, ideology, religion and superstition, openness to change and to share development are paramount forces in determining to what extent technological knowledge is able to perform its dynamic and transformative functions. As in African traditional societies, it is conceivable to have socio-economic systems where there are not some of such institutions and structures that are past-binding and at the same time, *status quo* or future oriented.

Thus, the model emphasises the natural property that new innovations make old technologies, products and processes, obsolete. At the point of adding the effects of incentives, our main concern is on two new terms. They are the process of "continuous but non-additive innovations" and "continuous and additive innovations". Innovations are continuous but non-additive when, as a result of existing circumstances, business operators innovate on the same existing knowledge in isolation (non-additively) of the awareness of the past and current state of a particular product and process innovations.

Usually, the surrounding environment and existing incentive structures define the possibility of having the above situation. In other words, it is a "positive" consequence of any lack of defined and administered incentive system. We already explained that the customary laws in Africa do not recognize individual innovations and do not reward them. The consequence is secrecy on the part of innovators in the high-income sectors, such as medicine, and indifference in the low-income sectors such as agriculture. The implication of both reactions is a negative relationship between past, current and future innovations, or the

possibility of a cyclical innovation patterns. The understanding of the pattern is very necessary in explaining what kind of protection system already exists or is needed to protect knowledge/technology in African traditional economies. In the next section, we specifically analyse the technicalities of the secrecy or indifference in the context of the customary laws on the two sectors – medicine and agriculture.

The impact of customary laws on productive sectors

The imperfections in the African customary laws for the protection of various components of knowledge, particularly innovation, have had two distinct and similar effects. Generally the rights in customary laws, even when not formally written, are clearly understood by all and not to be violated, except by approval of the authorities, usually the elders. The authorities of the elders became one of the most stable societal structures evolved to regulate the flow and use of resources in most African traditional societies. In the area of intellectual property, the rights and benefits are usually communal, belonging to a community or clan. In the high-income productive sector such as medicine, where the individual earnings are high, the result is "secrecy" on the part of the ingenuous innovators/practitioners. As a result of the imperfect treatment of ingenuous knowledge, the practitioners resort to secrecy to protect their knowledge. They therefore restrict the use of their knowledge from the general public.

In low-income sectors, such as agriculture, the impact produced "indifference" to the public gains from any innovation, on the part of the innovators. Low-income sectors innovators do not resort to secrecy but also do not project the innovations to the public domain. The incentive to project their innovation to the public obviously does not exist. The common response by the innovators is indifference, because of no expected special reward for putting their discovery in the public domain. Usually, innovators in the agricultural sector do not see any reason to inform the general public of their discoveries. The effects of both indifference and secrecy are the same on the growth-ladder model. In the next section, we focus specifically on how this is translated in a no-growth trap in the medical sector, with an overall stunting effect that

makes it far less visible than the modern counterpart, allopathic medicine.

The impact of customary laws on African traditional medicine

We explain next the dynamics/framework through which the African customary laws failed to support individual innovation in medicine, thus leading to high secrecy by the innovators in the sector. The consequence is very little growth. We also test the framework through the use of empirical data. The primary questions we expect to answer in this section are: why are the African traditional medical practitioners secretive? Are the motivations for the secretive behaviours economic? What specific examples of healing powers do the practitioners have? One caveat: secrecy is not part of the customary medical law in Africa (see for instance, Onyebuchi, 1998).

As stated earlier, the case of secrecy in medicine has similar effect as the indifference in agriculture. The two only vary in the dynamics. Perhaps it was perceived as optimal to always put innovations in the public domain, in African customary law. Intuitively this makes sense, at least in the short-term, while the innovations continue coming. In the long-run it does not. It hurts the search for innovation by individuals. Looking at the optimal effects of innovation to the general public without a consideration of the rewards for the individual deters future search for innovations.

To explain the issue of secrecy in the medical sector, one can liken our representations in the model to the suppositions of the Game Theory (see for instance, Sorin, 1986). This theory studies the logic of interdependent decision-making between individuals or groups, on the belief that the agents involved in a game are rational. It assumes that the agents have well-formed preferences and pursue their interests efficiently, and that they have strategies, which requires them to have more than one possible course of action. The actors vividly assume a zero sum effect of the game in which what the winner gets is exactly equal to the loss of the loser.

In line with the above, we posit that the key basis that determines the secret behaviours in African traditional medical sector is mainly threefold. They are: the inadequacy of rents and perceived high income from innovation; absence of public protection of intellectual properties; and the threat of business-stealing and obsolescence by the arrival of new innovations.

Innovation, surprisingly, has very little predictability. This is particularly so in medicine and agriculture, where research can be costly and long-term, and where the results are uncertain (Tony Blair, 2001). In this situation, the bearers of the unique knowledge consistently work to regulate against any threat of another individual stealing their knowledge. We named the specification the "motivation model", simply because of the motivation effects in-built in the interdependencies of the key variables.

The existence of the latest innovation, if pursued, does open up more windows of opportunity for future developments and further innovations. Some of the results will be more drastic, others will be non-drastic, and therefore will earn less. As we bear this in mind, those who are not inclined to follow the technical specifications should just read the text of the model. It will make for enough understanding. We hope that the logic is useful and digestible, for the technically inclined people.

As for the effects of indifference in the low-income agricultural sector, they are the same as in the figure 3. Both secrecy and indifference, in the model, mean depriving the general public of the virtues of growth-enhancing innovations. Both draw from the lack of incentive to do so.

The above model was tested using 1998 empirical data (see Nwokeabia, 2001). The results strongly support the main argument of the model. African traditional healers are known to have succeeded in various medical applications, among them bonesetting, child delivery, herbal medicine (for malaria and others), and inoculation. The implication is that it may be necessary to conduct intensive research into the activities of this group as contributors to economic growth. Some people might still be hesitant. In answer, let us say that it was once believed that the earth

was flat and a fixed point about which the rest of the universe revolved. Cartesian science proved this theory wrong.

The conclusion is that we may need to protect the African traditional innovators differently. It is simply a fact of life, and it does hold the potential for great benefits. Within the knowledge-based global village in which the economies of Africa have to operate, some of the insights it provides can help us structure our thinking to our own benefit and the benefit of the regional population.

IV.   Protection and growth

There are many alternative mechanisms that any society can use to allocate resources and resolve basic disputes over the outcomes. In Africa, the customary laws are some of the ways. In intellectual property ownership, the African customary laws grant informal/unwritten rights that can only be used and transferred by a set of generally understood rituals. The informal intellectual property system under the customary laws lacks the administrative structures associated with the formal IPRs. Usually, clans are apportioned certain professional rights such as bone setting, basket making, pottery and others. In such case, except people from the approved clans and tribes, others are put under social pressure to stick to the pre-apportioned professional rights.

As the bible says: "Out of Nazareth cometh not a Prophet". In most African customary laws, the practice of the various professions and use of the knowledge and associated ceremony is pre-defined by clans and along bloodlines. Some of the details in the profession are defined as confidential within these communal groups. The customary laws also strictly define who performs what function as in the Iboland masquerade system where individuals have to specialise.

Therefore, before taking the debate of protection, we have explained the importance, economics, elements and scope of TK. This includes the various components of knowledge and their applications in, say, traditional medicine and farming. Knowledge is usually created to solve problems. If such knowledge persists for a stretched period in a society, it becomes traditional. In this sense, the starting point for any need to protect TK should be to clarify why there is a need to protect, what problems (economic or social) can be solved, and what can be achieved.

Other studies and proposals have been made (see for instance the Crucible II Group 2001). Therefore, the definitions of concepts as provided previously, are essential to determine the need for, the scope and extent of protection needed to improve on their economic and development functionality. Despite all these efforts, many questions

about objectives and functionality remain unanswered. The technical details in this paper will aim to answer most of these questions.

The dividing lines between these aims are not however always clearly cut. In other words, the first issue is not the legal protection that can be used. It is rather the economic and social functionality of the protection system. Arguments on various objectives to be achieved by a protection system have been advanced. Among them, those of equity, conservation, preventing misappropriation and others. In all of these, it is more like the economic and social well-being of the bearers of the knowledge and their society that should be the priority. We therefore suggest that multiple strategies may be followed to protect TK under IPRs, including the customary laws. The basic point is the extent to which any one system can be followed without hurting the economic and social objectives of the knowledge bearers and the societies, particularly the innovation aspects.

Any system of protection of traditional knowledge in Africa should not be solely for protection purposes. Economic growth and development should be the aims of any protection system. According to Correa (2001), protection should be an instrument for achieving certain clear economic and development objectives. Legal models should be the means of achieving the aim.

This section is thus written for policy. The aim is to inform the policy-making process, concerning traditional knowledge, intellectual property rights (IPRs) and sustainable human development in Africa. It can help strengthen the capacity of Africa policy makers in intellectual property areas to safeguard adequately, the interest of their people and future economic growth. It is also to help bring the countries into meaningful discussion with industrialised countries around issues raised by the review of Article 27.3(b) of the Trade Related Aspects of Intellectual Rights Agreements (TRIPS agreements) of the World Trade Organisation (WTO). The impact of the Agreement on Trade Related Aspects of Intellectual Property Rights of the World Trade Organisation has broadened.

It is only when intellectual property is firmly protected and property rights are allocated that it becomes a tradeable issue. The owners of the rights can then either sell these rights or use them to enhance their well-being through guarded usage.

As is commonly admitted, some forms of protection, such as the customary systems already exist in many African societies/communities. The customary systems provide varying degrees of protection for the different components that can be found. In the words of Ekpere (2000), the customary systems in many African countries already apportion rights and benefit-sharing for communal and individual property. Yet it may appear that some imperfections exist even in the customary systems.

A good number of modern Africans now operate without their maternal languages – conducting daily businesses in most English or French. Most importantly, in the era of globalization, global legal regimes now define how all aspects of life are utilised and traded. The Trade Related Aspects of Intellectual Property Rights (TRIPs), in particular, define the aspects of the global trading framework on intellectual property rights. Yet the interface mechanism between the customary systems existing in traditional Africa and the global regimes such as TRIPs does not exist. Neither can do without the other, in as much as neither is perfect. In the next section, we briefly review the proposed protection systems for the sole purpose of understanding their virtues and weakness for amendments.

V.   Proposed protection systems

We departed into the argument of protection of traditional knowledge with the notion that any system either already in place or to be introduced must be growth enhancing. In the absence of this, it requires amendment. It is also true that the inadequacy of the existing protection/promotion system, the customary law, has resulted in a systemic devaluation and invisibility of African traditional knowledge, as already demonstrated in figure 5., the African growth-ladder model and the s-motivation model for medicine. The customary legal protection systems in African countries are generally acceptable. The *suis generis* system being proposed at the global level equally holds some prospects. We review each.

The customary laws with traditional knowledge as public good

Many rights are defined in the customary systems of many African societies. An example is the conservation and use of plant genetic resources by the traditional farmers. Most farmers breed and select farmer's varieties (landraces), thus leading to innovation in products. As already explained in the growth ladder models, in the existing customary systems, however, there is no special reward for attaining innovations. Farmers generally interact among themselves and exchange the varieties.

In such a case, however, the lack of incentive deters the motivation to inform the general public of any innovations. Sometimes, without knowing, the absence of special incentive systems even discourages future innovations. In that sense, the customary law protects the improved varieties because it resides in the kinsmen and is passed on among them. The innovator is not particularly compensated as a way of encouraging future innovations. The communal ownership of knowledge and innovation thus reduces the individual incentive/need to spend resources searching for new innovations.

A unique circumstance has evolved in African traditional medicine. Medicine is always in high demand. The rewards of better performance

remain particularly high. For this reason, most practitioners, even while working within a kinship strive to innovate to improve on their services. As is explained already in the rationale for secrecy in medicine, such innovation has very random occurrence. The probability is very low that even after spending long time and other resources, there may be any worthy outcome in the form of innovation. However, when such innovations do occur, the reward/income can be quite high. More customers are attracted. Income grows. Comfort improves. Most importantly, the reputation and respect of the innovator in the profession rises, even among the same kinsmen.

What most innovators in African traditional medicine have done is to evolve their individual protection mechanism in the absence of protection in the customary system. They resort to secrecy. They apply diversionary tactics. They also use concoctions to confuse the possibility of business stealing. In the end, whereas the knowledge of, say, bone setting has resided in the kinship, the individual practitioners protect against the diffusion of their insights/innovations to others, even among the kinsmen.

One unique thing is that most of the customary systems forbid stealing of these ideas. Thus, in the absence of deliberate measures to pass the innovation to the other practitioners and subsequent generation, the optimal value, in terms of use, of the innovation is not realised. This sort of development has a stunting effect on the industrial progress of the community of origin, of the particular knowledge. Without wide distribution and commercialization of innovations, it then appears that the original knowledge remains static.

The static perception comes from the effect of the "continuous but non-additive innovation" process. This means that the various operators continually innovate independently, without actually adding value to previous innovations since they do not know about them. Previous innovations do not serve as precedence to current and future innovations. This is what probably stunted the effects of traditional knowledge on Africa's development. The individual innovations are not diffused. Consequently, what remains among the kinship or the public

domain is only a little more than the original ideas. The growth-(quality/quantity) enhancing innovations, most likely to bring about industrial progress are kept secret by the individual owners. When the owners cease to operate, the productivity effects of their innovations also cease.

Perhaps, this is probably where the customary systems fail in the protection of TK for economic progress. Knowledge can sustain societies and communities. It is, however, innovation that produces the transformation process needed to move an economy from situation "A" to situation "B", where situation "B" is an improved state of being. Therefore, innovation as an engine of growth and as a business must be recognized and strongly rewarded in any knowledge protection system.

This is probably where the African customary system may interface with the modern IPRs. The customary systems recognize the practices of local communities. By vesting legal ownership/rights of knowledge on communities through IPRs, it raises the profile of that knowledge and encourages respect for it, both inside and outside the holding communities.

The recognition of what already exists in the customary laws can make the learning and development of such knowledge a more attractive prospect for younger members of such communities, thus perpetuating its existence. However, fencing off such knowledge in its current status may not add much to the well-being of the community. It does not guarantee that it would not be eroded, undermined or ignored, even at the risk of being lost. Whatever the previous protection system (customary) did not achieve in the past may not just start happening, simply because the system is recognized internationally. This is where the modern IPRs could supplement the customary system in the recognition of individual innovation within a commonly shared knowledge and technology.

Thus, combining the two systems assures the uplifting of the community knowledge as well as the continuous innovation needed for industrial progress in the communities. The merger of the two systems recognizes

the need for growth-enhancing innovation, which at the very best usually originates from individuals within the community. In traditional medicine, for instance, such incentive and recognition helps remove the secrecy, leads to commercialization and enables a more rapid value-added innovation process.

In this case, a situation that can be called "continuous and additive innovation" occurs. This creates industrial progress needed for the transformation of the communities. As stated before, this is the exact opposite of "continuous but non-additive innovation", caused by secrecy and indifference in the use of innovation. The role of modern IPRs helps remove the secrecy and reward the innovator. The modern IPRs, by rewarding the individual innovation, make the process a lucrative business. They open up innovation as a growth-enhancing engine of industrial progress in the regional poverty alleviation agenda.

The implication of all these for a *suis generis* protection of intellectual property in Africa is a simple three-stage approach. An effective system should aspire to grant the communal ownership/rights of knowledge to the community of origin. Subsequently, individual innovation of such knowledge is granted to individual innovators for a limited period. At the third stage, the ownership rights are re-transferred to the indigenous community. The essence of the approach is to safeguard innovation as a business and engine of growth and development. In so doing, the community of origin also benefits from its knowledge.

Several proposals have been made on the protection in TK in Africa (see for instance, Ekpere, 2000). Many questions about the economic objectives, tools and feasibility of TK protection had remained unanswered. The need for the insights provided in this paper arises for the fact that significant divergences exist as to whether IPRs systems should be applied to TK. If that were the case, what would be the rationale, aims and modalities of protection?

The over-emphasis of such a system of communal ownership against private ownership is actually a fault. The other is the lack of effective interface with the modern protection regimes. In Africa, much has

changed since colonial times. Most Africans now operate outside the customs in which they were born. New sets of reasoning and ways of doing things have been assimilated by the so- called "modern/educated" Africans.

The modern IPRs generally include any information not subject to IPRs or for which IPRs have expired. To the extent that TK is not covered under any of the existing IPR modalities, it would belong to the public domain and is free to general use. A lot is also ignored in this technically correct view. It ignores the fact that there are several dimensions to TK, particularly in that it has existed for ages. It also ignores the fact that TK is mostly subject to customary laws that recognise other forms of ownership or possession of rights. With the weaknesses of the systems in view, we suggest that different strategies may be developed to protect TK with a combination of both *suis generis* systems and customary systems, to be development enhancing.

A *suis generis* system is a system specially designed to address the needs and concerns of a particular issue. Applying the *suis generis* to traditional knowledge protection could mean a system entirely separate and different from the current IPRs system.

Given the nature of Africa's development challenges, the *suis generis* protection may be the way to go for the protection of African traditional knowledge. The parallel possibility of the customary protection systems and modern IPRs systems are the major rationale to accepting the possibility. Therefore, the insights provided in this chapter help clarify what sort of protection may be provided in the anticipated *suis generis* clauses.

Any protection aims to define ownership of rights to use the intellectual property. It also defines the incentive structures – rewards and punishments surrounding the use of the intellectual property. In the words of Correa (2001), one concept of protection essentially means to exclude the unauthorised use by third parties. Others regard protection as a tool to preserve traditional knowledge from uses that may erode it or negatively affect the life or culture of the communities that have

developed and applied it. The Organisation of African Unity (OAU) model laws see protection a bit more positively. Protection has a more positive role of supporting TK-based communities livelihoods and cultures. The OAU approach is based heavily on the African customary intellectual protection systems, and is quite interesting, except for one limitation.

The over-emphasis of the public good aspects of a protection system is a limiting factor in the OAU concept for TK protection. It lays emphasis on the community. In fact, there is a simple reason why the incumbent indigenous innovator will choose to engage in no further research. In the customary system, all the producers have access to the incumbent innovations/technology. This forecloses the possibility of any monopoly profit/profit maximization flow to the incumbent innovator. It also reduces the possibility of innovation as a business.

Therefore, the OAU law says nothing about the individuals' activities that usually initiate growth and development-enhancing innovations. Quality/quantity enhancing aspects of any knowledge or technology are usually initiated and repeated by individuals. This is the limitation in the customary protection systems. The effect is negative dependency. We have dealt with this in detail. Some changes must be made in both the African customary system of intellectual property protection, and the modern IPRs systems.

VI.   Conclusions

As a result of the foregoing analysis, a lot becomes obvious. General knowledge can be made a communal intellectual property. Making innovation a public good, at least in the short-term of 10–15 years, is unambiguously bad for sustained economic growth and welfare promotion. Knowledge can be a communal property. Innovation cannot be made a communal property. The more innovation is made a public good, the lower the monopoly rent to be appropriated by the successful innovator. It also makes greater the disincentives to innovate. Consequently, individual innovators who operate in the public domain approach will cease to innovate after one innovation. In the absence of incentive, the innovators use their newly gained knowledge privately. This minimizes the impact of the innovation on the economy. When the innovators cease to operate, the innovations cease to exist.   At this moment, no growth will occur because the innovation process is stopped. In other words, whether or not the economy grows at all depends on innovations and the psychology of the innovators.

The existing customary law in Africa in most cases makes a strong economic assumption/omission. The assumption/omission is that the existing African traditional knowledge system has been optimal in the region's production system. As a result, it appears correct, *prima-facie*, to maintain the *status quo*. This is inaccurate. The system has failed to self-correct because of the assumption/omission. The continually deteriorating state of well-being of traditional people in Africa is a testimony. For that, the system may have to be modified.

The assumption in-built in the customary laws rules out important economic phenomena. It answers only to the local needs, by mere assertion. It fails to recognise forward-looking economic and social objectives that the existing knowledge should serve in a highly competitive world. It fails in dealing with the functional stages of development in which incentive structures define different technological dynamics and the growth-enhancing effects. Any economy always aims to scale-up the state of what it was a year ago, with prospects for the future. In such a case, it is the introduction and diffusion of new

technological paradigms and discoveries – innovations that make this path possible.

Therefore, individual patents/rights to intellectual property and innovations increase the interval productivity of an innovation, sustained economic growth and incentive to innovative, additively. When innovations are made public, they also provide precedence for future improvements/innovations. It is more effective and the unit cost in terms of time is reduced. It is through this process that transforming the economy is quickly achieved thus leading to industrial revolution of an economy. When the incentive system takes into account the social returns to the individual innovator, this supports innovation as a business, and it produces innovation-driven growth as in figure 3. This explains a main welfare implication of any protection system adoptable for African TK. No one wants a case where lack of earnings and poor incentive system shuts down research and creativity completely to a no-growth trap.

Additionally, the customary/public domain approach takes advantage of the fact that the benefit of the incumbent innovation in production will continue forever. The private approach attaches no weight to the benefit that accrues beyond the personal gains. However, as is demonstrated, the public approach effect tends to generate insufficient incentive to innovate continuously or even make innovation a business.

Implementing the required policy changes in intellectual property rights and traditional knowledge is one enduring long-term challenge that inevitably demands a lot of African people and governments. At the point of joining the globalization process, however, these governments made a date with history, once more: a date similar to the fight for political independence in the 1960s. The question is whether governments wish to strengthen the people with original knowledge, to effectively participate in the global village or leave them dependent. The result of the date depends on what the people and their governments do with the way an ordinary indigenous African acquires knowledge and uses it to produces her/his solutions. The economic and social gains that we all stand to make, for improving the policies, are incentives for action.

VII. Recommendations

The new system of protection must include the possibility of conferring protection rights to both individuals and communities.

In benefit sharing, therefore, general knowledge could be protected through geographical indication via customary laws. A major recommendation is that the innovations should be individual intellectual property. In this just about 25 percent should return to community and the other 75 percent to the individual innovator.

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