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**REVIEW ARTICLE**

# ATTAINMENT OF AGRICULTURAL SUSTAINABILITY THROUGH INTEGRATION OF TRADITIONAL KNOWLEDGE OF FARMERS AND SCIENTIFIC KNOWLEDGE OF RESEARCHERS

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**ABSTRACT**

Nobel Peace Prize Laureate Amartya Sen has said "Development should be a process of expanding the real freedoms that people enjoy, in other words giving them the opportunities and choices that will enable them to take control of their own lives. So, it is not a case of talking about people or on their behalf; rather, the role of development policy is to help them articulate and assert their own interests and rights". Indigenous knowledge is considered as the social capital of the poor. It is their main asset to invest in the struggle for survival, to produce food, to provide for shelter and to achieve control of their own lives. ITK is the knowledge that people in a given community has developed over time and continues to develop it. It is based on experience, often tested over long period of time, adapted to local culture and environment, dynamic and changing and lay emphasis on minimizing risks rather than maximizing profits. Traditional knowledge is vital for sustainability of natural resources including forests, water, and agro-ecosystems across landscape. The practitioners of traditional knowledge tend to view people, animal, plants, and other elements of the universe as interconnected by a network of social relations and obligations. They have recognized that the wellbeing of human society is closely related to the wellbeing of natural ecosystems. Community knowledge includes scientific knowledge that is the basis of industrial development and traditional knowledge and both have separately contributed in their own way towards the process of development of mankind. Industrialized societies rely mainly on scientific knowledge whereas others are rich in traditional knowledge. A blend of modern and indigenous knowledge and practices will be imperative for environment friendly, need based, and location specific, technically sound, socially acceptable, economically viable and ecologically sustainable agricultural technologies. Hence, there is a need to plan and formulate strategies to integrate the indigenous traditional knowledge of farmers and the modern scientific knowledge of scientists from the research stations which will be effective in bringing out the aims of sustainability.



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## INTRODUCTION

Traditional knowledge is vital for sustainability of natural resources including forests, water, and agro-ecosystems across landscape. Indigenous It is an integral part of the culture and history of a local community. Traditional knowledge is empirical, acquired through practice and experience and is therefore related to cultural and physical resources of the location. The practitioners of traditional knowledge tend to view people, animal, plants, and other elements of the universe as interconnected by a network of social relations and obligations. They have recognized that the wellbeing of human society is closely related to the wellbeing of natural ecosystems. Indigenous traditional knowledge (or other co-terminous terms such as traditional knowledge, indigenous traditional knowledge, farmer's knowledge and local knowledge) generally refers to the long-standing information, wisdom, traditions and practices of certain indigenous peoples or local communities. In many cases, traditional knowledge has been orally passed for generations from person to person. Some forms of traditional knowledge are expressed through stories, legends, folklore, rituals, songs, art, and even laws. Other forms of traditional knowledge are often expressed through different means.

### Definition of ITK

There is no universally accepted definition of Indigenous Traditional Knowledge. Many authors have defined it in different ways.

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- Wang (1980) defined ITK as sum total knowledge and practices which are based on people's accumulative experiences in dealing with situations and problems in various aspects of life and such practices are special to a particular culture.
- As per IDRC (International Development Research Centre) Report, 1993" it is a complex concept that reflects on even more complex set of empirical, intellectual, social and spiritual factors that constitute human culture. It refers to the integrated expression of collective values and customs that guide interaction among peoples and between people and nature. Throughout the centuries, societies evolved by learning from experience and transmitting knowledge to younger generations.
- Indigenous Traditional Knowledge is the actual knowledge of a given population that reflects the experiences based on tradition and includes more recent experiences with modern technologies.(Haverkort, 1995)
- ITK 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. It is a dynamic system, ever charming, adopting and adjusting to the local situations and has close links with the culture, civilization and religious practices of the communities. (Pushpangadan *et al,* 2002)

**How Traditional Knowledge is different from the Scientific knowledge?**

One distinction that is often made between TK and modern or "western" knowledge is that unlike the latter, TK does not separate "secular" or "rational" knowledge from spiritual knowledge, intuitions, and wisdom. It is often embedded in a cosmology, and the distinction between "intangible" knowledge and physical things is often blurred. Indeed, holders of TK often claim that their knowledge cannot be divorced from the natural and cultural context within which it has arisen, including their traditional lands and resources, and their kinship and community relations. Traditional knowledge differs from modern knowledge in the manner of creation i.e. traditional knowledge is normally empirically validated therefore it is said that Modern Knowledge has been validated in laboratory of brick and mortar whereas traditional knowledge has been validated in the laboratory of life.

**Significance of Indigenous Traditional Knowledge (ITK)**

The realization that traditional knowledge has not become redundant in today's world is increasingly widespread. The Rio Declaration, the Convention on Biological Diversity, the documents coming out of the World Summit on Sustainable Development, and a whole host of other international instruments and forums have emphasized the current and future relevance of traditional knowledge. Institutions such as the World Intellectual Property Organization, the International Labour Organization, the Food and Agricultural Organization, the World Health Organization, UNESCO, UNEP, UNDP, the UN Commission on Human Rights, and a number of other international organizations have similarly given it importance.
Traditional knowledge provides the basis for many aspects of everyday life and occupation, like (i) agriculture and animal husbandry (ii) preparation, conservation and distribution of food (iii) hunting, fishing and gathering (iv) location, collection and storage of water (v) coping with disease and injury (vi) interpretation of weather and climatic phenomena (vii) making of clothes and tools (viii) construction and maintenance of shelter (ix) management of ecological relations of society and nature (x) study of land and sea (xi) adjustment to environmental and social change.

**Reasons for protecting Traditional Knowledge (Gupta, 2008):** There are number of reasons why there is need to protect the Indigenous Traditional Knowledge.

**1. To improve the livelihoods of ITK holders and communities**

ITK is a valuable asset to indigenous and local communities who depend on ITK for their livelihood as well as to manage and exploit their local ecosystem in sustainable manner. For example, local communities depend on indigenous crop varieties for sustainable agriculture and for selection of superior genotypes from these.

**2. To benefit national economy**

ITK has been recognized as a valuable input into modern industries such as pharmaceuticals, botanical medicines, cosmetics and toiletries, agriculture and biological pesticides. Most of industries look for the time tested traditional knowledge information for developing novel products having commercial acceptability. Hence, protecting ITK has the potential to improve the economy of many developing countries by greater commercial use of their biological wealth and increasing exports of ITK related products.

**3. To conserve the environment**

The traditional communities are intelligent and have made agriculture sustainable through their different agricultural practices. They create a balance between the environment and requirement.

**4. To prevent biopiracy**

Biopiracy refers either to the unauthorized extraction of biological resources and / or associated ITK or to the patenting, without compensation of spurious 'inventions' based on such knowledge or resources.

**Special features of Indigenous Traditional Knowledge (World Bank, 1998):** The special features of indigenous knowledge are:

- Local in that it is rooted in a particular community and situated within broader cultural traditions; it is a set of experiences generated by people living is those communities.
- Separating the technical from the non-technical, the rational from the non-rational could be problematic. Therefore, when transferred to other places, there is a potential risk of dislocating indigenous knowledge.
- Tacit knowledge and, therefore, not easily modifiable
- Transmitted orally, or through imitation and demonstration. Codifying it may lead to the loss of some of its properties.

- Experiential rather than theoretical knowledge. Experience and trial and error, tested in the rigorous laboratory of survival of local communities constantly reinforce indigenous knowledge.
- Learned through repetition, which is a defining characteristic of tradition even when new knowledge is added. Repetition aids is the retention and reinforcement of indigenous knowledge.
- Constantly changing, being produced as well as reproduced, discovered as well as lost; though it is often perceived by external observers as being somewhat static.

**Different aspects of ITK (Prusti, 2002; Girach, 2007):** Indigenous Traditional Knowledge system consists of an integrated body of knowledge system which tends to focus on different aspects like:

**1. Classification:** Local classification and quantification system of plants, animals, soil, water, air and weather.
**2. Agriculture:** Agricultural farming and crop system, land preparation, crop selection, propagation of plant, sowing, seedling preparation, plant protection method, harvesting, seed storage and processing.
**3. Human Health:** Nutrition, disease classification system, traditional medicines and herbal remedies in disease treatment, identification of medicinal plants, collection of useful parts or preparation of medicines, storing of medicines.
**4. Animal Care:** Animal breeding and production, traditional fodder and forage species and their specific use, animal disease classification and ethno-veterinary medicines.
**5. Soil Conservation:** Soil conservation practices, use of species for soil conservation and soil fertility, enhancement of practices.
**6. Water:** Traditional water management and water conservation system, traditional techniques for irrigation, use of specific species for water conservation, aquatic resource management.
**7. Agro-forestry:** Management of forest lands and trees, the knowledge and use of forest plants and animals and the inter relationship between trees, crops and soil.
**8. Plants:** As a source of wild food, building material, household tools, minor forest products, fuel wood and medicinal folklore system.
**9. Social networks:** Kinship ties and their effect on power relations, economic strategies and allocation of resources.
**10. World science:** Views of the universe and humanity's place with it, relationship between human and nature, myths, beliefs and customs.

**Sources of ITKs:** There are sources of ITK hidden in our village, communities and countryside. The main sources are (Satapathy *et al,* 2002):

1. Farmers
2. Community leaders
3. Elder persons
4. Folklore, song and poetry
5. Ancient records
6. NGOs
7. Extension agencies
8. Published materials of different languages

**Methods of ITK collection:** 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. Interaction with community leaders or elders
2. Rapid Rural Appraisal
3. Case study
4. Key Informant Method
5. History
6. Interview method
7. Participant/Field observation
8. Brain storming
9. Games
10. Group discussion
11. Surveys
12. SWOT Analysis

**Indigenous Traditional Knowledge (ITK) in Agriculture**

Normally, ITK is the knowledge that people in a given community has developed over time and continues to develop it. It is based on experience, often tested over long period of time, adapted to local culture and environment, dynamic and changing and lay emphasis on minimizing risks rather than maximizing profits. There have however, been a growing consensus now that some of the solutions to the problems that currently plague agricultural development must proceed from the role of understanding the dynamics within the local context and local capacities. Such dynamics include the roles of indigenous knowledge and practices in sustainable agricultural development. Agriculture is the most primitive occupation of the indigenous people. Though people have changed, the agriculture practices have remained unchanged among many groups of farmers because those practices are sustainable (Ghosh *et al*., 2010). Indigenous knowledge is a product of the adaptation of farming practices to the local environment, creating unique indigenous farming practices and food culture. For example, the indigenous knowledge of the people was very effective in meeting their food requirements, effective in areas of soil enrichment, land clearing, sowing, harvesting, weeding and mound/ridge making. Farmers adopt a wide range of indigenous agricultural practices based on generations of experience, informal experiments and intimate understanding of their environments. The application of indigenous agricultural farming for example has reflected in the following:

- Indigenous soil preparation and planting materials
- Indigenous methods of controlling pests and diseases
- Indigenous methods of maintaining soil fertility
- Indigenous methods of controlling weeds
- Indigenous methods of harvesting and storage

**Integration of Traditional Knowledge and Scientific knowledge**

Sustainable agriculture is the key to sustainable development especially for communities where agriculture is the mainstay of economy. In developing countries 70 per cent or more of the population lives in rural areas depending on agriculture for livelihood. In that context, agricultural development among smallholder farmers and landless people provides a livelihood for people allowing them the opportunity to stay in their communities. Agriculture affects the environment, human health, and even social order. Thus, any attempt to achieve sustainability must set as priority for the attainment of a more sustainable agriculture (Horrigan *et al.* 2002). Sustainable agriculture results from favorable interaction of social, economic and ecological factors. Traditional agriculture and modern agriculture differ in terms of technology and

ecological scale. The modern agriculture system aims at maximizing the production of marketable output and link between agro ecosystem and consumer is unidirectional whereas in traditional agriculture ecosystem, farm families are the major consumers and the link between agro ecosystem and consumer is bidirectional because agricultural and other wastes are recycled within the system. History shows that human societies that can protect their livelihood-based natural resources are able to sustain themselves. Some of the traditional ecosystems are ecologically sustainable such as Nile delta of Egypt which has sustained yield of wheat and barley for more than five millennia, but the productivity was lower than that of modern rice cropping system in that area. So even today we find several indigenous communities obtaining sustained and adequate income/returns from their agriculture because of sustainability inbuilt in it. Besides production of food, proper protection of the environments through indigenous knowledge and practices is always the inherent accompanying objective of agriculture in such communities. The introduction of modern scientific knowledge and practices through the application of chemical fertilizers, agrochemicals, machinery, and modern methods of irrigation in developing countries was a departure from traditional agriculture. Although, on one hand, the utilization of these modern scientific knowledge and practices has led to substantial growth in economy of the farmers, it has led to pollution, pesticides accumulation, poor water management, gene erosion, land degradation, etc on the other hand leading to the path of destruction. It is seen that quite often scientific methods and resulting approaches in specific communities or localities do not work. Several genetically engineered new varieties of rice seed have failed to give expected results in different localities or situations. Several biodiversity conservation methods have failed to give expected results because those types of strategies adopted were not compatible with the local system. Sometimes the process of change is not accepted by the people, so it cannot be sustained. The attainment of sustainable development calls for balanced interrelated policies aimed at economic growth, poverty reduction, human welfare and social equity amongst all nations and communities. Governments all over the world and other stakeholders have realized that it is not only necessary to respect varied cultures and traditions but also that the enrichment of diversity is in itself the path for overall sustainable development.

Traditional knowledge may indeed complement scientific knowledge by providing practical experience in living within ecosystems and responding to ecosystem change. And yet for many indigenous peoples and local communities it is not modern agriculture but traditional knowledge that has enabled them to cope with extreme weather and environmental change over centuries. In fact, modern agriculture, like hybrid seeds, has made them more vulnerable by increasing reliance on external resources. Many issues related to sustainable natural resources management and biodiversity conservation require the partnership between scientific and traditional knowledge.

Accordingly the two forms of knowledge should be combined, enhanced and harnessed and greater use of both scientific knowledge and technology and traditional knowledge and practices need attention (Pandey, 1998). Therefore, collective wisdom of humanity for development, embodied both in formal science as well as local systems of knowledge, is the key to pursue our progress towards sustainability.

**Strategies:** Keeping the potential constraints in conventional transfer of technology, a conceptual framework for incorporating indigenous knowledge systems into agricultural research and extension has been developed with the following salient features:

1. Strengthening the capacities of regional research and extension organizations;
2. Building upon local people's knowledge that is acquired through various processes such as farmer-to-farmer communication, and farmer experimentation;
3. Identifying the need for extension scientist/ social scientist in an interdisciplinary regional research team;
4. Formation of a sustainable technology development consortium to bring farmers, researchers, NGOs, and extension workers together well ahead of the process of technology development;
5. Generating technological options rather than fixed technical packages;
6. Understanding that it is impractical to depend entirely on research stations for innovations considering the inadequate human resource capacity of the regional research system.

## Conclusion

It is known that traditional knowledge is sustainable as it has evolved after thousands of years of observation and experience. This form of knowledge interlinks and establishes a holistic relationship between man and nature. It has supported life in a sustained way and continues to do so today. However, with globalization, this form of knowledge has been ignored completely and is gradually becoming extinct. Scientific knowledge has evolved over a period of a few hundred years and has its roots in traditional knowledge. The development process based on science and technology is no doubt faster but it has proved to be detrimental for our environment as is evident from the present dismal scenario of the global environment. Today greatest challenges which the world community is facing are the issues of socio –economic growth, poverty reduction, human welfare and development and the protection of the earth's resources, common and life support system. People, govt. and the scientific community all over the world have now realized the importance of sustainable developmental strategies. These groups have stressed the need for harnessing both scientific knowledge and technology in one hand, and traditional knowledge on the other hand to solve many issues related to sustainable natural resource management and biodiversity conservation. Thus, formulating policies for sustainable development will require a closer cooperation between scientists and the holders of traditional knowledge which include local people in general and indigenous people in particular. Now efforts are going on to collect local and indigenous knowledge with local problems and upgrading this knowledge for local use. This has resulted in the generation of employment and an overall elevation in the socio-economic status in selected areas. Various ITKs in agriculture, animal husbandry, fisheries and other and based activities have been in use since the human civilization by the farmers, animal owners and other practitioners. In spite of advancement in scientific knowledge in agriculture, ITK-based practices still remain in use by the vast majority of the farming community particularly in resource poor farming situations, without the knowledge of its scientific rationality. In this context, blending of indigenous knowledge with modern

scientific technologies is the need of the day to support sustainable development of agriculture and allied sector in our country.

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