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Documentation and Application of Indigenous Traditional Knowledge (ITK) for Sustainable Agricultural Development

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

This paper focuses on application and documentation of Indigenous Traditional Knowledge (ITK) which is a local knowledge that is unique to a given culture or society. It is a key element of the social capital of the poor and constitutes their asset in their efforts to gain control of their own lives. The flow of indigenous knowledge communication is necessary for preservation, development and sustainability of local wisdom. The study is based purely on secondary sources. Indigenous traditional knowledge system consists of an integrated body of knowledge system which tends to focus on different aspects of agricultural sciences i.e. agriculture, home science, animal care & soil and water conservation. It can be concluded that traditional knowledge is vital for the well-being and for sustainable development as it has evolved after thousands of years of observation and experience. By linking the indigenous knowledge systems of the people with farmer, research and extension, the output of researches can be made more fertile and usable. The participatory

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technologies that are developed through ITK integration will provide diversified technological options. Being low in cost, it will also benefit national economy besides sustainable agricultural development.

Keywords: Indigenous traditional knowledge; documentation and validation; agricultural extension.

1. INTRODUCTION

Indigenous Traditional Knowledge (ITK) is a local knowledge that is unique to a given culture or society [1]. Another study puts forward that this knowledge is generated and transmitted by communities, over time, in an effort to cope with their own agro- ecological and socio-economic environments [2]. It is the systematic body of knowledge acquired by local people through the accumulation of experience, informal experiments and ultimate understanding of the environment in a given culture [3]. ITK is a key element of the social capital of the poor and constitutes their asset in their efforts to gain control of their own lives [4]. The contributions of indigenous and local knowledge systems towards a better understanding of biodiversity and its sustainable use and management, has been documented in the scientific and gray literature in many domains: biodiversity conservation and wildlife management, customary marine resource management, rural development and agroforestry, traditional medicine and health, impact assessment; and natural disaster preparedness and response [5]. Such indigenous knowledge systems also provide the basis for local level decision making thereby capitalizing in indigenous creativity and spreading of indigenous knowledge among the local community. The flow of indigenous knowledge communication is necessary for preservation, development and sustainability of local wisdom. It contains legitimate knowledge and has the capacity to help the process of sustainable development and natural resource management [6].

Globally, the concept of indigenous knowledge gained recognition through the World Conservation Strategy of International Union and Conservations of Natural Resources in 1980 followed by World Commission on Environment and Development, 1987 and United Nations Conference on Environment and Education in 1992. These events recognized the existence of indigenous knowledge in every country, society and culture. Since India has a long history and much enriched culture, there is abundant reservoir of indigenous knowledge in every part of the country. It is embedded in a dynamic system in which spirituality, kinship, local politics, and other factors are tied together and influence each other. Indigenous knowledge systems may appear simple to outsiders but they represent mechanisms to ensure minimal livelihoods for local people. They are often tuned to the needs of local people and the quality and quantity of available resources [7].

This is a community based functional knowledge system, developed, preserved and refined by generations of people through continuous interaction, observation and experimentation with their surrounding environment [8]. Another studies put forward that rural communities use ITK for decision making in Agriculture, Healthcare, Food preparation, Education, Natural resources management, Human and animal health and a host of other activities [9-11]. There is a need to analyze the importance of ITK for allied Agricultural activities. It is also reported that ITK is farmers friendly, economic and environmental friendly, socially accepted and suited to specific local and environmental conditions [12]. So eventually, ITK is fruitful for sustainable development of the community and country as a whole.

2. INDIGENOUS TRADITIONAL KNOWLEDGE IN AGRICULTURAL EXTENSION

Sources of ITK are hidden in our village, communities and countryside. The main sources are farmers, community leaders, elder persons, folklore, song, poetry, ancient records, NGOs, extension agencies and published materials of different languages [13]. Indigenous knowledge of ecological zones, natural resources and agriculture is far more sophisticated than previously assumed [14]. These potential sources which possess indigenous knowledge (local farmers' knowledge) should be involved in the development activities. Thus, recognizing indigenous knowledge and harnessing it for allied agricultural development could form new paradigm for meaningful development where

special emphasis could be placed on developing and disseminating local content, improving the relevance of the information to local development, as well as capturing and auditing all relevant local resources.

Extension workers need to go beyond technology transfer to developing skills and knowledge of farm families for sustainable agriculture and rural development [15]. There should be a paradigm shift from the conventional method of technology transfer via training and visit, face to face contact as well as the top-down approach of generating technologies/innovations meant for farmers to the bottom-top approach which would see the farmer as the focal point, whose knowledge count more than that of the scientist [9] and from whom the scientist can learn from [16]. Development activities, especially those that aim to benefit the rural people directly, need to consider indigenous knowledge in the design and implementation stages of the process.

Although various extension approaches involves local communities in decision making process i.e. they ensure participation of farming families in development, Participatory Rural Appraisal and knowledge, attitude and practice (KAP) surveys are used for analysis of the situation, problem diagnosis, finding out alternative solutions, planning the course of action, monitoring, evaluation and feedback [17]. Farmer study circle (FSC) provides an opportunity for people to learn together, to strengthen their opportunities for influencing their own situation in life, and to fill gaps of knowledge and information in society. A group of people meet regularly for a period of time, most often once per week, to study a certain subject, theme or to take part in a practical activity. Study circles are characterized by democratic values and are based upon the participants' taking responsibility for the work. Together they plan their studies, based on their own needs and interests. An important part of the study circle methodology is the exchange of experiences and ideas between participants and their own analysis of the subject studied where learning is based on the collected wisdom of the group. By managing the process themselves, participants practice democracy, and systems of shared power, where participants come to conclusions or make decisions by talking, listening and understanding. Similarly facilitative approach involves shared responsibility for learning. The team usually possesses experience, expertise and wisdom in a particular area and the facilitator helps to access the wisdom of the group. A facilitator might help the team explore their data, their beliefs and ways of being as appropriate. A facilitative approach draws upon a variety of traditional strategies such as active listening, probing and paraphrasing [3,11,15]. These approaches and methods help to bring about fuller participation of farmers groups and strengthen their capacity to identify their needs, to set priorities and demand appropriate services.

Unfortunately, these participatory approaches just involve the farming communities to convince them with their methodologies instead of looking into indigenous practices and validating the same. Consequently, much indigenous knowledge is at risk of becoming extinct. Rapidly changing natural environment and fast pacing economic, political and cultural changes on the global scale exaggerate the situation. Traditional practices vanish and disappear because of the intrusion of foreign technologies. The tragedy of the impending disappearance of indigenous knowledge is most obvious to those who have developed it and make a living through it. Indigenous knowledge is not yet fully utilized in the sustainable agricultural development. The implication of this therefore is the need for a new paradigm or shift which calls for integration of indigenous traditional knowledge with modern technologies so as to help protect, improve, and sustain the people's local knowledge by involving them in programmes meant to develop them. This also calls for need for policy formulation that would strengthen the linkage between research, extension and farmer linkage. If this is properly harness by incorporating the indigenous traditional knowledge of the people in the linkage, research would no more be sterile or impotent and extension would no more be weak while the local community becomes originators of ideas.

3. DOCUMENTATION AND VALIDATION OF ITK

The origin of indigenous knowledge can be traced back to the ancient period. People used such knowledge from generation to generation for their livelihood in an unaccounted manner. There are no written documents for recording and dissemination of such knowledge. It found that such knowledge system is essential for development. It must be gathered and documented for a particular community [18]. It is commented that the collection and storage of indigenous knowledge should be supplemented

with adequate dissemination and exchange among interested parties using newsletter, journals and other media [19].

The knowledge survives through word of mouth particularly among the old generation. Documentation of their vital knowledge on different subjects is necessary before the old generation passes away. Documentation has great practical utility in almost every activity of human life such as health, animal health, livestock management, food, agriculture, timber, dye, religious ceremonies etc. It provides useful clue in planning projects for conservation of biological diversity, sustainable uses of natural resources, indigenous health practices etc. It increases awareness among younger generation to revive and restore pride among the farmers themselves [20].

4. PROCESS AND METHODS OF ITK ANALYSIS

As compared to outside knowledge, Indigenous knowledge has advantage of being cost effective and readily available [21]. Indigenous Knowledge has been effective in solving problems of rural communities. There are instances where modern scientific knowledge is not compatible rather simple local techniques proved useful. In addition use of ITK assumes the end user of specific agricultural Development projects are involved in developing technologies appropriate to their needs [22] .Very few attempts have been made to analyze ITK in Agricultural Sciences. There is a need to understand the methodology for ITK analysis so that researchers in Agricultural sciences and other allied areas can go for the thrust area. Given below are the steps for ITK documentation and validation [23].

4.1 Identification and Collection of ITK: (Methods and Techniques)

There are no fixed methods for collection of ITK. It depends on type of ITK, situation, people, social system, cultural values and other aspects.

1. **Documentation of oral histories:** To preserve the indigenous practices in the form of pictures, audio recordings, video recording and notes etc.
2. **Agro-ecosystem analysis:** It is a thorough analysis of an agricultural environment which considers aspects from ecology, sociology, economics, and politics with equal weight.

   a) Mapping (historical, social etc): Mapping is the creation of maps, a graphic symbolic representation of the significant features of a part of the surface of the earth.

   b) Transect walk: A transect walk is a tool for describing and showing the location and distribution of resources, features, landscape, main land uses along a given transect.

3. **Manual discriminative analysis:** In this process extension worker asks farmers to discriminate practices and find rationality.
4. **Decision tree analysis:** It is a decision support tool that uses a tree-like graph or model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility.
5. **Use of local resource persons:** To get the information from the local people of the community.
6. **Analysis of journals and newspapers:** Analysis of journals and newspapers to know about the indigenous practices of the local community can be done.
7. **Continuous interactions during on-farm experiments:** Experts build a rapport with the local people during on farm experiments so that they can know about their way of living and their local practices.
8. **In-depth interview of farmers:** Farmers are interviewed about their local resources and their use for daily livelihood and problems faced.
9. **SWOT analysis:** It is a structured planning method used to evaluate the strengths, weaknesses, opportunities and threats involved in practices used by the indigenous community.

4.2 Types of Documentation

1. Documenting large variety of practices without scientific validation.
2. Documenting prevalent practices and comparing them with traditional ones.
3. Documenting the practices evolved to mitigate specific problems of farming or for sheer survival under conditions of ecological and economic stress.

Methods and Techniques of documenting ITK

1. Notes
2. Photos

3. Audio-recordings
4. Video-recordings

4.3 Testing and Validation: Method and Techniques

1. Prepare a list of all the collected ITK practices
2. Decide the continuum for rating the rationality of ITK with specific weightage.

Continuum	Weight
Very rational	5
Rational	4
Undecided	3
Irrational	2
Very irrational	1

3. Send the list of ITK practices to experts for their opinion and judgment on each practice.
4. Calculate the weighed mean score of individual practices.
5. Select practices above mean score as rational.

5. APPLICATION OF ITK IN AGRICULTURAL SCIENCES

Indigenous traditional knowledge system consists of an integrated body of knowledge system which tends to focus on different aspects of Agricultural Sciences.

5.1 Agriculture

Indigenous knowledge in agriculture is very vast and diverse. This knowledge has been collected, accumulated and perfected over centuries. Indigenous knowledge of the people is very effective in meeting their food requirements, in areas of land clearing, sowing, harvesting, weeding etc. Their mixed farming mixed cropping, crop rotation etc. helped tremendously in their bumper harvest. Indigenous crops of a particular area play a vital role in food security. Local people of Uttarakhand (Garhwal region) use varieties of indigenous crops, i.e. mandwa or ragi (finger millet), chaulai (amaranth) and bathwa (chenopodium). Moreover, chemical analyses of all these crops prove as highly nutritive food value and safe diet [24].

The farmers of most of the agricultural countries have to struggle hard to protect their grains from various conditions causing damages to them but the farmer's indigenous storage techniques possess excellent storage structures. It is reported that local people of Tamil Nadu, India use *Kulumai*, an indoor grain storage structure for storing various food grains. These structures are eco-friendly, cheaper and locally available and do not cause any health hazards [25].

5.2 Home Science

The indigenous knowledge consists of a vast array of knowledge regarding the use of plants material for health purposes. It is reported that rural home makers use different indigenous medicinal plants i.e. Tulsi, Aamla, Neem etc. for treating the respiratory problems [12]. Use of the herbal plants for treating ailments is helpful in reducing expenditure on health care. People use various indigenous knowledge to control pest and fungi i.e. cow dung to control mites and fungus, tobacco leaves and stalks for pest control and neem leaves to control termites [26]. They also use different types of soaps for bathing and washing using indigenous resources such as palm oil, palm kernel, palm fibers and the leaves ash [27]. Medicines like quinine, aspirin, etc. are all derived from plants. Traditional medicine is available not only as curative medicine but also as the preventive medicines, cosmetics and in other consumables related to medical science that are taken as supplements to diet. It is estimated that 60.0 per cent of the world population and 80.0 per cent of the population of developing countries rely on traditional medicine, mostly plant drugs, for their primary health care needs. Indigenous knowledge in medicine is therefore extremely valuable for the scientists who are involved in drugs manufacturing and discovery.

5.3 Animal Care

Indigenous traditional knowledge is helpful in animal breeding and production as well as preparing traditional fodder and forage species etc [23]. Rural community possesses treasure of knowledge regarding animal husbandry practices. In the villages of northern Gujarat and southern Rajasthan women use local food resources for animal feeding which increases milk production. These resources are rich in protein and energy [7].

5.4 Soil and Water Conservation

Taxonomy of crops and soils is the basic knowledge on which decisions are made in selecting crop varieties to plant or soils to

cultivate [10]. The local people have gained experience in soil management because they know that to address the adverse effect of soil acidity; they have to use compost manure. To maintain soil fertility, they conserve the soil nutrient by adopting fallow system as well as shifting cultivation and crop rotation. Chakhesang tribe of Nagaland use, Zabo, which means 'impounding water', which is an indigenous method of catching rainwater from running off the mountains.

5.5 Forest/ Woods

Indigenous plants is a source of wild food, building material, household tools, minor forest products, fuel wood and medicinal folklore system. It is reported that local people of south India use coracle, saucer shaped craft made up of bamboo wood. It is a major fishing craft used in fisheries [28].

5.6 Plant Protection

Over the last decades, pesticides have been used to protect crops from insects and pests which are harmful to crop quality and yields. Unfortunately, many chemical pesticides, particularly those containing chlorinated compounds, are often persistent in the environment and can be toxic to hum ans but with the application of indigenous method of pest control the harmful effect of chemical pesticide can be overcome. It is reported that termites can be controlled by irrigating the fields during its attack. Local people also used indigenous knowledge to scare birds in rice fields by building a mock human being dressed like humans and erecting it at strategic position in the rice field. The birds mistake these mock beings as real and stay away from the field [29]. Farmers of Udaipur, Rajasthan used bruchid (*Callosorbruchus chinensis*), the oil of *Mentha spicata* to control pests [30]. Traditional knowledge of the use of pesticides, insecticides, can facilitate sustainable development of agriculture.

In Table 1, an attempt has been made to document scientific validated ITK practices used by the people of Punjab.

Table 1. Scientific validated ITK practices used by the people in Punjab

Broad area	Sector	Sub-sector	Local knowledge
Agriculture [1,29]	Agronomy	Weather forecasting	Rainfall was expected by farmers when wind remained blowing from the east direction continuously for long period of time
	Plant protection	Termite control	Termite was controlled by irrigating, the field during its attack.
	Conception and abortion	Increasing fertility among females	Eat quath of coconut, edible dates, raisins and *Trachyspermum ammi* (ajwain), *Saraca asoca* (bark of ashoka tree) with jaggery.
		Increasing fertility among males	Eat coconut and edible dates
		Control of abortion	Asafoetida with jaggery, powered *babul*, *trifala herd*, *bahera* and *amla*.
	Pre-delivery maternal care	Oedema in pregnancy	Eating 2-3 roasted edible dates on occurrence of oedema.
		Blemishes on face	Application of almond paste on face. Drinking milk with almond paste. Application of extract of marigold flower/leaves on face
		Pre delivery food	Eating hot vermicillies cooked in milk on the onset of labour pain. Drinking hot milk with homemade ghee.
	Post delivery maternal care	Control of excessive bleeding	Powder of *patha*, *sona geru* and *supari* 1/4th spoon with cold water for 3-4 times.
		Post delivery food	Homemade preparation of jaggery *Trachyspermum ammi* (ajwain) and ghee called *sandola* or *chuhana*. *Trachyspermum ammi* (ajwain) water. Almond milk. Glass of hot milk with 2-3 table spoons of
Health [31]			

Broad area	Sector	Sub-sector	Local knowledge
			homemade ghee.
			Viam panjiri prepared from fried wheat flour in homemade ghee and mixed with sugar, seeds of foxnut gum of palas tree, betel nut, gum acacia, almonds, *Trachyspermum ammi* (ajwain) and dry ginger.
	Lactation	Increasing milk secretion	Eating porridge of common cress.
			Drinking boiled milk with cumin seed.
	Care of new born	Care of premature baby	Keeping the baby in lap by wrapping him/her in cotton cloth or cotton.
	General health	Control of dandruf	Application of grinded beri and neem leaves.
			Application of camphor with oil.
		Growth and development	A table spoon of distilled liquids of *Trachyspermum ammi* (ajwain), mint daily to child.
	Minor ailments	Eye irritation	Applying garlic juice in the eyes.
		Swelling or redness of eyes	Washing of eyes with alum water
		Ear pain	Putting drop of garlic or onion juice.
			Putting drops of lukewarm mustard oil with fried neem leaves.
	Other ailments	Coughing	Sodium barborate with honey, roasted big cardamom with honey.
		Wound	Washing wound with garlic juice, use turmeric powder
	Medicinal plants	Stomach ache	*Akk, Haradh, Bahera*
Home science [31]	Storage of food	Non-perishable food(wheat, rice, pulse)	Storage in *bukhari* after moping it with neem leaves paste
			Room storage by air tightening the ventilators and windows with mud
			Placing turmeric buds in rice and applying turmeric powder.
			Aplying edible oil on the grains
			Placing dry neem leaves in pulses
			Rubbing ash on pulses
		Semi-perishable food(onion, garlic, potato &ginger)	Burning stem of onions, storage in hanging basket
			Keeping long stem of garlic, storage on protected ventilators.
			Storage of potatoes and ginger in sand by sprinkling cold water on it.
	Control of insects & pest	Insects (Ants, mosquitoes, lizards)	Sprinkling of turmeric or *suhaga*
			Fuming neem leaves with cotton sticks or cowdung cakes.
			Keeping of egg shells in different places, hanging garlic cloves.
		Pests	Keeping cot in the sun, washing them in boiling water.
Animal husbandry [31]	Feed for dairy animal	General feed	Soaked mustard cake, jaggery and salt.
			Green fodder with strained wheat husk
		Feed supplementation	Mixture consisting of wheat, mustard cake, taramira cake, halon, *metha*, fennal and *Trachyspermum ammi* (ajwain) as supplement to fodder.
	Treatment of dairy animal	Indigestion	Quath of *Trachyspermum ammi* (ajwain), jaggery, colocynth murraba or pickle with Pakistani salt.

Source: Kaur, PhD Thesis, 1999 [31]

6. CONCLUSION AND RECOMMENDATIONS

It can be concluded that traditional knowledge is vital for the well-being and for sustainable development as it has evolved after thousands of years of observation and experience. By linking the indigenous knowledge systems of the people with farmer, research and extension, the output of researches can be made more fertile and usable. ITK is a valuable asset to indigenous and local rural communities who depend on ITK for their livelihood as well as to manage and exploit their local ecosystem in sustainable manner. However, there is still a long distance to cover in scientific validation of Indigenous Agricultural knowledge. Farmers have wealth of knowledge, which eventually do not extinct but transfer from generation to generation on its own strength and influence. It is very important to concretize this experience into a system. Identifying, documenting and incorporating ITK in agricultural extension organization are essential to achieve agricultural development. ITK system provides a frame of reference for strengthening agricultural extension programmes. The participatory technologies that are developed through ITK integration will provide diversified technological options. Indigenous Traditional Knowledge being low in cost will also benefit national economy besides sustainable agricultural development.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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