

Indian Knowledge System as a Frame Work for Sustainable Food System

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ABSTRACT

Today the world is dealing with a lot of issues related to food. These problems include soil degradation, loss of biodiversity, climate change, malnutrition and unhealthy eating habits. The Indian Knowledge System is very important in this situation. The Indian Knowledge System refers to the Indian wisdom related to farming, food, environment, health and community life. Modern industrial agriculture has helped to increase food production. It has also created environmental and social challenges. The Indian Knowledge System can help us with these challenges because it has a lot of knowledge about farming and food. The Indian Knowledge System is about traditional Indian wisdom and it can teach us a lot, about how to live a healthy life and how to take care of the environment. This knowledge was formed over a long period of thousands of years. It helped the Indian societies to secure food and keep the environment safe. This was a time before new technologies were invented. The Indian societies were able to maintain food security and ecological balance because of this knowledge. This paper explains in detail how IKS offers a strong framework for sustainable food systems. It explores traditional farming methods, indigenous seeds, ancient water systems, food preservation techniques, Ayurvedic dietary practices and community-based food cultures. through many examples from different Indian regions, this paper shows that IKS is not only scientific but also practical for solving modern environmental and food-related issues.

Keywords: Indian Knowledge System, food systems, sustainability, agroecology, Ayurveda, traditional farming, biodiversity.

INTRODUCTION

The Indian Knowledge System (IKS) is a vast storehouse of traditional knowledge developed over the ages through observations and experiences. The IKS pertains to a large domain of knowledge sectors such as agriculture and soil science, water conservation techniques, seed conservation, native food habits, Ayurveda and nutrition, Community cooperative behavior and seasons and harvest festival traditions [1-8]

IKS is based on the ideology that there exists a deep connection between nature and humans [9]. This ideology has been expressed through the concept of “Annam Brahma” or “Food is divine” which describes the reverence that Indian culture has always held towards food and nature [10]. The holistic paradigm of IKS in terms of food and agriculture insists that there has to be an alignment with nature and that the interrelationships between food and health and their interlinkage with the environment should not be underestimated. The native communities can be considered as the primary or traditional environmental custodians by any standard. Traditional irrigation systems established by the native communities work in perfect sync with nature, facilitating effective water storagemanagement and recharging of groundwater. Such systems demonstrate the in-depth knowledge of native communities of the ecosystems surrounding them.[1]It is also important to use natural fertilizers that come from natural sources. This helps maintain soil fertility and its characteristics. The use of natural fertilizers prevents soil degradation and helps maintain soil microorganisms. It also helps maintain soil fertility.A number of modern scientists are attempting to link traditional knowledge recorded in ancient texts like Vrikshayurveda and CharakaSamhita with modern scientific principles in India. These texts contain the deeper understanding of plant sciences and ecology that reveal that traditional knowledge systems are not outdated but provide solutions to the current pressing issues of ecology[11].

In the Indian Knowledge System, agriculture has been treated as a process that has to function in accordance with the natural processes, not against them. The ancient farmers of India used to carefully follow the movements of the moon, changes in the seasons, effects of rainfall and types of soil before undertaking agricultural activities. Planting and harvesting used to occur in accordance with the lunar calendar as it was believed that the moon has the ability to affect the water content of the soil,seed germination and plant growth. The agricultural festivals such as

MakarSankranti are not merely cultural events but are also significant transistion points in terms of marking the entry of the sun into the Capricorn sign thus marking the beginning of the harvest season. The agricultural festivals used to help farmers coordinatetheir activities in accordance with natural processes, thus ensuring timely planting, harvesting and storage of agricultural produce at appropriate times.

Methodology

Research Design

This study uses a systematic review approach to understand how the Indian Knowledge System (IKS) contributes to sustainable food systems. This method was chosen because it allows for a clear, organized, and unbiased way of collecting and analyzing information from different sources. Since the topic covers multiple areas such as agriculture, environment, nutrition, and social practices, a systematic review helps bring all these perspectives together in a meaningful way.

Data Sources and Search Strategy

The study is based on secondary data collected from reliable and well-recognized sources. These include research articles, books, conference papers, government reports, and traditional Indian texts. A detailed search was carried out using important keywords related to the topic. Some of the main terms used include “Indian Knowledge System,” “traditional agriculture,” “sustainable food systems,” “agroecology,” and “Ayurveda and nutrition.” These keywords were used both individually and in combination to find the most relevant studies. This approach helped in covering a wide range of literature connected to the research topic.

Inclusion Criteria

To maintain the quality and relevance of the study, specific inclusion criteria were followed while selecting the literature. 1) Studies related to Indian traditional knowledge in agriculture and food systems 2) Peer-reviewed articles, books, and trusted reports 3) Studies that provide clear examples, case studies, or evidence 4) Publications available in English

Data Extraction and Thematic Analysis

After selecting the relevant studies, important information was carefully collected and organized into themes. The focus was on identifying common ideas and practices within IKS that support sustainable food systems. The major themes identified include indigenous seeds, natural farming, mixed cropping, water management, food preservation, Ayurvedic nutrition, and community-based practices. A qualitative approach was used to connect these themes and explain their importance in today's context.

Justification of the Systematic Review Approach

The systematic review method is suitable for this study because information related to IKS is spread across different fields and sources. This approach helps in bringing together all relevant knowledge in a structured way and reduces the chances of bias. It also helps in identifying gaps in existing research and provides a clearer understanding of how traditional knowledge supports modern sustainability goals.

Limitations of the Study

This study has some limitations. It mainly includes sources available in English, so some regional knowledge may not be covered. Also, the study is based on existing literature and does not include field-based or experimental data. Future research can address these gaps by including primary data and regional studies.

Indigenous Seed Diversity

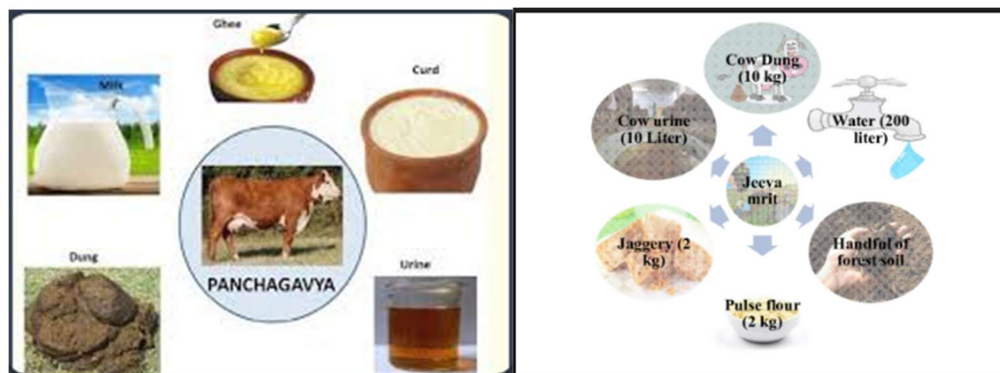
India has one of the richest traditions of indigenous seed diversity developed over centuries of keen observation and farmer-led selection. The farming communities in Odisha have preserved over 3,000 traditional rice varieties, many of which have special adaptations to drought, floods or saline conditions making them highly climate-stress-resilient.. In Tamil Nadu, the traditional red rice variety Kullakar is well known for its ability to grow in extremely dry and poor soils with minimum water and external inputs. Farmers in hilly regions of Uttarakhand'scultivate many local varieties of Rajma, each suited to specific altitudes, temperatures and soil types. In fact, these seeds are indigenously adapted to the local environment and therefore capable of surviving extreme climatic conditions unlike many hybrid seeds. Thus, they reduce dependence on

chemical fertilizers and pesticides and contribute toward nutritional and dietary diversity, strengthening sustainable and resilient food systems.[12]



Natural Farming and Seed Diversity

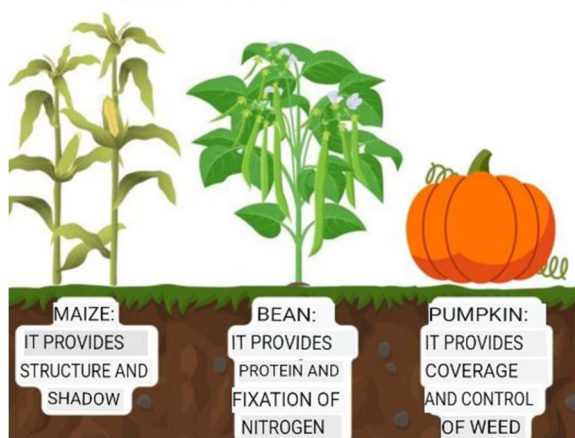
In the Indian Knowledge System, the health of the soil has always been given importance and organic or natural inputs, not chemical fertilizers, were used by traditional farmers. Cow dung, cow urine, and leaf composts are some of the natural ingredients used as soil enrichers. Preparations like Panchagavya, an organic mixture of the five products of cows, are known to increase plant growth and increase the plant's immune systems against diseases and pests. Similarly, Jeevamrit, an organic mixture of microorganisms prepared using cow dung, cow urine, jaggery, and pulse flour, increases the population of microorganisms present in the soil, positively effecting the structure of the soil and the availability of nutrients. Through the application of Jeevamrit, the microorganisms present in the soil increase, thereby improving the structure of the soil and the readily available nutrients of the soil. Recognizing the advantages of this natural process, many farmers in the states of Andhra Pradesh, Maharashtra, and Himachal Pradesh are adopting this natural process of farming, resulting in increased soil health, lower production costs, and sustainable agricultural production.[13]



Mixed Cropping and Polyculture

Generally, farmers did not grow plants of a single species, that is, monocropping, but rather followed a pattern of mixed cropping and polyculture, where a variety of plants were grown together and supported each other. A good example of this pattern is the “Three Sisters,” in which maize, beans, and pumpkins are grown together. Maize helps provide a natural scaffold for bean plants and serves as a climbing medium, while the bean plants, in turn, enrich the soil through nitrogen fixation from the atmosphere. On the other hand, pumpkins spread over the topsoil and prevent weeds from growing, ensuring that the topsoil retains ample moisture. Another common practice, that of growing millets, pulses, and oilseeds, helps increase the nourishment generated from a single plot, leading to higher yields of grain, protein, and healthy fats. Another example of polyculture that was common in states such as Karnataka and Rajasthan is the cultivation of millets, pulses, and oilseeds [14].

METHOD OF CULTIVATION "THE THREE SISTERS" OR "MILPA"



Traditional Water Management

Efficient and locally sophisticated water-harvesting systems existed in ancient India long before modern advances in water engineering. Johads were created in arid states like Rajasthan to conserve rainwater in small soil-and-earthen ponds, which not only conserved water but also maintained groundwater levels and ultimately irrigated land. In Rajasthan, there was an initiative in which over 300 johads were restored by local inhabitants of the Alwar District; this led to a

remarkable increase in water levels from 40 meters to 60 meters, and previously arid land became productive and fertile again [15].

More than 1,000 years ago, people in Tamil Nadu developed the *eri* (tank) system, a chain of connected water tanks that collected rainwater and distributed it across fields and villages. These tanks helped irrigate farmland and refill wells, ensuring that rural communities had enough water for farming and daily use. Even during harsh seasonal droughts, when the land would normally dry up, the *eri* system allowed villages to survive and remain productive [16].

The *Zabo* system, practiced in Nagaland, brings together forests, water storage, livestock, and agriculture into a well-integrated and balanced system. Rainwater is first collected from forested hilltops and then allowed to pass through natural vegetation, which acts as a filter before the water is used for irrigation [17]. This close link between natural resources and farming ensures efficient water use while protecting the environment. Such integrated practices clearly show that the Indian Knowledge System is based on practical scientific understanding and has remained sustainable over generations.



Food Processing and Preservation by Traditional Methods

The Indian Knowledge System comprises various traditional food processing and preservation methods that are energy-efficient, environmentally friendly, and nutritious. These processes were

developed to ensure the sustainability and availability of food throughout the year without any ill effects. Fermentation has remained a major component of traditional diets in India for many years. Preparations such as idlis and dosas are made from fermented batter, which not only makes them easily digestible but also enhances nutrient absorption. In Northeast India, gundruk, which consists of fermented leafy vegetables, has remained a major source of nutrients during off-season periods. Another example of a fermented food in India is kanji, which has been widely consumed in North India for many years due to its probiotic effects [18].

AYURVEDA AND NUTRITION

Seasonal Eating (Ritucharya)

Ayurveda provides comprehensive guidance on dietary practices by focusing not only on what to eat but also on when, how, and where to eat. Ayurvedic dietary principles align closely with the rhythms of nature and the environment. Ritucharya, an Ayurvedic practice, emphasizes the need to modify one's dietary habits with seasonal changes to ensure the balanced functioning of the body. During the winter season, when digestive power is strong and the body requires warmth, Ayurveda recommends consuming foods such as sesame seeds, jaggery, and ghee, which help warm the body. In contrast, during the summer season, when the body requires cooling foods to prevent dehydration and heat-related health problems, Ayurveda advises consuming foods such as buttermilk, tender coconut water, and other easily digestible items that help cool the body [19].

Region-Based Diet

Another important characteristic of Ayurvedic practice is *Deshachara*. It emphasizes the consumption of foods that are grown locally and are therefore suitable for the people of that region. Regionally grown foods are better adapted to the local environment and the lifestyle of the people who live there. Diets in coastal regions commonly include fish and coconut-based dishes, which are rich in healthy fats and protein and are well suited to hot and humid climates. People living in hilly regions often consume fermented foods as well as meals prepared from millets, as these foods are easily preserved and digested in cooler climates. In desert regions, staple foods such as bajra (pearl millet) and legumes are preferred because they thrive in dry environments and provide sustained energy. Eating according to *Deshachara* promotes sustainability, nutritional adequacy, and better adaptation to local climatic conditions [20].

Six-Taste Principle (Shad-Rasa)

According to Ayurveda, it is necessary that all six tastes be incorporated into every complete meal. These tastes are sweet, sour, salty, pungent, bitter, and astringent. Each taste has its own role in digestion. When foods representing all six tastes are consumed in moderation, they help maintain proper metabolism [21].



SOCIAL AND CULTURAL SYSTEMS FOR SUPPORTING SUSTAINABILITY

Community Cooperation

In the traditional Indian system, the sustainable use of natural resources was an outcome of collective efforts of the community. The Village Panchayats and the elderly jointly determined the dates of sowing the seeds, the distribution of water resources, and the conservation of forests. In other words, the mutual decision of the community helped avoid the misuse of natural resources and maintained a proper distribution of the resources [15, 22].

Women as Knowledge Keepers

Women have traditionally been the keepers of environment and nutrition knowledge. They have conserved seeds, used plants for medicine, preserved food, and been responsible for nutrition in their homes. For the region of Telangana, the role of women's seed festivals has been found to be essential in retaining over 30 species of millets [18, 23-24].

Local Markets and Food Culture

Traditional markets are an integral feature of food culture in India and serve to promote indigenous or low carbon food and consumers-cultivators direct interfaces. Traditional markets conducted on a weekly basis in Madhya Pradesh include sales of forest products like mahua,

amla, and bamboo shoots, that are nutritious and help sustain livelihoods and native species [24,25].

CASE STUDIES

Case Study 1: Sikkim – India's First Organic State

Sikkim became India's first fully organic state by prohibiting the use of chemical fertilizers and pesticides. As a result, the land and water sources of this region are now cleaner, and biodiversity is also higher due to greater ecological balance. In addition, farmers from Sikkim now enjoy higher farm revenues because of the higher price tags on their fully organic farm products. The Sikkim sets an example clearly that a profitable and sustainable agri-system can be achieved by harnessing government aid and indigenous ecological practices [26]

Case Study 2: Millet Revival in Karnataka and Odisha

Millets, which were regarded as low-value crops, are being promoted by government and NGO interventions in both Karnataka and Odisha states. Millets are drought-tolerant and need less water for irrigation; hence, they are highly nutritious. Millets are now being used in school meals and restaurants owing to their potential to promote sustainable agriculture and preserve biodiversity through crops [27]

Case Study 3: Andhra Pradesh Community Natural Farming (APCNF)

In the state of Andhra Pradesh, groundnuts are cultivated by more than 6 million farmers using agro-methodologies of natural farming and "Jeevamrit," which has had beneficial effects of lower production costs, an increase in carbon content in soils, healthier food, and lesser debt burden of farmers. The story of APCNF is an example of successful integration of indigenous knowledge systems with modern farming, thereby contributing toward increased economic and ecological sustainability [28]

Case Study -4 Kerala Homestead Gardening

In Kerala, homestead gardening is followed by families, and they grow bananas, coconuts, vegetables, medicinal plants, and spices around their residential area. Such a practice helps to provide food all year round, and also it increases the nutrient content of the families and helps to conserve biodiversity since various plant species can be maintained in a garden. "Homestead gardens provide a beautiful example of a sustainable, resilient, and self-reliant food system.

[29]

HOW IKS ALIGNS WITH CONTEMPORARY SUSTAINABILITY

AGENDA

The Indian Knowledge System (IKS) specifically helps realize a number of Sustainable Development Goals (SDGs) of the United Nations. IKS helps achieve SDG 2: Zero Hunger by encouraging diverse and nutritious food crops, SDG 13: Climate Action by adopting climate-resilient agriculture practices, SDG 15: Life on Land by preserving biodiversity and soil health, and finally SDG 12: Responsible Consumption and Production of food products through sustainable agriculture and minimum wastage of food products. Research studies have revealed that most of the practices of IKS align well with agro-ecology and regenerative agriculture practices.

POLICY IMPLICATIONS

For making the IKS-based food systems stronger, the government can do a number of things. These include encouraging organic and natural farming, developing a seed bank of indigenous varieties, and encouraging millets and other traditional crops. It is also essential to involve women's organizations in this initiative as they are the guardians of knowledge related to agriculture and cuisine. Incorporating the concept of IKS in the school and college curriculum can spread the knowledge of sustainable methods of farming in the coming generations as well.

CHALLENGES

Despite the strengths, it can be noted that IKS also experiences many challenges. There is a loss of traditional knowledge because of the death of older generations, the use of hybrid seeds is replacing traditional crops, and much of this knowledge is still unrecorded. Additionally, the migration of people from rural to urban centers means that few people are using traditional farming practices. All these challenges can be remedied through awareness and training activities, research, and policy interventions that help ensure that IKS also plays its part in making sustainable and resilient food systems.

CONCLUSION

The Indian Knowledge System provides simple, practical, and eco-friendly means of building sustainable food systems. Be it indigenous seeds, organic fertilizers, Ayurveda-based diets, or cooperation at the community level, IKS offers options which are sound from a scientific point of view and safe from the ecological perspective.

IKS, in addition, represents modern wisdom that can light up a path into the future in a world facing climate change and food habits that are not conducive to health. This revival and integration of IKS with modern science will give us resilient, healthy, and sustainable food systems for all.

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