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Evaluation of Role of Traditional Knowledge Digital Library and Traditional Chinese Medicine Database in Preservation of Traditional Medicinal Knowledge

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ABSTRACT

The purpose of paper is to describe the importance of traditional knowledge in the field of medicine. It particularly discusses the importance of traditional medicine knowledge in the developing countries and the challenges involved in preservation and protectionof it. It evaluates the role of the Traditional Knowledge Digital Library (TKDL) and Traditional Chinese Medicine (TCM) database with protection and preservation. The paper outlines the theoretical aspect of knowledge preservation, especially with reference to the protection from bio-piracy. The TKDL and TCM database codified traditional medicinal knowledge and made them available in international languages. Both the databases have rich collection of traditional medicine system for the help of researchers and medical professionals. The paper discusses the theoretical and conceptual understandings of traditional knowledge, and its preservation and protection.

Keywords: Knowledge preservation, traditional knowledge, digital libraries, intellectual property rights, Traditional Knowledge Digital Library, Traditional Chinese Medicine

1. INTRODUCTION

Traditional knowledge is a term generally applied for knowledge that is generated in informal ways. It has generally been passed on from one generation to other generation. It may be in the written form or transmitted only orally. The Traditional Knowledge can be held by individuals, communities or society as a whole[1]. It can also make an important contribution to analyse environmental and social conditions within specific regions or specific geographical areas. The use of Traditional Knowledge in medicine is very common in the developing countries. Now a days Traditional Knowledge is at the risk because of the rapidly changing natural environments, fast growing urbanisation, new technologies, lack of awareness, and language barriers.

Over the past decade, traditional knowledge has received increasing attention on the international agenda. Factors contributing to this include the recognition of its importance in the lives of the people and in the conservation of biodiversity; concerns about the rapid loss of Traditional Knowledge and global cultural diversity; concerns about unauthorised and inappropriate patenting and use with no sharing of its benefits with the original holders. Many countries and communities worldwide are considering this issue at the national, regional, and international levels.

World Intellectual Property Organisation (WIPO)[2] defines traditional knowledge as "Traditional knowledge (TK) is knowledge, know-how, skills and practices that are developed, sustained and passed on from generation to generation within a community, often forming part of its cultural or spiritual identity."

1.1 Types of Traditional Knowledge

The traditional knowledge can be broadly divided into two categories recorded knowledge and oral knowledge. Those categories can be described as:

- Recorded knowledge - This is often referred as codified and is available mainly in the form of ancient text and manuscripts. These are mainly in those languages which were used in their time of origin.
- Oral knowledge - This is referred as knowledge that is not recorded or codified anywhere. It is transferred only orally from generation to generation within the community. Oral knowledge needs more attention to identify and preserve as it is the basis of livelihood for many indigenous communities.

1.2 Challenges in Protecting Traditional Knowledge

A patent is given for the innovation or invention that is invented by a person or an organisation. Whereas, traditional knowledge is created and owned collectively by communities and they transfer it from one generation to another by traditional folk and customs. The modern intellectual property right (IPR) laws don't have any mechanism to protect the public domain knowledge. A small change in traditional knowledge or practice can make a new product which can be independently patentable.

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The corporate and multinational companies from developed countries make small changes in traditional knowledge of developing countries for their commercial products. They patented it without sharing any benefit with the communities which hold the source of traditional knowledge. Thus, the present patent system gives the entire economic benefit to those who have only slightly modified the traditional knowledge and given nothing to those who developed it over generations. Worst of all is once such patents are granted, the laws restrict people to use them including the communities that developed and held the knowledge for generations.[3]

Traditional K needs to be protected in addition of preserving them. World Intellectual Property Organisation (WIPO) clearly distinguishes between preservation and protection. Preservation means identification, documentation, transmission, revitalisation, and promotion of cultural heritage to ensure its maintenance. Whereas, the protection of traditional knowledge means the protection against misuse and misappropriation such as copying, adaptation or use by unauthorised third parties.

1.3 Importance of Traditional Medicinal Knowledge

Medical science has progressed very much in human healthcare. Scientific innovations and development of new medicines have played a major role in this achievement. However, despite of these successes, it is estimated that over one-third of the world's population lack to afford essential drugs. Modern medical treatment is not available for a large proportion of the world's population. Thus, traditional medicine is widely available even in remote areas. It is affordable by the majority of people living in developing countries due to its local availability and low cost. In India, according to the Government, 70 % of the population uses traditional Indian medicine.

The most widely used traditional medicine and alternative therapies are herbal medicines and acupuncture. Today traditional medicine and complementary and alternative medicine play an increasingly important role in the reform of the health sector of many countries.[4]

1.4 Traditional Medicinal Knowledge in India and China

India and China have rich heritage of traditional medicine system. Indian traditional medicine and traditional chinese medicine have many similarities. The focus of both the systems is on the patient rather than disease. Both systems fundamentally aim to promote health and enhance the quality of life. Half of the botanical sources used as medicines in both systems has similarities. Even both medical systems have similar philosophies geared towards enabling classification of individuals, materials and diseases.

The TCM considers the human at the centre of the universe as an antenna between celestial and earthly elements. Water, earth, metal, wood and fire are the five elements of the material world. The world is a single unit and its movement gives rise to 'yin and yang' the two main antithetic aspects. The actual meaning of the term 'yin and yang' is 'opposites', such as the positive and the negative. The four bodily humors (qi, blood, moisture and essence) and internal organ systems (zang fu) play an important role in balancing the yin and yang in the human body. Proper formation, maintenance and circulation of these energies are essential for health. When the two energies fall out of harmony, diseases develop. The physician takes into account this concept while treating patients. Drugs or herbs are used to correct this imbalance of 'yin–yang' in the human body.[5,6]

The ITM considers that the universe is made up of combinations of the five elements (pancha mahabhutas). These are Akasha (ether or void), Vayu (air), Teja (fire), Aap or Jala (water) and Prithvi or Bhumi (earth). The medical system coded the elements into three forces, which govern all life processes. These three forces (kapha, pitta and vata) are known as the three doshas or simply the tridosha. Each of the doshas is composed of one or two elements. Vata is composed of space and air, Pitta of fire, and kapha of water and earth. The tridosha regulates every physiological and psychological process in the living organism. The interplay among them determines the qualities and conditions of the individual. A harmonious state of three doshas creates balance and health. An imbalance manifests as a sign or symptom of disease.[7]

1.5 Preservation and Protection of Traditional Medicinal knowledge

There are many bad patents granted over medicinal and food plants which communities have been using for thousand of years. The patent applications for these have not acknowledged the prior knowledge and use by indigenous peoples of these resources. In some cases, researchers intentionally took patent of some traditional medicine with slightly modifications. These cases made developing countries aware about protection of their traditional knowledge. The initiatives have been started to protect and preserve traditional knowledge globally. India and China are the countries which have a maximum share of traditional knowledge in the world. They also started taking initiatives to preserve and protect their traditional knowledge.

2. TRADITIONAL KNOWLEDGE DIGITAL LIBRARY (TKDL)

India is one of the largest traditional knowledge holding countries in the world. India's effort on revocation of patent on turmeric and neem led to the genesis of the Traditional Knowledge Digital Library (TKDL) (Fig.1). It is a knowledge repository on the Indian traditional system of medicine which includes Ayurveda, Siddha, Unani Siddha and Yoga. It is a collaborative project of the Council of Scientific and Industrial Research (CSIR), Ministry of Science and Technology and Department of AYUSH (Ayurveda, Yoga and Naturopathy, Unani,

Figure 1. Traditional knowledge digital library (TKDL) homepage (www.tkdl.res.in/).

Siddha, and Homeopathy), Ministry of Health and Family Welfare.

The TKDL project digitises the documents of various Indian traditional medicine systems which are available in the public domain. These documents are in the form of ancient literature and other existing literature and rarely understandable to the common people. The TKDL targets Indian systems of medicine, viz., Ayurveda, Unani, Siddha, and Yoga available in public domain. This is being documented by sifting and collating the information about traditional knowledge from the literature existing in local languages such as Sanskrit, Persian, Arabic, Urdu, and Tamil in digitised format, and is available in five international languages which are English, German, Spanish, French, and Japanese. Information comprising about 2 lakh formulations have been transcribed for realising the objective of TKDL project. Each Sloka is read and converted into a structured language using Traditional Knowledge Resource Classification (TKRC) by subject experts. The codes are then filled into data entry screen. The Slokas are also saved in the database. The translated version of all the TKRC codes is ported in the database. The abstraction is done by the subject experts. The codes once saved in metadata directory are converted in different languages based on unicode technology.

The TKRC is innovative structured classification system named for the purpose of systematic arrangement, dissemination and retrieval. It has been evolved for about 25,000 subgroups against few subgroups that were available in earlier versions of the International Patent Classification (IPC), related to medicinal plants, minerals, animal resources, effects and diseases, methods of preparations, modes of administration, etc. The TKDL software with TKRC converts text in local languages into multiple languages. It may be noted that the software does not transliterate, rather it does a knowledge-based conversion, where data abstracted once is converted into several languages by using unicode, metadata methodology. The software also converts traditional terminology into modern terminology, for example, Jwar to fever, Turmeric to Curcuma longa, Mussorika to small pox, etc.

With the help of TKDL, India is capable of protecting more than 2,92,662 medicinal formulations. Thus, TKDL gives defensive protection for India's traditional medicinal knowledge. Now it is estimated that there is as much as a 44 % decline in patent claims filed on Indian systems of medicine[8]. The TKDL made a huge impact around the world and inspired many developing countries to protect their traditional knowledge against wrongful exploitation, primarily in the pharmaceutical sector. However, TKDL is limited in its coverage as it does not include the non-codified or oral knowledge. It is also restricted to medicinal knowledge.

2.1 Search Types and Search Options in TKDL

TKDL includes a search interface providing full text search and retrieval of traditional knowledge information on IPC and keywords in multiple languages. The search features include single or multiple word searches, complex Boolean expression search, proximity search, field search, phrase search, etc., in the form of simple and advanced search options. Simple search lets the user search a combination of keywords. This is a searchable database which can be started by clicking on the Ayurveda, Unani or Siddha icons on the homepage. Figure 2 shows TKDL search interface.

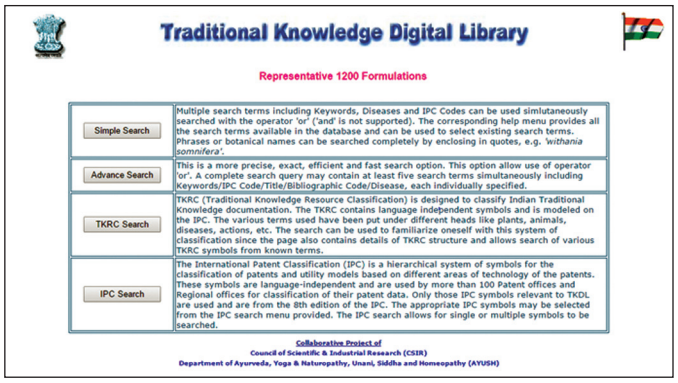

Figure 2. Traditional knowledge digital library (TKDL) search window.

2.1.1 Simple Search

Different search terms, including keywords, diseases and IPC codes can be used with the operator 'OR' (the use of operator 'AND' is not supported). The corresponding menu provides all the search terms available in this database and can be used to select the appropriate search terms. The features of Simple Search are:

(a) Terms to be searched may be entered or selected from corresponding help menu.

(b) Single or multiple search terms may be entered.

(c) Multiple search terms may be searched using operator OR.

(d) To search using local names with Keyword Help, one has to tick the check box—'with local name'.

2.1.2 Advanced Search

This option allows a search, using several search terms such as keywords, disease, IPC code, bibliography and title, each individually specified. All these terms can be selected from appropriate help menu.

Features of Advance Search

(a) Terms to be searched may be entered into text boxes provided or selected from the corresponding help menu.

(b) Single term can be searched but the text box on the top should not be left empty

(c) For help in the appropriate keyword search, the Keyword Help may be used. It provides a complete list of the keywords used in the representative database, including ingredients of plant, animal or mineral origin. Local names and Sanskrit, Tamil or Urdu terms as they appear (in diacritical) may be used directly.

(d) Disease Help provides a list of all the diseases that can be cured by the formulations in the database.

(e) Each formulation is given a title. This may also be used as the search term. Use the Title Help to select the title.

(f) To search using local names with Keyword Help, tick the check box—'with local name'.

(g) The operator OR can be used to obtain results containing both search terms, e.g., curcuma OR cough will give all the formulations containing either curcuma or cough.

(h) The drop down menu of 'knowledge is known since' can be used to see the formulations on the basis of the time period. For example, 200 years will display all instances of the formulations, which fulfil the search criteria and are 200 years old.

(i) One can select 'along' 'with summary' or 'without summary', for viewing the results accordingly.

2.1.3 Additional Search Options

(a) **TKRC Search:** TKRC is designed to classify Indian traditional knowledge documentation. The TKRC contains language independent symbols and is modeled on the IPC. The various terms have been put under different heads like plants, animals, diseases, actions, etc. The search can be used to familiarise oneself with this system of classification since the page also contains details of TKRC structure and allows search of various TKRC symbols for known terms.

(b) **IPC Search:** The International Patent Classification (IPC) is a hierarchical system of symbols for the classification of patents and utility models based on different areas of technology of the patents. These symbols are language-independent and are used by more than 100 patent offices and regional offices for classification of their patent data. Only those IPC symbols relevant to TKDL are used and are from the 8th edition of the IPC. The appropriate IPC symbols may be selected from the IPC search menu provided. The IPC search allows for single or multiple symbols to be searched.

3. TRADITIONAL CHINESE MEDICINE DATABASE (TCM)

China has a rich asset of traditional knowledge. The most important type of traditional knowledge in China is Chinese traditional medicine (TCM) which is derived from its ancient traditions. The traditional Chinese medicine is mostly in written form. China has its traditional knowledge in Chinese language, whereas Indian traditional knowledge is written down in various regional languages. The uniformity in language made it widespread and highly accessible. The TCM is also used in other Asian countries such as Korea and Japan. Hence legal protection in one country becomes ineffective as it can be freely used in other countries. Therefore, China's policies focus mainly towards positive protection of traditional knowledge by promoting innovation based on integration of TCM in modern western knowledge.

The TCM database was started by the Computational and System Biology Laboratory, which started to integrate TCM and western technologies in 2003. The traditional TCM contains three-dimensional structural information of TCM constituents and is ready for molecular docking simulation.The TCM database is currently the most comprehensive and largest non-commercial medical database available for downloading (Fig. 3).

Figure 3. Traditional Chinese Medicine Database@Taiwan (TCM) Homepage (http://tcm.cmu.edu.tw/).

The database contains approximately 20,000 ingredients from 453 different herbs, animal products, and minerals and is increasing rapidly. The TCM database is organised by traditional actions of Chinese medicines. There are a total of 22 different drug classes and some are further divided into subclasses based on clinical applications recorded in TCM monographs. The TCM classification is based on traditional Chinese theories, including the Yin-Yang, the human Meridan/Channel system, the Five Elements theory, and the Zang Fu organ theory. The TCM lists certain classes, such as parasite elimination, dampness reduction and itchiness relief, medicinal and

topical application medicinal, contain toxic ingredients and are no longer prescribed in clinics. These data do not imply endorsement for any clinical or private use of the toxic TCM compounds nor for any animal products present in the database[9].

3.1 Search Types and Search Options in TCM

The TCM database is constructed to create the most complete TCM library and to strengthen the TCM research network to date. In addition, this web-based database is implemented with virtual screening and molecular simulation functions. The TCM database can be browsed by simple and advanced search options. It also provides a website search engine is available at top the page for users who prefer search by Chinese medicine names and other TCM information.

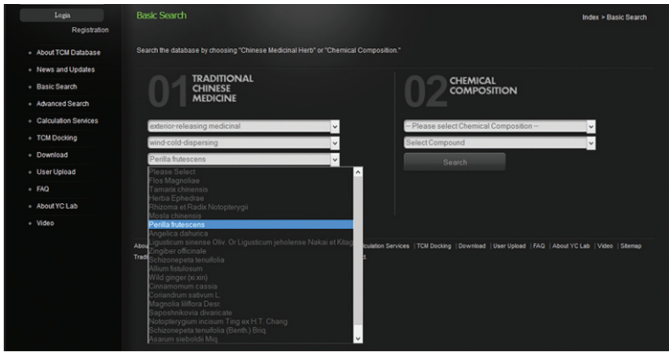

Figure 4. Basic search interface in TCM database.

3.1.1 Simple Search

The simple search option enables users to browse the website, either by TCM medicine or by chemical composition (Fig. 4).

Search by TCM

The search by TCM-medicine option allows users to select the intended drug action group and then the desired TCM medicine.

Search by Chemical Composition

The search by TCM-chemical composition option allows users to find possible TCM sources of the given molecule. This search result is directly linked to the TCM compound webpage without the need to specify TCM action group. The result is organised in a 'TCM profile' for both search options. It provides the identified TCM compound(s) and the associated references. The compound's 2D and 3D structures and molecular properties are open by clicking on a TCM compound in the profile. Users can download the structure of the molecule in cdx (2D) or mol2 (3D) format at the bottom of the TCM compound web page. In addition, users can also click on the links to browse other Chinese medicines that contains the selected TCM compound.

3.1.2 Advanced Search

The advance search option incorporates a molecular drawing interface (ChemAxon) for structure search. Users can also specify structure types, including exact search and substructure search, whichever best describes users' needs. Both of the advance search options can be used alone or in conjunction. The result will return molecule(s) that satisfy the input specification in a tabular format with name and 2D representation[9]

Following additional facilities are also available for its users;

- **Download interface—**The TCM database organises ingredients by their drug action classes and their original sources. Users can also download a specific drug class or a specific TCM or the whole TCM database from the download page.
- **Sharing TCM constituents—**The advancement of new technologies made easy to study new TCM ingredients. The new ingredients must be added for avoiding duplication work. The TCM database also provides an upload function for scientists who are interested in sharing their findings on Chinese medicines. Users may upload their own molecules to the TCM database server in mol2 format. The uploaded molecules are reviewed and incorporated into the TCM database.

4. CONCLUSIONS

The preservation and protection of traditional knowledge is a major challenge among the countries that hold it. A variety of initiatives are being made across the world to protect it. India and China are the most developing countries and they hold a large part of traditional knowlege of the world. They also have a rich heritage of the traditional medicine system. The bio-piracy of their traditional knowledge made them aware about protection this knowledge. The TKDL and TCM database are the initiatives taken by both countries for protection of from bio-piracy. The traditional knowledge recorded in these databases become public domain knowledge. Thus, these cannot be considered as patentable. These records are easily accessible to patent offices around the world and no one can apply for patent them. If a person applies, patent examiners could easily check this database and reject the application that might be a mere copy of traditional knowledge. It helps in protecting by bio-piracy. The TKDL and TCM are rich databases of medical information and are very helpful for research and industry.

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