Healthcare and Economic Growth in Nigeria : A Repository Database System for Traditional Herbal Medicines Used in Healthcare

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ABSTRACT

It is no secret that health is instrumental to an individual's education, income and overall development. Studies show this is true for countries as well; health can be a causative factor for the aggregate economic growth of a country. In spite of more than 150 years of introduction of Western style medicine to Nigeria, traditional healing and medical practices remain a viable part of the complex health care system in Nigeria today. As important as traditional medicine is, there is no complete database for medicinal plants in the Nigerian locality that are comprehensive enough to meet the need of individuals especially for self- healthcare. The limited knowledge of the ethno botanical characteristics of plants has made people seek cure outside the country. This research work was able to build a repository database which comprises of 182 indigenous herbal medicinal plants of 70 family species (linked with the pictures of the plants), their names in the three major Nigerian languages, the parts used for medicinal purposes and the ailments/diseases they cure. However, studies have shown that not all herbal medicine or natural medicine are safe, some poisons are also natural. To reach a stage where herbal products of assured quality and effectiveness become more integrated into mainstream medicinal treatment in Nigeria, equal obstinate must be employed because of the opinion of some traditional herbalist who believe that unprocessed natural products have an innate superiority and that the mystical aura surrounding herbs will somehow be destroyed by extraction and standardization. In same vein, more innovative strategies employing all the associated sciences and information communication technologies must be created in order that traditional botanical medicine can help in the development of sustainable manner of healthcare products and dissemination of information to the dramatically expanding population.

Keywords : Healthcare, Economic Growth, Nigeria, Herbal Medicine, Repository Database System

I. INTRODUCTION

It is no secret that health is instrumental to an individual's education, income and overall development. Studies show this is true for countries as well; health can be a causative factor for the aggregate economic growth of a country. The World Health Organization has estimated that a 10-year increase in average life expectancy at birth is associated with a rise in economic growth of some 0.3-0.4% a year (Singh and Ghosh, 2017). This evidence is available at the micro-disease level as well: for example, a 10% decrease in malaria is associated with an increased annual economic growth of 0.3% (Singh and Ghosh, 2017). A case in point is Asian countries such as China, Malaysia, South Korea and Thailand. Plotting their economic growth vis-à-vis two key health indicators reveals an astounding fact: They have succeeded in improving health as well as delivering sustained economic growth (Singh and Ghosh, 2017).Data over decades reveals that health improvements, illustrated through the infant mortality rate and life expectancy, actually preceded their economic surge. This is illustrated most dramatically in China, where both infant mortality and life expectancy improved dramatically in the 1960s, before the surge in Chinese economic performance. In other words, countries become healthy before they become wealthy.

Incidentally, Nigeria is among the developing nations with poor health outcomes and its attendant problems. The health status of Nigeria is still considerably low and exists below that of some countries in West Africa. Low life expectancy at birth, high infant and maternal mortality rates, malaria and tuberculosis afflictions are some of the characteristics features of the Nigeria`s health status. Life expectancy at birth in Nigeria was estimated at only 48 in 2007, compared with 56 in Ghana (Onisanwa, 2014). This is complemented by the high numbers of women who die of complications during pregnancy or childbirth. Although the global maternal mortality ratio of below 400 maternal deaths per 100 000 live births in 2008, the maternal mortality ratio for Nigeria was 1100 per 100 000 live births, still on the high when compared to 560 and 910 in Ghana and Guinea respectively(Onisanwa, 2014). The prevalence of HIV/AIDS among adults aged 15 and above infection has contributed significantly to Nigeria's low life expectancy (WHO, 2010). It was estimated at 2,886 per 100,000 people. It is above the Prevalence rate in Ghana (1722), but below that of Cameroun (4580). Also, the per capital income in Nigeria is low, with more than half of the population leaving below the poverty line. Thus, provision of adequate funding for health care either by the household or the government remains difficult.

Nonetheless, traditional systems of medicines, including herbal medicines, have been used for many centuries for health care by people in countries of the South-East Asia Region as well as in other parts of the world. Since the concept of "Health for All" through primary health care (PHC) was launched at the International Conference on Primary Health Care at Alma-Ata in 1978, there has been a global movement to realize universal health-care coverage. However, in spite of advances made in the health sector, equitable health care coverage; availability, accessibility and affordability to conventional health care and services are quite often beyond the reach of people who are indigent, marginalized and underserved. Moreover, the present upsurge in the use of traditional medicines or complementary and alternative medicine – generated after the Alma-Ata International Conference – has become a global phenomenon (WHO, 2010). This development portends well for a more comprehensive health care delivery and health sector reform in facing new challenges in PHC due to demographic, economic, environmental, and social changes that have a negative impact on health development.

Although Nigeria has a good green vegetation where a lot of medicinal plants grow, but the limited knowledge of the ethno botanical characteristics of plants has made people seek cure outside the country whereas solutions lies within. According to World Health Organization report in 2004, despite all advances made in orthodox medicine, traditional medicine will continue to gain renewed interest in health care services of Nigerians (Raphael, 2011). This may be attributable to increased awareness in the potential and curative ability of these alternative medicines and in particular the various short comings revealed for several synthetic drugs (Ugbogu and Odewo, 2004). According to Gbile and Adesina (1986), herbs usually serve as the repository materials and have been acknowledged to be generally safe with minimum side effects. As important as traditional medicine is, there is no complete database for medicinal plants in the Nigerian locality that are comprehensive enough to meet the need of individuals especially for self- healthcare. The aim of this paper is to develop a repository database system, by compiling identified medicinal plants from certified researches and publications for the African nation, particularly the Nigerian locality in their indigenous names linked with the pictures of the plants and their medicinal uses. However, studies have shown that not all herbal medicine or natural medicine are safe, some poisons are also natural (Ansari and Inamdar, 2010). Herbal medicine however, natural can cause serious illness from allergy to liver or kidney malfunction to cancer and even death. Most herbal produce on the market today have not been subjected to drug approval process to demonstrate their safety and effectiveness.

II. Nigeria's Health Sector and Economic Performance: Snapshot

2.1. Economic Performance

Nigeria is the most populated country in Africa with a 2013 population estimate of over 167 million people, a population growth rate of 2.5% and average life expectancy of 54 years. Following the rebasing of Nigeria's Gross Domestic Product (GDP) in 2014, Nigeria's economy is now the largest in Africa, ahead of South Africa, with an estimated GDP of USUSD509.9 billion in 2013 (PharmAcess Foundation,

2015). The economy recorded a growth of 7.36% in 2011 and 6.68% in 2012, surpassing Sub-Saharan Africa's average growth rate of 4.9% in 2012 and ranking as one of the fastest growing economies in the world (PharmAcess Foundation, 2015).

Nigeria is traditionally agrarian, with the agricultural sector accounting for almost 20% of the total GDP in 2013. Nigeria is also Africa's largest oil–producing nation and the tenth largest in the world, estimated to account for 8.62% of African regional oil demand in 2014(PharmAcess Foundation, 2015). Oil provides 90% of the country's exports and about 75% of the government's revenues. Activities in the Nigerian health and social work sector contributed only 0.65% of Nigerian GDP in 2013, up from 0.61% in 2010 based on the rebased GDP basis (PharmAcess Foundation, 2015). The sector has recorded a tremendous compound annual growth rate (CAGR) of 16% over a period of 4 years spanning 2010 - 2013 and accounts for 7.38% of the Nigerian labour force, contributing1.44% of new jobs created in quarter four of 2013 ranked 147th out of 189 economies (PharmAcess Foundation, 2015).

2.2. Health Sector

The Nigerian healthcare system is organized into primary, secondary and tertiary healthcare levels. The Local Government Areas (LGAs) are responsible for primary healthcare; the State Governments are responsible for providing secondary care while the Federal Government is responsible for policy development, regulation, overall stewardship and providing tertiary care. The LGA level is the least funded and organized level of government and therefore has not been able to properly finance and organize primary healthcare, creating a very weak base for the healthcare system. Nigeria has five hospital beds per 10,000 population (PharmAcess Foundation, 2015). The federal ministry of health's (FMOH) health facilities (HFs) census of 2005 showed that Nigeria had a total of 23,640 public and private hospitals (PharmAcess Foundation, 2015).

Although recent data on the number and growth rate of hospitals, diagnostic centers and laboratories is not available, there has been a visible growth in the number of private health facilities in Lagos, Abuja, Port Harcourt, Kano, Enugu and all the other major cities.

The 2008 Demographic and health survey showed that the private sector provides over 65% of healthcare services. This is even more for the poorest quintile at 72%. Among the private sector providers, pharmacies and patent medicine vendors (PMVs) play a critical role. Pharmacies and PMVs provided 39% of the services to children with fever in 2008, compared to public clinics 37%, private clinic 13% and shops 7% (PharmAcess Foundation, 2015). Total healthcare expenditure continues to rise in Nigeria and BMI estimated total healthcare expenditure (THE) at USD18.3 billion in 2014 (PharmAcess Foundation, 2015). Household out-of-pocket expenditure (OOP) has remained the major source, constituting about 70.3% of THE in 2009. Government expenditure on health as a percentage of GDP is below the average for Sub-Saharan Africa. Less than 5% of Nigerians were covered by any form of health insurance at the end of 2013.

Nigeria is one of the developing countries faced with the "double burden" of persisting high prevalence of communicable diseases and rising prevalence of non-communicable diseases. Key health indicators such as maternal and infant mortality are worse than the Sub-Saharan African average and Nigeria was not on track to achieving most of the health-related MDG by 2015. Malaria is Nigeria's most important public health challenge and is responsible for 60% of outpatient visits to health facilities in Nigeria, 30% of childhood deaths and 11% of maternal deaths. Over 90% of Nigerians are at risk of malaria with over 100 million cases per year and about 300,000 deaths (National Malaria Control Programme, 2012). The Federal Ministry of Health estimates a financial loss of approximately USD8.4 million per year.

Table 1 Health indicators

Under 5 mortality rate	117
Maternal mortality rate	560
Prevalence of HIV	3.1%
Estimated proportional mortality attributable to cardiovascular diseases (CVD)	12%
Estimated Diabetes prevalence	4.04%
Risk of getting cancer before75 years of age	10.4%

Source: PharmAcess Foundation (2015).

2. Herbal Medicine in Nigeria's Healthcare System

Nigeria is made up of at least 250 linguistic groups (which some describe as ethnic groups), of which 3 are major groups comprising over 60% of the total population. Although all of these groups share common major macro-culture and macro-traditions, each evolved its own micro-culture and micro-traditions in response to prevailing environmental circumstances. Traditional medicine and healing constituted part of the micro-cultural evolution.

In pre-explorers and pre-western trader's Nigeria, traditional medicine was the system of health care delivery. Traditional healing and medical practices included herbalists, divine healers, soothsayers, midwives, spiritualists, bone-setters, mental health therapists and surgeons. In spite of more than 150 years of introduction of Western style medicine to Nigeria, traditional healing and medical practices remain a viable part of the complex health care system in Nigeria today (Schram, 1971).

Presently, traditional medicine practices are a main source of livelihood in Nigeria for a significant number of populations who depend on it as their main source of income. High population growth rate (2.8% annually) and poverty coupled with dwindling economic reserves in the country make Nigerians resort to more affordable sources for their immediate health needs (Raphael, 2011). As the population increases, demand for traditional medicine will increase. In order to provide affordable health care services especially, to those who cannot afford orthodox medicine, several state governments through their traditional medicine boards have tried to institutionalize the use of traditional medicine. They do this through tradomedicine fairs and exhibition which seeks to enlighten the public on the possible cures from this kind of traditional medicine. Nigeria has established national and state traditional medicine boards for regulation of herbal medicine practice and to promote cooperation and research. The Federal Government has also set up and financed the Federal College of Complementary and Alternative Medicine, Lagos under the Federal Ministry of Health to train herbalist on its use and practices. Herbalist are also being encourage to register their proven and efficacious standardized herbal preparations with the National Agency for Food and Drug Administration and Control (NAFDAC) (Raphael, 2011).

III. Review of Literature

Linfongo, et al (2014), did a survey of medicinal plants from Nigeria to validate the use of traditional medicine within the local Nigerian communities. They identified and examined the ethno botanical uses of thirty-three (33) selected plant species. The result of their work identified about 100, out of 120 chemical compounds that match with the ethno botanical uses of plants. This survey further suggested that the information gathered from the identified compounds derived from African medicinal plants, particularly from Nigeria, could be a suitable starting point for extensive drug discovery projects.

A publication by Nithya and Brindha (2014), presented a research work that shows how herbal nutraceutical can help significantly in the maintenance of health and also contribute in developing a disease free environment. The study presented selected traditional drug sources that are common to their environment (Thanjvaur, Tamilnadu), the plants are: Delonix elata (L), Erythrina Variegeta (L) and Eclipta alba(L). Apart from being herbal nutraceutical, it was found that these plants are useful in controlling various disorders such as Cancer, Diabetes as well as improving human immunity. Thirty-one different medicinal plants were identified by the survey carried out by Abo, et al (2008). These plants were confirmed to treat and cure diabetes mellitus. The information was gotten from interaction and interviews from one hundred traditional healers in the South West region of Nigeria; who know and use medicinal plants to treat and cure diabetic patients. Interestingly, there are medicinal plants put together as herbs that have been screened by Elufioye, et al (2012) used for memory enhancement and anti-aging. This research was carried out in Sagamu, Nigeria. It shows that plants in form of herbs, spices and foods constitute an unlimited source of phytochemicals available for improving human health including the improvement of memory and aging. Forty-one plant species were confirmed to constitute important compounds that are used as memory enhancer and anti-aging herbs.

Sonibare, et al (2009) presented an ethnobotanical survey of three local government area in Ijebu area of Ogun State, south-west, Nigeria, for plants used in the treatment of measles. They got their information from twenty respondents which constituted herbalists, herb-sellers and old people with folk knowledge. They

confirmed twenty-three plant species which possess curative properties for the cure of measles. They enumerated recipes for preparation and recommended the dosages for their usage. It was concluded in their result that there is an urgent need for the introduction of a strategy for the conservation of indigenous medicinal plants in the area. For the cure of malaria fever; Bankole, et al (2016), evaluated the antimalarial activity of three medicinal plants used in Nigerian folklore for the treatment of malaria infection. In their research, it was revealed by the phytochemical analysis that was carried out that, there is the presence of tannis, saponins and phenolic compounds in all the three plants tested. The plants are Markhamia tomentosa plant, Polyalthia longifolia plant and Trichilia heudelotii plant which are locally used to cure malaria fever. An ethnobotanical survey of about ninety-eight species of plants from different families was used traditionally either singly or combined with another plant to treat malaria and fever which is assumed to be more than half of the Nigeria medicinal species (Adebayo, J.O., and Krettli, 2011).

Odugbemi (2006) published a book called "Outline of Medicinal Plants in Nigeria", there he compiled a total of 621 plants with their botanical name, family names of species, their Yoruba local names, the part of plant to be used and also the type of diseases and ailments they can cure. He went further to launched on the internet, a website with an updated database having 838 medicinal plants and a separate view plant gallery to the pictures of medicinal plants found in Nigeria. The database has useful information for researchers, students in various disciplines of medicine, pharmaceuticals sciences, Biological Sciences, Traditional Medicine, Veterinary Medicine and Anthropology experience visions affinity with the gardening lifestyle. Although this is not an ICT research, there is a need for improvement to achieve the targeted aim. Some of the shortfalls of the research were that a large number of compiled medicinal plants common to the Nigerian environment was displayed in the Excel spreadsheet format. Also the pictures for the plants are compiled in another file in the form of a gallery, both data are not linked. More so, only Yoruba language was captured in the database.

Ogirima et al, (2014) designed a web based and mobile oriented herbal information system. The design was able to identify herbs, the herbal vocabulary in Yoruba and the medicinal usage of the herb. The platform of the design is an interactive one where one can exchange scientific ideas by local name (Yoruba). The model used was a set of rules for keyword searching was created to verify the preciseness of output produced.

Other publications by Ogirima et al (2012); (2013), proposed a mobile oriented decision support system for herbal medicine prescription. Mobile devices are increasingly making provision for the tools and knowledge needed to improve health care, enabling solutions that benefit patients as well as healthcare professionals and institutions in both the private and public sectors worldwide. The proposed system provides an easy way to get herbal prescription without consulting the herbal practitioners. The system was proposed to enhance the effectiveness of herbal medication having its information in the knowledge base that improves efficiency in decision making. The system was built to give a feedback cure for any ailment queried. It is a decision support system (DSS) that has the following attributes, diagnostic protocol, self-assessment and quality control in the domain of herbal prescription. Remote area dwellers that do not have internet facilities will be able to use their phones to obtain herbal prescriptions on their relative health challenges. The limitation of this research was that the aim of reaching the Nigerian larger societies has not been achieved because only the Yoruba language names where used. Also many may not subscribe to the use of these direct prescriptions due to the fear of standardization. That is, the quantity of usage and authenticity of the herbs.

Omotosho, et al (2014) used an ontology based application to construct the treatment system based on traditional medicine. The objective of their work was to provide a way of sharing medicinal knowledge in Yoruba language which they called Yoruba Traditional Medicine (YTM) in a machine-readable form. The model used was the Description Logics formation with visual reasoning capabilities and processes. The ontology-based approach was proved to be a robust technique for knowledge representation because it has bridged the gap between the problem of unstructured data i.e. names of different models and techniques for knowledge representation and clear knowledge of modern classification. The work further established the comparison of health care services from the 20th

century towards what is obtainable in the present 21st century. The pitfall of this research was the research collated the name of the medicinal plants with their botanical names and names only in Yoruba language which is restricted only to the western part of the country.

Aigbokhan (2014) compiled a plant manual in the form of a book called Annotated Checklist of Vascular Plants of Southern Nigeria. The book is a quick reference guide to vascular plants of Southern Nigeria (Igbo) he included the local names of the plants in Hausa and Yoruba. Although this is a robust manual for local use in Nigeria, it has the following limitations: it is not in its electronic form; the pictures of the plants for easy identification were not included.

For the purpose of sharing of information on indigenous healthcare delivery; Ogirima (2014), built a practical model in relating with basic online tools that will assist individuals to access herbal prescription. He concluded that with the quest for globalization, there is a need to have details about herbs, their uses and the parts used and also share the information on the internet. The limitation observed in this work is that the standard of herbal constituents cannot be guaranteed. Information shared in the computer science profession has to be Accurate, Complete and Reliable.

IV. Materials and Methods

Primary data for this research was gathered through interviews with few traditional herbal medicine practitioners and academics/researchers specialized on the area of medicinal plants. On the other hand, the secondary data derived from compiled and documented researches on medicinal plants as well as reviews of related works. In sum, a total of 182 medicinal plants species belonging to 70 plant families were compiled for this research work; this was authenticated by expert in the field of Biological Sciences. Additionally, the corresponding names of the plants in Nigerian three major languages, their common names, parts of the plants used and their medicinal uses were compiled (see attachment). To achieve the repository database system for the compiled medicinal plants, an indigenous healthcare information system was designed and named: African Mobile Healthcare Information System (AMHIS).

The framework of the developed application for the African Indigenous Healthcare Information System is presented in Figure 1 as the Use Case diagrams for the Administrator. Figure 2 shows the User of the developed system. It is a representation of the workflow of the medicinal plants search in the database.
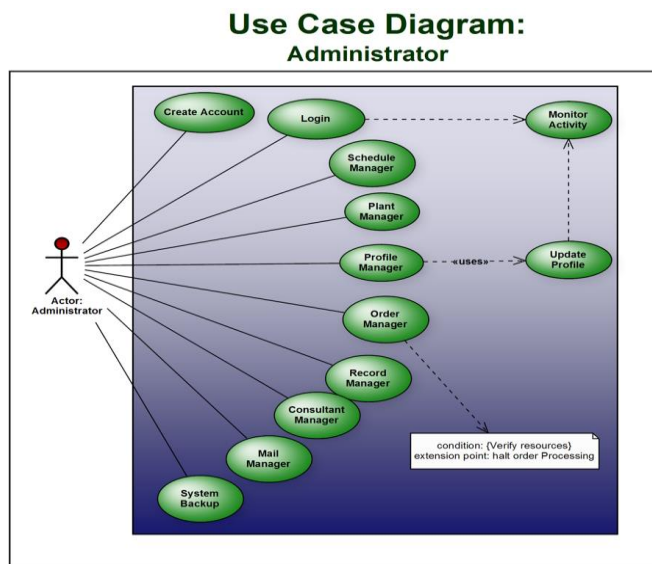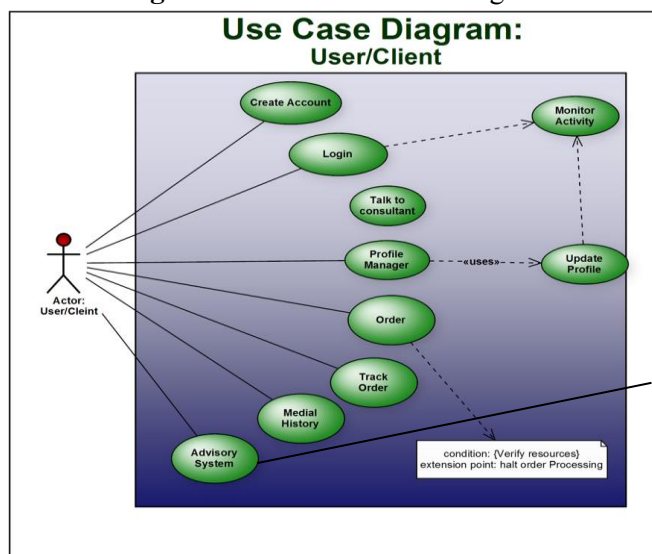

Figure 1: User's Use Case Diagram

Figure 2: User's Use Case Diagram

V. Results and Discussion

5.1 Implementation of AMHIS.

The web based platform AMHIS is an African indigenous medicinal plants database designed to make possible the identification, description and medicinal usage of 182 medicinal plants peculiar to Nigeria which were presented in the botanical names and the three major Nigerian languages. The description and Screen shots of the application are presented as follows:

5.1.1 Description of AMHIS

The application consists of eight (8) major menus which are enumerated below:

- **User Management**: this is where the administrator manages registration and all transaction activities of the users. It consist of four sub-menus, namely: New User, Manage User, User detail and Appointment scheduling (See the Figures below)
- Plant Manager: this module handles all activities about the medicinal plants. The following sub-menus are listed under this module: New Plant, Edit Plant, Delete Plant, View Plant.
- Monitor: It is the interface to monitor the records of number of plants as they are being updated in the database, number of user registered on the platform and the value of the amount of products ordered for.
- Analysis: this module shows the analysis of the result of the Apriori algorithm implementation at intervals when the database is being updated with new discovered medicinal plants
- Order Manager: Manages the transaction of purchasing medicinal plants. The sub-menus are: View Order and Delivery Reports
- Offline Messages: user can leave messages offline for enquires
- Herb Review: Allows Admin to update, add or delete herbs when necessary.
- FAQ: Allow users to ask question and give their view and opinions on herbs and medicinal plants.
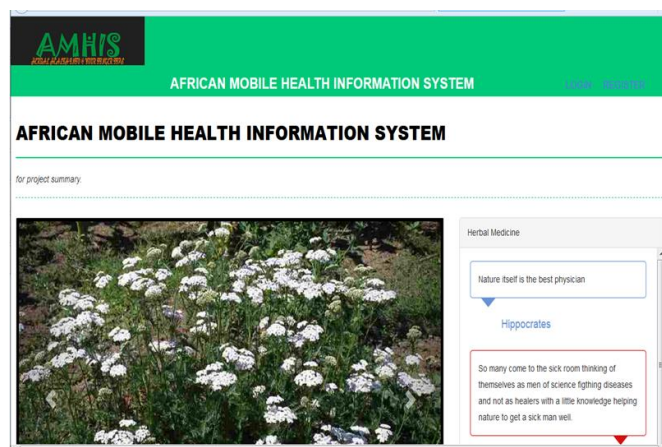
5.1.2 Screen Shots

Figure 3: The web page for AMHIS

The above interface shows the home page of the web application for African Mobile Healthcare Information System.
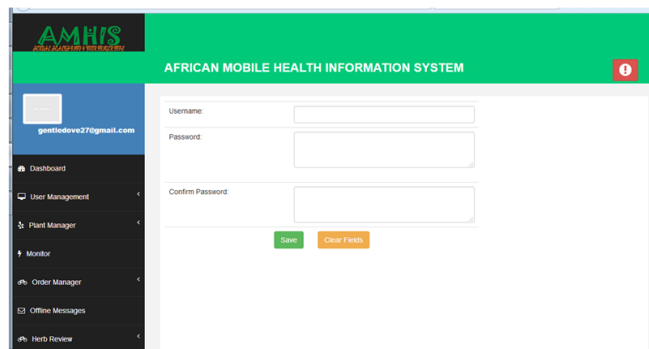

Figure 4: User login Registration Interface.

The User login interface allows a user to enter his /her email address and a password to have access to the module of the application. This helps to keep track of the record of the number of users that visit the site.
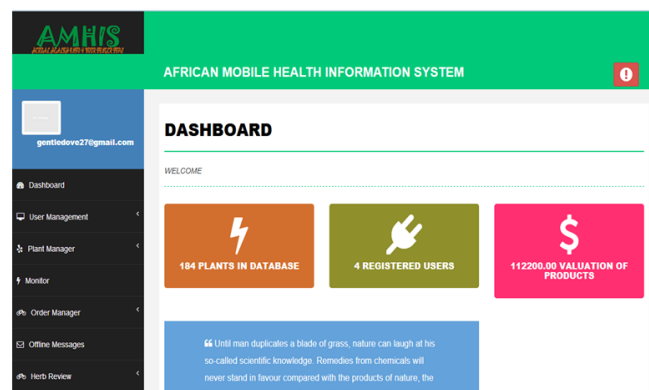

Figure 5: The Monitor Interface

The Monitor interface keeps track of the record of transactions in terms of update of the number of medicinal plants in the database, number of registered users and the total income from the transaction of sale of medicinal plants.
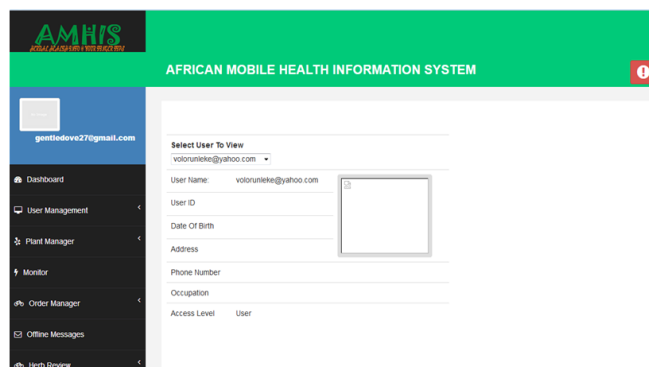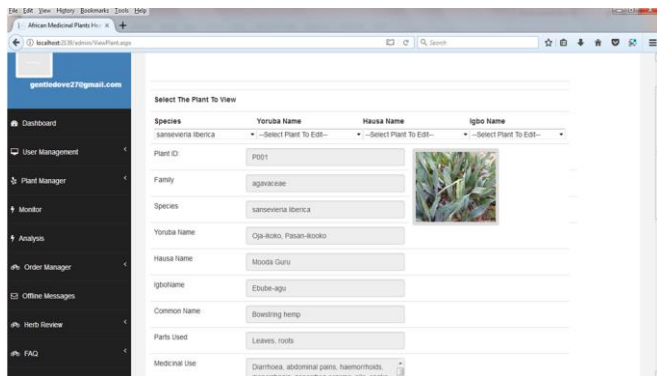

Figure 6: The interface for registering a client/ patient

The above interface allow user to register as a patient for consultation purposes. A user will be linked with a certified herbal medicine practitioner.


Figure 7: The interface for searching/viewing information about Medicinal Plants with botanical and local Nigerian languages names

The above interface allows user to search for information about medicinal plants. The search can be done by clicking on the choice of language by user. The dropdown box is clicked and the name of the plant is chosen. This brings out the names of the same plant in the other languages, the picture, part of plant to be used and the medicinal usage.
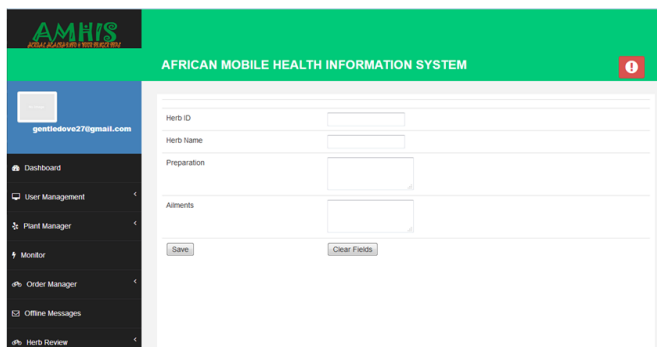
Figure 8: Interface to register herb, its preparation and the ailment it cures

The above interface allows user to add herbs that has been certified and authenticated by certified herbal medicine practitioner, which the standard and quality are okay for the general public use. The name of the herb, its preparation, the dosage and the ailment (s) it cures.
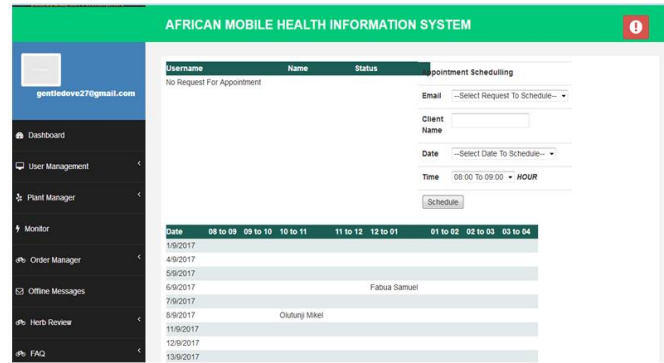
Figure 9: Interface to schedule patient's appointments

This interface schedules registered patients appointments to be linked with certified herbal medicine practitioners.

In sum, a user will be equipped with the knowledge of the African medicinal plants that are peculiar to the Nigerian environment. To bring herbal medicine closer to individual African; the application makes the identification and medicinal usage of each plant easy, by the inclusion of clear pictures of the plants. Also, the various parts or section of plants, where the extractions of medicinal constituents are gotten have been included alongside with the diseases /ailments they can cure.

VI. Summary, Conclusion and Recommendation

It is no secret that health is instrumental to an individual's education, income and overall development. Studies show this is true for countries as well; health can be a causative factor for the aggregate economic growth of a country. In spite of more than 150 years of introduction of Western style medicine to Nigeria, traditional healing and medical practices remain a viable part of the complex health care system in Nigeria today. As important as traditional medicine is, there is no complete database for medicinal plants in the Nigerian locality that are comprehensive enough to meet the need of individuals especially for self-healthcare. This research work was able to build a repository database which comprises of 182 indigenous herbal medicinal plants of 70 family species (linked with the pictures of the plants), their names in the three major Nigerian languages, the parts used for medicinal purposes and the ailments/diseases they cure.

Conclusively, herbs usually serve as the repository materials and have been acknowledged to be generally

safe with minimum side effects (Gbile and Adesina, 1986). However, studies have shown that not all herbal medicine or natural medicine are safe, some poisons are also natural (Ansari and Inamdar, 2010). To reach a stage where herbal products of assured quality and effectiveness become more integrated into mainstream medicinal treatment in Nigeria, equal obstinate must be employed because of the opinion of some traditional herbalist who believe that unprocessed natural products have an innate superiority and that the mystical aura surrounding herbs will somehow be destroyed by extraction and standardization (Tyler, 1999). More innovative strategies employing all the associated sciences and information communication technologies must be created in order that traditional botanical medicine can help in the development of sustainable manner of healthcare products and dissemination of information to the dramatically expanding population.

VII. Acknowledgement

VIII. REFERENCES

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