

Information Management in Herbal Research: Nexus of Trends and Application of Emerging Technologies

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ABSTRACT

In recent time, herbal information and products have been used to treat different sicknesses and diseases such as arthritis, insomnia, ulcer, diabetes, cough, fever, constipation and cardiovascular problems. Several researches conducted have given birth to the use of different herbal products (such as rosemary Lavenders, sage, curry leaf⁷ Tea bush, Bitter leaf, Thyme, garlic, ginger, Ginseng and Aloe Vera) for medicinal and culinary purposes. Due to the ever increasing importance of herbal research information, there is need for adequate and proper management of herbal research information. This article examines the need for information management in herbal research, characteristics of herbal research information as well as the nexus of trends of information management in herbal research. It discusses and identifies the roles of libraries in the management of herbal research information. The paper also identifies some emerging ICT tools used for information management in herbal research. It concludes that apart from helping to preserve valuable information on herbal medicinal research, proper management of herbal research information also help to lpreserve the indigenous knowledge of the people from being lost as a result of factors such as acculturation and biodiversity. The paper recommends that government and information agencies should draw up strategy for proper management of herbal research information as this will enhance access to quality herbal information.

1. Introduction

Herbs loosely refer to plants that have culinary, cosmetic, or medicinal uses. MaximumYield (2019) defined herbs as the usable parts of herbaceous plants (plants that lack a woody stem). Herbs usually have savory or aromatic properties that are used for medicine and flavoring food. Culinarily, herbs are said to be different from spices because they are regarded to be leafy green or flowering parts of a plant (either fresh or dried), while spices are usually dried and produced

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from other parts of the plant, which could be the seeds, bark, roots and fruits (Wikipedia, 2019). According to BYJU Learning App (2019), herbs is distinguished from other plants in that it is usually a short plant with green, delicate stem without the woody tissues and they have few branches or are branchless.

Over the years, herbs have played a significant role in maintaining human health and improving the quality of human life. They have served humans well as valuable components of seasonings, beverages, cosmetics, dyes, and medicines (Craigie, 1999). In the African continent and other parts of the world, herbs have been widely used basically for food and medicinal purposes. Many of the herbs are used to treat several ailments such as stress, arthritis, insomnia, ulcer, diabetes, cough, fever, constipation and cardiovascular problems. The most popular herbs in sub-Saharan Africa include rosemary Lavenders, sage, curry leaf, Tea bush (*Ocimum gratissimum*) Yoruba Efirin, Bitter leaf (*Vernonia Amygdalina*), Thyme, garlic, ginger, Ginseng, *Azadirachta indica* (Dogoyaro), Aloe Vera and lemon grass (Enwere, 2009). These herbs have so far met the culinary and medical needs of human. However, through herbal research, newer herbs are had been identified and more uses of old herbs have also been discovered. The term herbal research is a combination two words herbs and research.

Erhabor (2012: 2) defined research as “an independent, creative, cumulative and often long-term investigation conducted by people with specialist knowledge about the theories, methods and information concerning their field of enquiry.” This investigation, when conducted in relation to herbs (viz-a-viz its production, uses, preparation, and functions) is called herbal research. Enwere (2009) explained that herbal research is the investigation into the practice of using herbs and herbal preparations for medicinal and culinary purposes. The need for improvement in medicinal and culinary herbs (especially in production, uses, preparation, and functions) has led to individual specialist engaging in herbal research. The consistent research in the use of herbs by different researchers and locals in communities has led to a significant increase in the amount of quality herbal research conducted. This is more noticeable in the area of herbal medicinal research. Thus, there is need for proper management of information generated through herbal research. The focus of this study is to examine the nexus of trends of information management in herbal research as well as the application of emerging technologies.

2. Theoretical Background

2.1 Herbal Research

Herbal research in the last few decades have gained substantial attention in different countries like Nigeria, China, India, and even the United States of America (USA). Herbal research is getting significant attention especially in global health debates. Enwere (2009) defined herbal research as an investigation into the practice of using herbs and herbal preparations for medicinal, culinary and other purposes for the overall benefit of man. There has been enormous investment in herbal research in Africa and other part of the world. This underline the overall importance of herbs

to manakind. For instance, Tilburt and Kaptchuk (2008) reported that eighty percent of African population use some form of traditional herbal medicine, while the worldwide annual market for herbal products approaches US\$60 billion. Zamiska (2006) also noted that the world health organization (WHO) has over the years, made substantial investment in herbal research.

Interestingly, the focus of herbal research over the years has been in two-fold: herbal medicinal research and herbs for culinary purposes. While the former have gained a significant attention in the global scene, the latter has attracted a significantly less attention outside Africa and some part of Asia. This is evident in the number of scientific research conducted on culinary herbs and spices. Very few scientific studies have actually been conducted on culinary herbs and their properties. For instance, Opara and Chohan (2014) reported that the leaf, root, bark, berry, bud, seed, stigma of a plant or flower are used for the purpose of cooking as they add to or enhance the flavor of foods, including meats, sauces, vegetables and desserts.

As opposed to culinary herbs, herbal medicinal research has attracted far more attention. Omicsonline (2019) noted that herbal medicinal research is a systematic investigation into the use of plant's seeds, berries, roots, leaves, bark, or flowers for medicinal purposes. In recent time, herbal medicinal research has become more mainstream as improvements in analysis and quality control along with advances in clinical research show the value of herbal medicine in the treating and preventing diseases. Also, the nature of many herbal medicinal products has so far improved and maintain the health of man.

In spite of the seemingly numerous benefits derive from herbs, Telles et al. (2014) reported that there is no paucity of research on herbs or herbalism. They opined that, although there is an increase in the use of herbs and herbal medicine worldwide, research in this area is inadequate. Even the few studies carried out face serious difficulties in terms of gaining global acceptance. Some of the main reasons why the studies conducted are considered flawed and inadequate include small sample sizes, variable or inconsistent results, inadequate research designs, insufficient statistical power (possibly related to small sample sizes), poor controls, inconsistency of descriptions of the treatment or product, and lack of comparisons with other treatments or with a placebo or with both.

In the Nigerian society, herbal research (especially herbal medicinal research) is bedeviled with several barriers. Sofowora (2008) identified some of the barriers to include cost of acquiring information, distrust of researchers by practitioners, the desire to pass down information only to offspring and the fact that a lot of unwritten knowledge resides in the hands of healers in many societies. All these necessitate the need for more enlightenment and proper information management in herbal research.

2.2 Information Management

Information, simply defined as the outcome of processed data, is a very important tool for planning, decision making and problem solving. Information can be encoded into various forms for transmission and interpretation (for example, information may be encoded into a sequence of signs, or transmitted via a signal). It can also be encrypted for safe storage and communication (Wikipedia, 2019). Information

practitioners have generally agreed that for anything to be called information, it must be timely, accurate, complete, consistent and unique. However, the advent of information technology has led to an era where there is an influx of information (information explosion). This has so far contributed to the need for proper information management.

Information management is the collection, storage, dissemination, archiving and preservation of information. It enables teams and stakeholders to use their time, resources and expertise effectively to make decisions and to fulfill their roles (APM, 2018). Choo (1995) explained that information management is a cycle of processes that support the organization's learning activities viz-a-viz identifying information needs, acquiring information, organizing and storing information, developing information products and services, distributing information, and using information. For proper information management to occur, information must go through series of stages. Abdalla (2015) identified five stages of information management as information planning, information capturing, information storage, information reporting and information archiving. Information management also, often time, encompasses information governance, information asset management, information security, records management and information access and use management.

Information management has become even more increasingly important in any organization and for any business due to the high volume of information produced daily. Information is an asset and its effective management can have a direct and lasting impact on achieving business or organizational objectives. The essence of information management is to make every bit of data and information count towards an outcome. Proper information management ensures that information is available to the right person, in the right format and at the right time.

2.3 Need for Information Management

Today, information is one of the most important assets to any organization and in managing any product. Managing information is extremely crucial to the success of the organization and the spread of a product. So, management of information is important, just like that for supporting technology and processes. Information is key for organizations or someone to stay on trend and get ahead of the competition. Insights gained from the data are extremely useful in the formulation of important policies, decision making, planning and problem solving. Proper information management in herbal research ensures that information is readily available for improvement on herbal products. Lehman Brown (2018) identified the following as the reasons for information management:

- It helps to control the creation and growth of records
 - It enhances easy exchange of information
 - Provide opportunity to assimilate new records / information management technologies
 - It helps to safeguard vital information from loss as well as maintain data integrity
 - It helps in planning of information needs and resources
 - Information management helps in monitoring of primary and secondary processes in herbal research
 - It helps in Controlling of processes of information flow and communication
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- Information management provides availability of real time insights for forecasting, planning, and evaluation

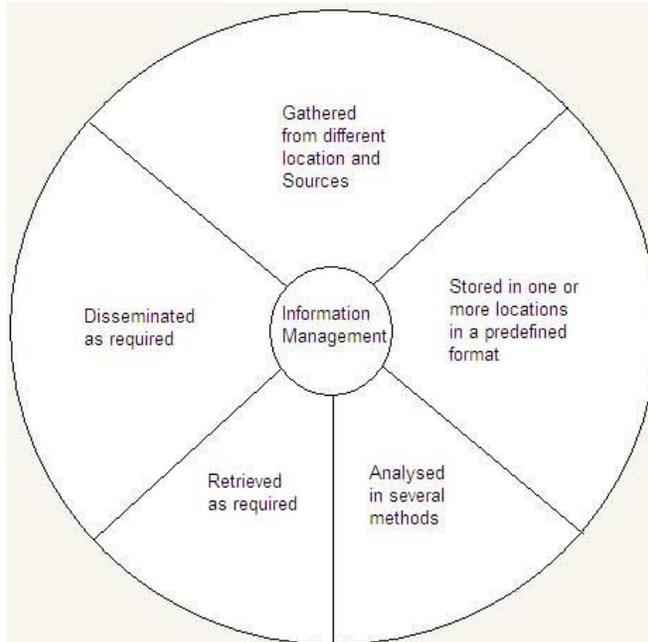


Fig. 1. Information Management (Adapted from APM, 2018)

2.4 Characteristics of Herbal Research Information

From time immemorial, herbal information has always been possessed by elders who received the information from their ancestors and transfer same to their children. Herbal research information (especially herbal medicinal research) possesses some distinct characteristics which make them different from conventional (medicinal) research. Sarkhel (2017) identified the characteristics of herbal research information as:

- Locally bound, indigenous to specific area
 - Culture and context specific
 - Non-formal knowledge
 - Orally transmitted and generally not documented
 - Dynamic and adaptive and
 - Closely related to survival and subsistence for many people worldwide
 - It is local knowledge generated within communities, based on experience relating to innovation, adaptation, and experimentation
 - Adapted to the local culture and environment; and expressed in local languages
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3. Components of Information Management in Herbal Research

Information management encompasses a cycle of activities such as data gathering, analyzing, categorizing, contextualizing, and archiving (and in some cases, deleting it). The process of information management is always changing as technology changes. However, the components of information management remain the same. Smartsheet (2019) identified the four main components of information management in herbal research as people, policies and processes, technology, data and information.

- 1) People: this is the key component of information management in herbal research. The people here consist of both the creators and users of the information. The people are responsible for the gathering, analyzing, processing, storage and archiving of herbal research information. The people component is the main component within which all other components revolve.
- 2) Policies and processes: The laid down rules that determine who has access to what and in what format. This component also caters for the steps on how to store and secure information. The process explains that information must be stored and secured, and timeframes for archiving or deleting.
- 3) Technology: this refers to the medium that is used to store and transfer data and information. Technology in this context includes physical items (computers, filing cabinets etc.) that store data and information. It is pertinent to note that the technology has evolved over time. There is currently a shift from manual information management system to a computer or automated information management system.
- 4) Data and Information: this is the core of the components of information management. It is what the other components use. They are facts usually in a structured or organized format.

3.1 *Nexus of Trends of Information Management in Herbal research*

The wide range of use and acceptability of herbal products in developing countries has led to the development of novel form information management in herbal research. Herbal information has been used in time past for healthcare, social and psychological benefits. Herbal information has been found to be useful in the treatment of sicknesses and diseases such as malaria, diabetics, epilepsy, dementia, sickle cell disorders and inflammation (Adeleja, 2006). The invaluable nature of herbal research information has ensured that the information is managed across generations. At the earliest stage, herbal research information was mainly tacit in nature. Elders were the main custodian of this information and they received it from their ancestors. Herbal research information was orally passed on from one person to another (Osemene et al., 2011). It was commonly preserved through oral means and demonstration rather than documentation. However, with the emergence of libraries, paper and other documentation technologies, herbal research information was easily preserved in different format. This helped to reduce the risk of loss of information.

Prior to the advent of paper and other documentation technology, herbal research information was managed by humans in three distinct modes namely: vertical, horizontal and oblique. According to Hewlett and Cavalli-Sforza (1986), vertical mode involved the management and transfer of in-

formation from parents to their children, horizontal involved individuals of the same generation while oblique involved individuals of one generation to unrelated individuals of the next generation. However, by the end of 19th century, great advancement was made in paper making and it was then widely used as a means of documentation. While paper was the predominant format of storage of herbal research information at this time, herbal research information was also stored in non-paper format such as cassette tapes, films and others. Ngulube (2002) noted that due to the impermanent nature and advancement in different storage media, herbal information were later managed using information and communication technologies such as computers, blogs, cloud storage and social media tools. It is important to also note that the preservation and management of herbal research information can be achieved through establishing a community web portal using Web 2.0 technology. The memory database can be embedded in the portal as a wiki, allowing collaborative writing and sharing of ideas, content, images, oral histories and videos between members of the local community.

4. Role of Libraries in the Management of Herbal Research Information

Libraries over the years have played crucial role in information management. The core duties in libraries focuses on the concept of information management which include but not limited to creating, storage, analyzes, organization, retrieval and dissemination of information in print and non-print format. Also, the five laws of library science as propounded by SR Ranganathan (the father of Library science) also highlight the role of libraries in information management. Libraries place emphases on the efficient dissemination of information to the appropriate user at the right time. Rifaudeen (2015) observed that, right from the medieval era, libraries have effectively managed herbal research information by preserving, displaying and sharing herbal information in different formats for use by members of different communities. Libraries play important role in management of herbal research as they are able to acquire, process, organize, disseminate, preserve and discard herbal information effectively and efficiently.

The emergence of Information and Communication Technology (ICT) has enhanced the efficiency and effectiveness of libraries in managing herbal research information. In recent time, libraries have adopted different information technologies in the management of herbal information. For instance, libraries now deploy technologies such as quick response (QR) code, cloud storage technologies (like Google Docs, Xdrive, MediaMax, & Strongspace) as well as social media tools in the storage, marketing and dissemination of herbal information. Libraries also curate, organize and update different electronic databases on herbal research for library users. Libraries are also known to carryout awareness and sensitization campaign on use and management of herbal research information.

Furthermore, the information management skills of library and information professionals also pinpoint the role of libraries in the management of herbal research information. Library professionals are the most valuable information asset in libraries and they are involved in managing information and information resources. Library professionals have over the years managed herbal research information by way of acquiring herbal information resources, processing, organizing, storage and dissemination of herbal research information. The responsibilities of management of herbal research

information are more effectively carried out by library professionals because they have the knowledge, skills and attributes related to information management, library services, archiving, data management, content management as well as information access and retrieval. Okuonghae (2018) highlighted the following as roles of libraries in management of herbal research information:

- 1) Acquiring of herbal research information sources in print and non-print format
- 2) Organizing herbal knowledge and information
- 3) Cataloguing and classification of herbal research documents and digital knowledge
- 4) Providing knowledge mining of herbal research information from the emerging knowledge warehouses
- 5) Providing of reference services and electronic information services
- 6) Disseminating herbal information from printed and/or computer-held digital sources
- 7) Handling the tasks of massive digitization, digital storage process, and digital preservation of herbal research information
- 8) Providing universal access and retrieval of herbal research information, ultimately access to all

4.1 Emerging ICT Tools for Information Management in Herbal Research

As a result of the widespread and acceptance of use of ICT tools for knowledge sharing and dissemination of information, the following emerging ICT tools can be used for information management in herbal research:

- 1) **Blogs:** blogs are part of web 2.0 technologies used in the dissemination of information to a wider group of people. It is an internet sub-technology that can also be used to archive information. In recent time, botanists and other scientists now use blogs to manage herbal information. Through blogs, herbal information is not only shared, but they are classified and archive for future use. Some notable blogs for herbal information include ‘Natural News Blog’, ‘Jill’s Home Remedies’, ‘Mystic Naturals’ and Henriette’s Herbal Blog.
 - 2) **Websites:** according to Wikipedia (2019), a website is a collection of related network web resources, such as web pages, multimedia content, which are typically identified with a common domain name, and published on at least one web server. The website is a 21st century technology that gives herbal products a virtual space and enables the public to view the information. Through websites, pictorial and textual information of herbs are share. Classification and storage of herbal information can also be carried out in different herbal website. Notable herbal website include www.reddit.com/r/herbs, www.eatweeds.co.uk, and www.theherbexchange.com.
 - 3) **Social media:** Social media are internet sub-technologies that enable users to create and share content or to participate in social networking. Social media tools include but not limited to Facebook, Whatsapp, LinkedIn, twitter and Tumblr. The widespread use of social media tools makes it easy for sharing of herbal information. Social media application allows for direct communication between producer and consumer of herbal products. Using management systems
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like Hootsuite, one can keep an eye on multiple social media accounts at once through one simple interface, making it easy for even a social media beginner to rise to success.

- 4) **Cloud computing Technologies:** Cloud computing technologies are computing components (hardware, software and infrastructure) that enable the delivery of cloud computing services such as: SaaS (software as a service), PaaS (platform as a service) and IaaS (infrastructure as service) via a network (i.e. the Internet). The technology relies on shared computing resources rather than having local servers or personal devices to handle applications. Cloud computing technologies allow for the storage of herbal information in the cloud. The technology also allows for sharing of herbal information.
- 5) **Mobile Technology, Smartphone, QR Code:** Modern mobile technologies such as smartphones, QR code, Flash drives and CD ROMs are used for managing herbal research information. Advancement in mobile technologies enable users to store large amount of information as well as share the information with the public. Technologies like QR codes also give users the opportunity to market herbal research information. Examples of smartphones with the capability to store and share data are android and windows phones.
- 6) **Online Conferencing systems:** With online conferencing systems, having to take lengthy, expensive trips is now a thing of the past. When it's not possible to meet with partners in herbal research or potential consumer of herbal products in person, having a well-supported web conferencing platform can be an excellent replacement.

4.2 Challenges associated with Herbal Research information management

The transmission and management of herbal research information have not received adequate attention compared to the attention given to conventional research. This situation is pitiable because herbal (medicinal) research has over the years provided services in parallel to conventional (medicine) research. One notable challenge faced in the management of herbal research information is that, not all herbal research information is available in written form. Some herbal information is only found in practice and is transmitted orally from one generation to the next. This renders its preservation difficult. Ngulube (2002) identified the protection of intellectual property right as one of the challenges faced in the management of herbal information. He noted that in managing herbal information, one must consider and protect the right of the originator of the idea (which is quite difficult with herbal information considering the fact that it is usually orally passed from person to person). Sen, Chakraborty, and De (2011) observed that quality and regulatory challenge of herbal research is one of the challenges facing herbal medicine. They noted that the widespread and growing use of botanicals has created a global health challenge in terms of quality, safety and efficacy. This has affected the documentation of herbal information in many communities.

Furthermore, on Onojie (2014) identified the following as the challenges faced in the management of herbal research information.

- 1) Poor communication and documentation of herbal information by locals
 - 2) Inadequate government efforts to recognize and set national policies for herbal usage
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- 3) Lack of intellectual property right to protect the originators of herbal information
- 4) Lack of global interest and awareness about some useful herbs
- 5) Lack of standardized knowledge sharing culture among locals
- 6) Language barriers and disuse of vernacular languages
- 7) Lack of research and development on product and process development
- 8) High rate of illiteracy among herbal practitioners leading to poor knowledge management strategies
- 9) Lack of globally acceptable standard for the use of herbal medicine
- 10) Lack of a globally accepted information systems for herbal information
- 11) Lack of current and good herbal information manufacturing practices

5. Conclusion and Recommendation

In this era of unprecedented increase in the amount of herbal research information produced, the importance of proper management of herbal research information cannot be overemphasized. Apart from helping to preserve valuable information on herbal medicinal research, information management of herbal information also help to preserve the indigenous knowledge of the people from being lost as a result of factors such as acculturation and biodiversity. This is in addition to other benefits such as easy access to herbal information, improved information sharing and storage. Thus, the researchers recommend that:

- 1) Government and information agencies should draw up strategy for proper management of herbal research information (especially in the area of herbal medicinal research) as this will enhance access to quality herbal information.
- 2) Libraries (especially those in local communities) should take up the responsibility of managing the herbal research information in their communities.
- 3) Libraries should carryout awareness and sensitization campaign on information management in herbal research for the indigenes of the local community they belong to in order for them to embrace emerging tools in information management.
- 4) Government and NGOs should recognize the role of herbal medicine in the society and give it adequate attention by setting up regulations to guide its processes and use.

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