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Emerging paradigm on traditional knowledge: Content, documentation and classical approaches to testing*

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In any functional and dynamic society there is a continuous review of the existing knowledge, practices and technologies in varied areas. Knowledge from multiple sources including tradition, modernity and innovation and adaptation of both of these take place in a dynamic manner. In India, we have an unusual situation – on the one hand there are traditions in varied areas including specific technologies such as agriculture, medicine, textiles, metallurgy, etc. as well as theoretical sciences including mathematics, grammar, linguistics, logic, etc. that have survived for several centuries if not millennia. During the colonial period, there were knowledge systems and practices drawn from colonial sources and imposed upon our institutions that began to occupy all public spaces. This is a trend that has continued well after independence. Currently, the traditional knowledge systems occupy a very marginal place and receive very little support or resources or patronage from the state. In terms of public discourse on this matter, it is often stated explicitly or implied that choices of technology are made solely based on their scientific validity and it is on these grounds that traditional knowledge is found wanting. This article reviews some recent developments in this area – to begin with we review the nature and social organization of traditional knowledge. Then we go on to look at knowledge in the specific domains of agriculture as well as healthcare and a recent effort for the comprehensive documentation of traditional knowledge across all domains. We then look at testing and validation efforts that have taken place along traditional/classical lines. Examples are cited from the area of agriculture. It is seen that there is overwhelming evidence in favour of the validity of such knowledge.

Keywords: Documentation, Knowledge, Testing, Tradition, Validation

During the colonial period there was a serious and systematic assault on our traditional knowledge systems in varied areas including health care, agriculture, material sciences, theoretical sciences, etc. They lost state support and patronage and there was a serious erosion of the resource base that they could access and public support suffered due to various reasons including the overall decay and degradation of the material and social resource base. The newly emergent institutions had no place for them and at best were patronizing or paid lip service. However, the post-independence period has seen a slow and a gradually increasing interest in this area.

- Now documentation of these traditions and knowledge systems has been taking place intensively in some areas and extensively in others.
- In terms of assessment of the utility and value, there have been varied approaches ranging from assessment from a completely modern Western perspective, assessment from what may be considered traditional perspective as well as various new and hybrid models.
- In terms of the utilization of these systems again there has been a wide range of approaches from – standalone use, selective use, use in a modified form and use that is blended/integrated in interesting and creative ways with modern approaches.
- More recently, communication about these efforts at all levels (documentation, assessment and validation) has become possible in large scales and multiple manners because of the power of the internet and social media.

These are very interesting developments and this article is a first attempt to review this phenomenon during the last few decades. This would not be confined to any single domain of science/technology but would be drawing examples from experiences and efforts in several domains, particularly - medicine, agriculture and natural resources management

*Dedicated to *Azadi Ka Amrit Mahotsav* (*India*)

I. Social organization of traditional knowledge

One of the important aspects of traditional knowledge that is widely recognized in recent years is the social organizations of traditional knowledge systems. It is now recognized that folk as well as classical traditions exist in varied areas such as health, agriculture, architecture, music, grammar and many more such areas. This is significant since a large number of efforts relating to documentation, testing and validation have started with the practices from the folk traditions. In the following section, we provide an outline of this phenomenon taking the health traditions as an example.

A. Social organization of indigenous health traditions

The Indian subcontinent abounds as it were in a variety and diversity of health traditions. The Ayurvedic and Siddha systems of medicine provide us with perhaps the longest unbroken health tradition with not only a stream of practitioners but also textual and theoretical backing[1,2]. These have made their presence felt even outside India, in other parts of Asia such as Sri Lanka, Nepal, Tibet, China, Thailand, Cambodia and Indonesia.

A remarkable feature of the Indian medical tradition, however, it finds expression in two different ways, namely classical systems and folk systems. By "classical systems," we mean the codified systems consisting of Ayurveda, Siddha and Unani and characterized by institutionally trained practitioners, a body of texts, and highly developed theories informing their practices. The folk traditions (which may be called *Lok Parampara*) consist of oral traditions passed on from one generation to other, or *guru* to *sishya* in tens of thousands of our villages throughout the ages. Such folk traditions are rich and diverse, and include several kinds of practitioners, as the following illustrates.

- Home remedies and cures for common ailments
- Hundreds of thousands of folk and tribal practitioners known as Vaidus, Nattu Vaidhyars, Bhagats, etc., who learn orally and treat a variety of ailments
- Over 600,000 *Daies* (traditional birth attendants) who perform home deliveries
- Folklore on health (e.g., proverbs relating to health)
- Knowledge and beliefs regarding foods – *Pathyam* and *Apathyam*, i.e., foods to be preferred or avoided during specific diseases, or conditions such as pregnancy, lactation in mothers, etc.
- Knowledge of diagnostic procedures
- Knowledge of preventive measures
- Knowledge of Ritucharya or adaptation of food and regimen to suit the season
- Yoga and other physical cultural practices for preventive and promotive healthcare
- Special areas such as bone setting, Visha Chikitsa (treatment for poisons), Panchakarma (five purificatory procedures), etc.
- Individuals/families specializing in the treatment of specific diseases, e.g., jaundice, asthma, snake-bite

B. Traditional knowledge relating to agriculture

In a later section where we have dealt with the process and experiences of testing and validation of traditional knowledge, we have also spoken in detail about traditional practices relating to agriculture.

C. Relationship between folk and classical traditions

The relationship between folk and classical traditions is found to be symbiotic. There is a strong commonality of underlying theory and world view expressed at the level of *Panchamahabhoota* (the theory of composition of matter) and *Tridosha* (the theory of causation of disease). There is also a striking common ground between the technical terms used by expert practitioners and those known to folk practitioners. Sanskrit technical terms and vocabulary from Ayurveda such as *Vata, Pitta, Kapha, Ushna, Sheeta, Laghu, Guru, Guna, Veerya*, etc., are also very much part of the knowledge of folk practitioners and households[3].

Ayurveda's classical texts statements about folk traditions are of interest. Charaka Samhitha says: *"Oushadihinaamaroopabhyaam, jananthehyajapaa vane, avipaashchaivagopaashcha ye cha Anyevanavaasinaha*" – "the goat herds, shepherds, cowherds, and other forest dwellers know herbal remedies by name and form. Similarly, Susrutha-Samhitha states: "*Gopaalasthaapasaavyaadha ye chaanye Vanacharinaha, Moolajaathihi cha tebhyo Bheshajavyakthi Ishyathe* – "one can learn about herbal medicines from cowherds, tapasvis, hunters, those who live in the forest and those who live by eating roots and tubers."

This highlights a very important feature of our science and technology namely that its knowledge, theories and principles were not confined to a small number of experts, institutions, or texts, but are seen to be created and shared on a wide scale, even with those ordinary folk who are the day-to-day practitioners of

the art of medicine. In fact, though we have used the term "folk knowledge" to denote knowledge with our people for want of a better term, its connotation is quite different in the modern context. The modern Western view uses "folklore" to denote knowledge of supposedly dubious value prevailing among common people and propagated orally, in contrast to "proper" scientific knowledge with its own terminology, theories and abstractions, which resides in a different body of people viz., experts.

In the Indian tradition, this kind of a sharp qualitative distinction does not seem to exist. "Folk" practitioners are equally innovators at the frontiers of their discipline, and theories and technical categories belong to their domain as well. If we consider, for example, a highly developed branch of Indian Science such as medicine, the basic theories at its foundation, such as the panchabhuta theory of matter and the tridosa theory of causation of disease and its treatment, are common knowledge among the people. Similarly technical terms such as those mentioned above are part of common vocabulary. Here, the expert or specialist plays a different role, namely one of systematizing the corpus of knowledge.

In this connection, it is interesting to look at the view of grammarians of Ancient India since in traditional Indian knowledge the theory of language is very sophisticated and highly developed. Panini's grammar, the Ashtadhyayi, is always presented as a paradigmatic example of a perfect theory. Patanjali in his celebrated Mahabhashyam commentary on the Ashtadhyayi discusses theories in detail – what constitutes a theory and how theories are made. For example, in a discussion about the role of the Grammarian, Patanjalisays[4]

"He who needs to use a pot goes to a potter's house and says, 'make me a pot; I need to use one.' But no one similarly goes to a Grammarian and says 'Coin words, I shall make use of them.' He thinks of objects and makes use of words denoting them the loka (i.e., usage prevailing in the world) is the authority for use of words.

Thus, there is no looking down on common folk or lay practitioners. On the contrary, the sastras themselves repeatedly assert that in their concrete particulars and practical use in real-life situations that the truth of the sastras ultimately resides.

II. Documentation of traditional knowledge

In this section, we have provided examples about various significant recent efforts about the documentation of traditional knowledge. Three different types of efforts have been given as illustrations namely –

- Folk traditions relating to *Vrkshayurveda* (Traditional Indian agriculture and plant science)
- Folk traditions relating to traditional medicine focusing on the efforts of a network LSPSS (Lok Swasthya Parampara Sambardan Samiti) which had its origins in the 1980s and
- PPST (Patriotic and People oriented Science and Technology) foundation which was active from the early 1980s onwards – was involved in work in varied areas of traditional knowledge including material sciences, theoretical sciences and also the issues of methodology, philosophy and epistemology.

A. Folk traditions of *Vrkshayurveda* – Traditional Indian agriculture and plant science

There is evidence from a variety of sources to indicate that there is a stupendous knowledge of *Vrkshayurveda* that survives and even flourishes at the folk level. The carriers of this knowledge are the farming community who are undoubtedly the largest repository of this knowledge and its practitioners who are gardeners, lay persons, housewives, etc. Since the 1980s one has seen a spurt of publications, documentations and discussions of this knowledge. An overview of some of this is provided below.

1 *Indigenous technical knowledge in agriculture: ICAR volumes*

The Indian Council of Agricultural Research (ICAR) launched a nationwide mission mode project on collection, documentation, and validation of Indigenous Technical Knowledge (ITK) under the National Agriculture Technology Project (NATP) during the year 2000. As part of this process, information on ITK was collected from primary sources through voluntary disclosures and simultaneous collection and compilation of ITK from available literature, books, journals, and theses. The final compilation comprised of a total of five documents in seven volumes[5-11]. Of these, the first two documents consisting of a total of four volumes listed 4879 indigenous practices[5-8] whereas the third and fourth documents described efforts at validating and cross validating these practices[9,10]. The fifth document described geographic indicators[11].

2. *Magazines and journals*

Several newsletters, magazines and scholarly journals are now available which report and discuss

indigenous practices of agriculture at varied levels. One of the most popular and widely circulated magazines of this kind is Honey Bee, a quarterly journal published by the Centre for Management of Agriculture, Indian Institute of Management, Ahmedabad[12]. Since 1990, the magazine has carried a fascinating array of reports from various parts of India and now increasingly from various parts of the developing world about the traditional knowledge of agriculture. Interestingly it has also provided a platform in which the comments and responses to the reported practices, their utility and possible rationale from the modern scientific view is made by scientists and practitioners of modern agricultural systems. The magazine is now vastly strengthened and is being published in several Indian languages including Tamil, Malayalam, Kannada, Telugu, Oriya and Gujarati. There are also scholarly journals which carry peer-reviewed articles on various aspects of traditional Indian agriculture. One of the most interesting of such journals that has been in existence now since 1994 is a quarterly journal "Asian Agri-History" published by the Asian Agri-History Foundation which has carried a large and varied number of fascinating articles on traditional Indian plant science[13]. There are also journals of a slightly different nature such as the Indian Journal of Traditional Knowledge being published by the Council of Scientific and Industrial Research (CSIR); its scope is wider covering all aspects of traditional knowledge and is not limited to agriculture[14]. However, it also has a fair coverage relating to the area of traditional agriculture.

B. LSPSS (Lok Swasthya Parampara Sambardan Samiti)–Documentation of local health traditions

From the early 1980s, there was an extensive interest in the documentation and utilization of local health traditions in various parts of India. This eventually culminated in the formation of a national network of organizations named as – "LSPSS (*Lok Swasthya Parampara Sambardan Samiti*)". What was interesting about LSPSS was that the effort was not focused on academics or theoretical research. It was rather focused on examining and developing the current relevance and potentials of these traditions particularly with respect to primary health care. This network and effort had various interesting features such as –

- The recognition of medical knowledge of varied levels ranging from the household and folk practitioner to the experts of Ayurveda, Siddha, etc.
- Building specific links between the community and the two streams of knowledge.
- Initiating an active dialogue with modern institutions and practitioners.
- Innovative programs such as the Gurukul fellowship scheme by which institutionally trained practitioners of Ayurveda, Siddha, etc could study with outstanding folk practitioners in a mutually respectful arrangement.
- A series of publications were brought out by LSPSS – while these were originally confined to Ayurveda, in course of time they also included veterinary sciences and plant sciences[15-28]. These monographs were also translated into Hindi.

These efforts eventually lead to the establishment of major institutions including FRLHT (Foundation for Revitalization of Local Health Traditions) (http://www.frlht.org/) as well as the TDU (Trans Disciplinary University) (https://tdu.edu.in/)

C. PPST (Patriotic and People Oriented Science and Technology) Foundation

The PPST (Patriotic and People-oriented Science and Technology) group is a voluntary network of Indian scientists, professionals, scholars, historians, sociologists, philosophers, thinkers and social activists formed in the late 1970s. Efforts to understand the reasons for the rather poor state of the contemporary Science and Technology enterprise in the country led the group to, among other things, examine more closely our own traditions of Sciences and Technologies that have existed prior to the Western domination of India starting from the eighteenth century. In these pursuits, the Gandhian historian Shri Dharampal (1922-2006) has had a major influence on the group.

During the period 1980 – 2000, the findings of the PPST group have been disseminated widely through the media of the PPST bulletins, the Congresses of the traditional S and T of India, various R&D projects taken up, etc. The picture that emerged was that much of our efforts in the S and T and other domains of the last century or so had been largely in the nature of weak imitations of what was happening in the West, with little organic link with our own traditions, history, requirements, people's knowledge and practices. While certain amount of technological and managerial skills and competence have been achieved in the process, the group believes the goals of nation building and people's welfare can be achieved only by

building on the foundation of our own civilizational ways, values and strengths. This would amount to adopting the spirit of Swaraj and Swadeshi in every field, as enunciated and demonstrated by Mahatma Gandhi during our freedom struggle.

A selected listing of the contributions of the PPST group can be foundhere[29-44]. What is significant and remarkable about these efforts is the following –

- The efforts encompassed various areas of material and technical knowledge such as agriculture, health care, material science and food and nutrition.
- It also included abstract and theoretical areas such as mathematics, astronomy, grammar and logic.
- Detailed articles and studies were reported about philosophical and epistemological aspects.
- While the efforts were initiated largely by a group of scientists with modern training, three – "Congresses of traditional science and technologies of India" were organized in the years 1993, 1995 and 1998 which involved the participation and coming together of well over one thousand participants in each congress.

The PPST (www.ppstindiagroup.in) also resulted in a large number of institutions that have continued to function either initiated by drawing inspiration from it.

III. Testing, validation and utilization - Classical approaches

To begin with we look at what may be considered as – "Classical approaches" to the testing and validation of traditional knowledge. We site examples drawn from the area of health care and agriculture.

A. Modern studies on traditional knowledge - Hot and cold

In India, choices of food among the people at large are still derived from the Āyurvedic worldview and understanding. This is an area where the local communities abound in various do's and don'ts, which often appear to be not comprehensible to the modern investigator. This is perhaps one of the reasons why there is a poor understanding of the nutritional value of many substances that were traditionally valued very highly such, as rice. The characterisation and description of rice that is found in the texts of Āyurveda use terminologies which are entirely different from the modern medical and nutritional terminologies. The gap is quite wide on these matters between the modern and the traditional, and there have only been a few scattered and sporadic efforts to bridge this gap. In fact, concepts such as hot and cold are not only not understood, but also dismissed as superstition. Consider the following question, which appeared in a journal published by the National Institute of Nutrition[45]. "It is true that there is a widespread belief that some foods are "hot" and others "cold." However, there appears to be no scientific basis for such classification. It is not desirable to limit the choice of food based on such beliefs."

There has been an attempt to directly understand and assess the concepts of traditional medicine, such as hot or cold employing modern nutritional laboratory techniques. At the outset, it may appear that the concepts of traditional medicine such as hot and cold are completely outside the scope of understanding of modern medicine and few would think that there is any kind of dialogue possible. However, it is interesting to note that in the late 1960s an attempt was made by a scientist from the National Institute of Nutrition, Hyderabad, to try and understand the biochemical basis for the Āyurvedic understanding of hot and cold foods[46]. A list of food items that are believed to produce either heat or cold when consumed was prepared, and from among these, two diets were formulated. The first consisted mainly of hot foods and the second cold foods. Hot foods were generally those that, when consumed, produced a subjective feeling of burning eyes, burning micturition and a feeling of warmth all over the body. Four normal healthy adult subjects from the laboratory staff were selected for the metabolic study. Protein, fat, and calorie intakes were adjusted according to the Nutrition Advisory Committee recommendations. The subjects were first placed on a diet comprising mostly of the hot foods for a period of 10 days followed by the second period of 10 days when they were given a diet consisting mainly of cold foods. The period of intake of each of these types of foods was 10 days. When the subjects were consuming hot foods, the acidity of the urine was much higher than when they were consuming cold foods. The high acidity of urine may be the possible cause for the burning sensation during micturition. Urinary excretion of sulphur was also found to be higher in hot foods than in cold foods, indicating a possibility that the high sulphur content of urine may be the cause for the high acidity of the urine. Nitrogen retention was found to be lower in hot foods than in

Table 1 —Results of ICAR Document 3 (Validation Volume) in terms of efficacy, grouped thematically[9]

S.No	Theme	Total number of experiments	Analysis of Proved valid	Results of Partially valid	Experiments To be repeated	Not valid	Results not declared
1	Rainwater Management	3	3				
2	Soil and Water Conservation	2	1	1			
3	Tillage Practices	1	1				
4	Crops and Cropping Systems	5	4	1			
5	Pest and Disease	13	9		1	2	1
6	Farm Implements	4	3	1			
7	Grain/Seed Storage	8	8				
8	Horticultural Drops	18	16	1		1	
9	Veterinary Science and Animal Husbandry	34	23	3	1	7	
10	Fisheries	3	2				1
11	Food Product Development	5	5				
12	Natural Yarns and Dyes	2	2				
13	Ethnic Food	7	7				
14	Thermal Efficiency	1	1				
15	Weather Forecasting	4	3		1		
16	Low- Cost Housing Materials	1	1				
	Total	111	89	7	3	10	2

cold foods, although the total nitrogen content was the same in both the diets.

Surprisingly, this remains the only research report in India where such an effort has been made to comprehend Āyurvedic parameters through a laboratory exercise.

B. Validation of ITK practices of agriculture

While it is obvious that there is a tremendous amount of literature on *Vrkshayurveda*, the question may arise as to its validity. This is traditional knowledge and it is not backed up by experimental data about the testing and validation efforts in the modern sense. In this connection it is interesting to take a look at the effort made by ICAR for testing and validating these practices[5-11]. Information about this corpus of knowledge has already been given in section III. A.1 earlier[5-11]. They are summarized below.

Of the 4879 practices that were documented, a set of 111 ITK were selected and subjected to experimental testing and validation by several ICAR institutes, State Agricultural Departments, and State Agricultural Universities and other Universities across the country. These pertain to various topics such as pest control, crop protection, farm implements, weather forecasting, etc. The results of these validation experiments were published as a separate volume. This volume does not contain an overall analysis of the results - hence our Centre has compiled the results in a tabular format (Table 1).

Table 2— ITK practices tested by ICAR: An overview of the success rate.

S.No	Validity	Number	Percentage
1	Proved valid	89	80
2	Partly valid	7	6
3	To be repeated	3	3
4	Not valid	10	9
5	Results not declared	2	2
6	Total ITK tested	111	100

It is seen that a whole range of practices have been tested on themes ranging from rainwater management to weather forecasting. We are also able to separately list the results of each experiment whether it is proved valid, partially valid, or not valid, etc., and we also compiled the results in terms of percentages (Table 2). This showed that about 86% of these practices were valid or partly valid, and about 9% not valid. In a few cases the scientists felt that the experiments needed to be repeated, and in a couple of cases the results were not declared.

In summary, there was overwhelming evidence in favour of the validity of these practices.

C. Other experiments and results on traditional agriculture

While the above effort of ICAR was vast and extensive, several other such efforts have been made by various organizations. We summarize below a couple of such efforts made by CIKS[47]. What was significant about these experiments were that the

diagnosis as well as the – "Line of treatment" for these problems were based on the principles of *Vrkshayurveda*. We also share how such efforts have resulted in the production of – "A package of practices" relating to agriculture building on tested and validated traditional knowledge.

1. Treatment of mango tree at the CIKS

In the early 1990s, CIKS had an office that was rented and located in an independent house in Thiruvanmiyur in Southern Chennai. The office compound had a mango tree that was not fruiting. The landlord told us that the tree had never been seen bearing fruits, and so we decided to examine and treat it based on the approach of *Vrkshayurveda*. The symptoms observed were abnormal leaves, darkened flowers, dropping of flowers and stalks, and low fruiting. As per Ayurvedic understanding this was diagnosed as being due to vitiation of Pitta dosha. The treatment decided upon was irrigation with a decoction of *Nalpamara Pattai* and goat's meat in milk for a month at weekly intervals. *Nalpamara Pattai* is a classical Ayurvedic preparation consisting of a mixture of the bark of four palm tree varieties, namely, *Ficus religiosa*, *F. benghalensis*, *F. glomerata*, and *F. insectoria*. In addition, the plant was drenched with meat of goat that was cooked in milk. After four weeks of such treatment, it was observed that the growth of fresh leaves and flowers was enhanced, dropping of flowers stopped, and the tree started fruiting. The landlord was quite pleased to see that his tree that was written off as barren had started fruiting so late!

2.*Control of mango leaf webber* (*Orthaga euadrusalis*) *at Theosophical Society*

The Theosophical Society in Chennai is a huge tract of greenery at the estuary of the Adyar River. It occupies an area of several hundred acres. During the year 1993 we had a request from the society to help them to treat and control to the extent possible a serious problem that had come up with their mango orchards. Upon examination of mango trees, we observed the following: leaf Webber infestation period was April-December; higher infestation in orchards with lesser spacing between trees and shady areas; the larva web on the leaves which completely fed on them, leaving them withered and dry. The treatments included: a) cutting-off heavily infested branches from the tree, separating and destroying, b) spraying affected areas with Neem oil and *Pongamia* oil (*karaja*, *Millettia pinnata*) solutions, and c) fumigating using the powders of two substances, namely, *Daru haridra* (*Berberis aristata*) and *Vayu vidanga* (*Embelia ribes*). The results obtained from *Vrkshayurveda* treatments for control of mango leaf Webber were quite striking and exceeded all the expectations. Plant growth was enhanced. The trees put forth fresh leaves and flowers and eventually started fruiting again. This was our first experience with making a trial on such a scale, which gave us a lot of confidence.

3. Packages of practices

There have also been recent efforts to put together package of practices for cultivation of various crops which include (but are not restricted to) practices drawn from *Vrkshayurveda* for seed treatment, pest control, disease management, increasing soil fertility and post-harvest storage and management. Such package of practices has been brought out as publications by CIKS with respect to some specific crops such as paddy, cotton, some specific vegetables such as tomato, brinjal, oilseeds such as groundnut, and spices such as chilli[48-50]. The results of a large number of trials and experiments carried out by CIKS have been published as a series of articles, books and manuals[51-62]. The CIKS approach during this entire period was to popularize and spread the knowledge and practices of *Vrkshayurveda* amongst farmers and their groups with very little or no focus on the research and scientific publications.

Conclusion

This review shows that there is extensive knowledge in traditional systems in varied areas. This is not only in the areas of technologies or hard sciences such as agriculture, metallurgy, textiles, etc. but also in theoretical areas including mathematics, astronomy, logic and grammar. A special feature of such traditional knowledge is that it finds expression both as formal scholarly knowledge as well as folk knowledge which are in a symbiotic relationship. Recent efforts undertaken to subject traditional knowledge of agriculture to testing and validation from modern scientific viewpoints are discussed. It shows that there is overwhelming evidence in favour of the validity and utility of such knowledge.

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