



Indigenous Knowledge, Biotechnology and Environmental Sustainability: A Study on the Paraja tribe of Koraput District, Odisha

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Abstract: Indigenous Knowledge carries distinct connotations: local Knowledge, Traditional Knowledge, or knowledge developed by the community over long interaction with the particular environment. Indigenous knowledge is often passed down through people's memories. The indigenous knowledge remains in the society and is expressed in activities that reflect on the form of stories, folk songs, folklore, proverbs, dance, myths, cultural values, beliefs, rituals, community laws, local language, taxonomy, agricultural practices, managing equipment, materials, plant species, and animal breeds (Basu et al. 2009). It is primarily inherited from ancestors to descendants over generations, serving as the foundation for the utilisation and management of Natural Resources. It is a collective experience and knowledge of phenomena that remains with older generations. In fact, Indigenous or Traditional knowledge developed over prolonged interactions between people and their local environments. The basic format and intensive structure of the knowledge system remain with a few people, such as the Shaman (Gurumain of the Paraja Community), who disseminate it to others in a restricted manner.

Keywords: Indigenous-Knowledge, Bio-Technology, Folklore, Gurumain, Sustainability.

Introduction

In the year 1919, Károly Ereky used the word 'Bio-technology' for the first time to refer to 'the production of products' where the raw materials aid living organisms. The essential value of biotechnology lies in harnessing biotic systems, such as bacteria, yeast, and plants, to accomplish specific tasks or yield valuable products.

As we know, Biotechnology is a multidisciplinary field that integrates natural and engineering sciences to develop organisms and their parts into products and services. Recently, the field of biotechnology has grown, expanding the areas in which science is applied. The instances found nowhere are potentially more hazardous when the latest technology interacts with indigenous cultures. Moreover, Indigenous Knowledge is defined as ‘the knowledge developed by local people in a given environment due to close interaction between man and environment over generations through communal connection, kinship network, rituals, customs that manifest in the oral tradition of a social group. As a result, it helps for judicious management of the bio-cultural resources on which man’s daily sustenance is factually dependent. Empirical experiences of people have shaped the core context of Indigenous Knowledge (IK), which is embedded in local contexts. Indigenous knowledge within a particular community is passed down through generations, often through word of mouth and cultural rituals known as ‘oral tradition’. The basis of indigenous knowledge is revealed in many activities that have sustained societies and their environments for centuries. In the 1980s, Indigenous Knowledge (IK) gained worldwide recognition through events such as the ‘United Nations Conference on Environment and Education’. As per the United Nations Declaration on ‘Rights of Indigenous Peoples’, free, prior, and informed consent is to be obtained from indigenous peoples in matters that affect their rights, survival, and well-being.

The present piece of paper explores the role of biotechnology among practitioners who are also indigenous people of Odisha: ‘Paraja’, similarly with other indigenous peoples around the world, embrace special relationships with growing different organisms and the earth. Eventually, the influence of biotechnology on Paraja culture and beliefs, and the investigation of indigenous culture, are of significant interest to researchers and societies globally, as lessons may be relevant to the broader global community. The present objective of the study is to establish the role of biotechnology and the indigenous Paraja community of Odisha. The paper seeks to comprehend how biotechnology may fit into the Paraja life of Odisha.

Problem of the Study

Recently, researchers have been working to implement biotechnology, such as genetic engineering, and indigenous approaches to sustainable biodiversity management (Waiti & Hipkins, 2002). Both Waiti and Hipkins (2002) stated that, due to these encounters with Western scientific thought, it is now significant for all scientists to

consider Indigenous cultural values. However, there is little information available on cultural values and biotechnology from a scientific perspective across different Indigenous Communities of Odisha. The present study hunt to address the gap by determining the role of cultural and traditional rituals in the biotechnological concept. Barnhardt and Kawagley (1998) argued that innate knowledge systems remain fundamental and in practice among indigenous people, and further that there is a growing appreciation of the contributions that indigenous knowledge can make in areas such as medicine, resource management, biology, and human behaviour. From the issues highlighted above, I identify the major research prospects as follows: how does biotechnology fit into the Indigenous Paraja world, and is it possible to coexist without harming each other?

Objectives of the Study

The main objectives of the present piece of my work on Paraja are:

1. Understanding the value of the Paraja Indigenous Knowledge System.
2. Understanding the value of Biotechnology.
3. Protection and respect of Paraja Indigenous knowledge.
4. Analysis of the symbiotic relationship between Indigenous knowledge and Biotechnology.
5. Find the possibility of the simultaneous existence of both the Indigenous knowledge system and biotechnology.

Indigenous Knowledge, Bio-Technology and Environment

The study on Indigenous knowledge and its connection to Biotechnology and the environment is based on in-depth qualitative discussions using a Systematic sampling process. For this purpose, 26 men and 24 women were interviewed, of whom 10 were Gurumain (Shaman) practitioners. Here, I have taken age and experience as criteria. While the majority of interviewees were older, experienced members of their community. To understand the Paraja people and culture, this research systematically examined the Paraja socio-cultural life. The research study tried to establish Paraja's indigenous knowledge and procedures of its observations to ensure the validity of the cultural adaptation. Each Interview with Gurumain (Shaman) took roughly one hour and was recorded and later transcribed. It was sensed that the most viable gradient for the conversational study of the Paraja Shaman. Here,

they described many more facts on the modification of the seeds, plants, animals, etc. In this regard, M.H. Brown (1990) stated that gathering and interpreting narratives can serve as an opportunity to uncover values, and this should readily apply to the betterment of indigenous people. Many authors note that narratives are the fundamental organizing instrument through which humans perceive the world (Fisher, 1984; Ward, 1985), and thus are appropriate for understanding how Paraja Indigenous Cultural elements are perceived in biotechnology. Narratives have been credited with generous order and connotation to social structures (Bennett, 1978); signifying how people may act (Brown, 1990; Kirkwood, 1992; Kreps, 1990); and promoting specific actions (Meyer, 1997). Narrative studies have also helped illuminate individual behaviour (Tompkins & Cheney, 1983) and in emphasizing variations within a social structure (Mumby, 1987).

Paraja Indigenous Knowledge

As we know, the Dravidian community, the Paraja, lives in the Koraput district of Odisha and sustains itself by relying on the resources available to them. They observed every bit of natural resources and nature; they understood and analyzed their behaviour under different times and ecological conditions, and finally developed their own way of life in that specific geographical area. It is a fact that Indigenous knowledge is developed through profound observation and long interaction with nature, and it uses the community to address the problems they face in their day-to-day lives. Therefore, eminent scholars like Ellen and Harris in the year 2000, rightly considered the 'Indigenous knowledge' into the following eight types:

- (1) Indigenous or 'Local Knowledge' that is surrounded within a certain place.
- (2) It is 'orally transmitted'; passed on over recurrence, demonstration & imitation.
- (3) Indigenous Knowledge is an outcome of interactions in the everyday life of the community.
- (4) It has never found any systematized theoretical context.
- (5) It is superfluous to serve preservation.



- (6) It repetitively changes to cope with the situation. Group Shaman Collecting Medicinal Plants
- (7) The essence of knowledge disseminates through the community.
- (8) The knowledge is integrated holistically, both the biotic and Abiotic environments.

Indigenous Knowledge of Paraja and Nature

Indigenous people like 'Paraja' firmly believe that, among many other things, their connection to a sense of unity with the environment is an essential aspect of their distinctiveness, and defining who they are (Duri, 2004). This is demonstrated by their affiliation with land, forests, hills, waterways, and air. Subsequently, nature, in a broad, all-encompassing sense, is seen as 'sacred' to Paraja, and efforts to adapt these resources carry profound cultural implications. In this regard, an opinion of Deloria (1994) may be stated here that, "most of the tribes were very hesitant to renounce their homelands to the whites because they recognized that their lineages were spiritually linked to the land" (p. 172-173). This statement emphasizes the importance of natural resources and views them as joint and intergenerational.

Hence, the land is still imbued with strong meaning for Indigenous People (Jones & Hunters, 2004, p. 4), stating: "A mystical or Spiritual association of Paraja knowledge reflected in piety to land ownership." The Paraja Indigenous knowledge is allied with the boundaries of land, tribe, and self. It is coherent that the effect of land rivalry had on Paraja identity, as the distribution of land became equal to the disassociation of tribes from their ancestral roots. Eventually, the Loss of land up to 95% was equivalent to the psychological hostility from identity, like amnesia due to trauma. Tribal topographical features and significant markers, such as mountains and rivers, became a fundamental part of their identity (Walker, 1989). Paraja people maintained respectful and spiritual connections with the land (Category of Land) and the earth's natural resources, like hill (Dangar), forest (Ban), Land (Jami), and water resources (Jhala), and their identity was intimately associated with the location of tribal boundaries (Sandhi). This highlights the fundamental importance of land and nature on Paraja identity and ideology.

Table I: Classification of Land and its use

<i>Sl. No.</i>	<i>Types of Land in English</i>	<i>Types of land in Paraja</i>	<i>Use of Land</i>
1.	Lowland (wetland)	Atal jami/ Bada Jami	Long duration Paddy (bed adhan, Bhujni)
2.	Comparatively high Land to above	Dhip Jaami	Short-term Paddy (RI-36, Swarna, Mixed Crops like Millet, or Pea)
3.	Comparatively high land to above	Gada Jami/ Bata Jami	Ragi, Alsi, Upland Paddy, Millet, Dal
4.	Comparatively high land to above	Padar Jami	Ragi Alsi, Maize
5	Comparatively high land to above	Baad Jami	Pumpkin, Water Gourd, Ladies Fingures, Cow Pea, Beans etc.
Village: Habitation and construction of Houses			
6	Upland Approach to the hill and close to the village	Gada/ Bata Jami	Alsi, Mustard, Maize (jana), Kangu.
7	Hill Slopes (hill Land)	Dangar Jami	Some part for NTFP, collection, and some part for medicinal part, and some part for hill cultivation (Maize, pea etc.).

(Sources: Behera and Dash, 2017, pp 257)

The table above presents the Paraja classification of land and its uses. As shown in the table above, Paraja divided the land into seven categories, each with a specific purpose. Different types of seed cultivations are materialized as per their category.

Table 2: Agriculture Season and the time of Agricultural activities of one whole year

<i>Sl. No.</i>	<i>Name of the month in Pariji/Parji</i>	<i>English Name</i>	<i>Activities in Pariji</i>	<i>Agricultural activities</i>
1.	Baisakh	April-May	Dan Bunba	Sowing Paddy
2.	Landijeth	May-June	Dan/Mandia Ruha	Millet, Paddy Transplantation.
3.	Asadh	Jun-July	Nijeibar	Weeding
4.	Chait	March- April	Suan Bunba	Sowing of Suan
5	Diwali	Oct-Nov	Dan Kata	Harvesting (Pady)
6.	Pand	Nov-Dec.	Alsi Marba	Harvesting (Ragi)

(Behera & Dash: 2015, Pp, 258, N.B. Pariji is the language of Paraja tribe)

In Table II, it is clearly mentioned the agricultural season and the different activities of the Paraja, indicating that the time of sowing seeds and different activities undertaken by the Paraja for agriculture are very much season-friendly.

They select the seeds for the specific land that is unique and soil-friendly. According to the category of soil and water holding capacity of the soil, they select the seed for sowing. So, it helps them with better harvesting. They also know the protection of the agricultural field from different harmful insects and pests by using some leaves and roots of different medicinal plants, that collected from the jungle. Paraja also has adequate knowledge of the preservation of harvested food grains.

Table 3: Classification of Stones & its Use

<i>Sl. No.</i>	<i>Types of Stone</i>	<i>Use for the Purpose</i>
1.	Mugni Pakna	Use to cover the under-earth site of the newborn's placenta (Bamlikhal). Hundi (Place of village Deity). At Sadar (Khamsil; memorial stone at the village meeting place.
2.	Datkoli Pakna	Use for making the boundary of the house and the kitchen garden.
3.	Khanda Pakna	Use for the identification of the village Boundary
4.	Kala muguni Pakna	Use for the construction of a House.

Source: Behera & Dash, 2015/ Pp;266, Stone in Parji- 'Pakna'

In Table 3 above, the available stones around the village and hill that remain close by are divided according to their quality and use. So, as per Paraja's knowledge, stones around them have different qualities, and they use those stones accordingly. According to them, some stones are very strong and others are brittle or loosely intact. Some of them are used for ritual purposes, and others are used for household construction. So, they identify different stones and their quality for use.

Table 4: Paraja God and Goddess and their Abode place in their environment

<i>Sl. No.</i>	<i>Name of the Hill/ Forest</i>	<i>Abode Place of God/ Goddess</i>	<i>Activities</i>	<i>Accessible</i>	<i>Non-Accessible</i>
1.	Samna Dangar	Dangar Debta/ Ancestor	Cultivate millet, Maize, ladies-finger, Cow-pea, etc.	yes	-
2.	Bhitar Dangar	Bad Debta	Cultivate cow-pea, Maize, Banana, etc.	yes	-
3.	Bahiri Jungle	Ban Duma & Ancestor	Grazing of the Cow, Ritual for Ban Duma, Collection of Tuber, Firewood, Collection of different types of tubers, Plant fibers, Roots, wood for house construction, and agricultural implements.	yes	-

Sl. No.	Name of the Hill/ Forest	Abode Place of God/ Goddess	Activities	Accessible	Non-Accessible
4.	Bhitar Jungle	Bad debta/ Ban duma	Collection of the forest produces, Ritual hunting, availability of rarely medicinal plants, different types of fibers, and edible/ medicinal roots.	yes	-
5.	Kandapada	Maikanda/ Maichiali	Collect different types of edible wild roots, fruits, and tubers.	yes	-
6.	Duduma	Sata Bhauni (7 Sisters)	Collect Cane, Bamboo, and different plant medicines.	No	Yes
7.	Jhola	Kamini	Collect Medicinal roots, fruits, and tubers, etc.	No	Yes
8.	Podka Dangar	Bhima Debta	Hunting purpose, collection of timber for making a Plow and a Yoke.	No	Yes
9.	Kauli Dantgar	Bad debta	For Hunting, the collection of wood for household use, and agricultural implements.	No	yes

Sources: Behera and Dash: 2015; pp-268.

Table 4 describes the abode places of God and Goddesses. The specific place of the village is abode by the particular god or goddess. So, they never make any use of that area without conveying their prayer to that particular god or goddess. The part of the hill, forest, or forest land is proclaimed as a place of sacred and auspicious. Therefore, without any specific cause, they never collect any plants or parts of plants, they also never collect any fruits and roots from those places without sufficient reason. Paraja never hunts animals unnecessarily all around the year except ‘Chaitra festival” or “Chaitra Benta” (in April). So, in the Paraja indigenous knowledge system, there is a sense of environmental protection, which is fully reflected in their ritual and custom (Rousselau and Behera, 2003).

Indigenous Paraja and Science:

According to Durie (2004), neither ‘indigenous knowledge can be validated by science nor science can be evaluated according to the principles of local knowledge. Because each of them is made on distinctive procedures. Again, Durie (2004) said that science has at times been accused of bigotry towards other influences, particularly that indigenous knowledge cannot be assessed bestowing to a set of norms to



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assure validity. He presages that indigenous knowledge, however not attributing to scientific principles, still runs the risk of being streamlined according to these ethics, with the knowledge then becoming worthless as it is then out of its milieu. For instance, Paraja have often terminated science as an authentic knowledge base due to its inability to elucidate the spiritual phenomena (Durie, 2004), highlighting the probabilities with the way science and Paraja view on landscape. In this regard, Kawagley (1998) said that, if science was a development of European thought, it is wondered whether scientific bodies of knowledge have arisen in other cultures. Obviously, when seeking to explore on pattern of science with Paraja Culture, there are risks associated with explanation and faith. This observation elucidates the exceptional challenges that leading scientific explorers on biotechnology with reference to the culture of the Paraja of Odisha.

As per the description of Kawagley (1998), scientific propositions usually have their roots in observations and instincts around the normal world; henceforth, laboratory science arises as the true science, which diminishes the legitimacy of science that is consequential from realistic observation and intuition, therefore it lessens individuals' cultural principles which is traditionally operate in a particular geographical area. According to Snivley and Corso Gilia (2000), the skirmishes between Traditional or indigenous knowledge and Western science take place due to Western science being imparted at the cost of traditional indigenous knowledge. As a whole, Science was unlikely to have a single source of origin; eventually, it is more likely to have a plurality of origins and observations (Kawagley, 1998). Afterward,

the researcher proposed that it is naïve to confine the description to the science to 'laboratory science' only. Of late, Mason Durie (2004) analysed and criticized the conversation between science and indigenous knowledge; at that time, both sides undertook that one is more pertinent than the other. Such a diverged discussion does little more than provide additional foundation locations in defense rather than provide new visions. Nevertheless, these dealings are not mutually exclusive. As per Snively and Corso Gilia (2000), it is acknowledged that Aboriginal cultures have made complete noteworthy contributions to western science, and Fleer (1999) specified that the essentials of western science have presently been dragged into interrogations, which, on one occasion professed as framework-free and impartial, is nowadays attracting big questions.

Biotechnology

Presently, Biotechnology expands extensively and carries many wide-ranging definitions. According to Hobbelink (1991) 'biotechnology' is "any technique that utilizes living organisms to create, modify, or improve products, plants, and animals, or to develop micro-organisms for specific purposes". This definition of Hobbelink broadly describes, biotechnology encompasses practices that are as old as humankind. Local or Indigenous communities had been pollinating plants and hybridization faunas for centuries. The Indigenous communities around the world have used fermentation technology to prepare mauve, and other arrangements were practiced many years ago. Presently, biotechnology is more linked with contemporary knowledge, predominantly heritable alterations (GM).

Nowadays, this method for altering the genetic composition of cells and organisms can be used to alter or mix the characteristics or traits of a microorganism, plant, or animal. In the 1970s, biotechnology developed the Genetic Change (GMs) capability to transfer genetic material between life forms still has the potential to expand and complete the modification and development of the technology. Biotechnology is often eagerly associated with GM, the current education; this research takes biotechnology in a comprehensive form to mean a "variety of techniques for modifying life forms for various practical uses which encompasses, but is not limited to, GM" (Cook & Fairweather, 2005, p.1).

Here we got in to the point The Patterns Indigenous knowledge is the that is exclusive to a quantified culture or society, and this knowledge is inherited from one generation to the generation, usually by expression is related to cultural rites,

and has been the basis for agriculture, food preparation, health care, education, conservation and the wide range of other activities that withstand a society (Behera and Dash; 2017). Indigenous people have a vast knowledge of the ecosystems in which they live and of ways of using natural resources sustainably. Today, some suggest that there is a risk of this knowledge being lost and valuable knowledge within it about ways of living sustainably (Gough, 2005). This categorization of indigenous knowledge fits well with the Paraja of Koraput, Odisha, as do the fears for loss of knowledge.

Indigenous People and Biotechnology

According to Indigenous activist Tauli-Corpuz (2000), rather than one conclusive interpretation on biotechnology, indigenous people have articulated several divergent opinions about their position on biotechnology. All of them specified three different and opposing opinions towards biotechnology and indigenous cultures.

Developments of science and technology are unavoidable, and if so, then indigenous people should forge the best conceivable conventions to share profits consequent from the resources and make rules on admission which will make them equally beneficial.

Nothing is wrong with biotechnology, and so, indigenous people should not be opposed to it. The problem doesn't relate to the actual science or technology, but the question arises as to who has control over it.

Hostility towards the further development of biotechnology, with a strong protest against the manipulation of life forms in different ways.

As a whole, Tauli Tauli-Tauli-Tauli-Corpuz (2000) said that most indigenous people agree with this third statement. Although they are not alone in taking this opinion, they are often accused of being anti-progress, as we have seen in the Kandha community of Rayagada, the Paraja of Damanjodi, Odisha. Both Tauli-Corpuz (2000) again said that indigenous people have involvement beyond most Western people, for example, undergoing colonization, having their communal mobilized to allow for government seizure of lands and properties in the name of progress and advancement. Therefore, Tauli-Corpuz (2000) affirmed that indigenous people are now looking to find their rights to regulate over their bodies, territories, resources, knowledge, and cultures. So, it is clear that the association between biotechnology and indigenous people is a multifaceted one, and there is a need for investigation into how indigenous culture and biotechnology might be able to persuade each other.

Indigenous Culture and Biotechnology

Recently, Researchers working on Indigenous knowledge and the essence of science gathered diverse information on both topics with different methodology. The methods and values of both systems are being studied to gain a better understanding of Indigenous Culture, noting an increasing number of indigenous researchers who utilize the interface between science and indigenous knowledge as a source of inventiveness (Durie, 2004).

Again, he specified that scholars have to be accessible and empathetic to both systems, and often find the middle ground where both will be compatible with the other. This fact for research that moves from demonstrating the importance of one over the other, to recognizing prospects ascending out of uniting both (Durie, 2004). Cram, Phillips, Tipene-Matua, Parsons, and Taupo (2004) supposed that after careful attention to diverse actualities of Indigenous culture that Indigenous knowledge is not anti-science, but rather embracing of science in order to help them to fulfil their goals of the whole community. Moreover, nowadays scholars are involved not only in biotechnological study, but also at the cutting-edge of science and cultures.

Presently, Indigenous people of Odisha are suffering from land alienation, deforestation, obsolete of old seeds (Maize, Millet, Paddy, etc.), food processing, agricultural processes, etc. Paraja and other indigenous people of Odisha are involved in the continuing progression of land claims and normal customary rights to use their own ecological resources, and economic reimbursements due to loss of livelihood. It was firmly appropriate when it came to the genetically modified (GM) Food, animal husbandry issue; in this condition, they could probably bring claims for their rights and grumble against the Government if genetic modification contradicts the customary rights over flora and fauna (Table V), (Fletcher, 2005). Cram et al. (2004) quoted a key indigenous form of agriculture proposal given to the state government for application to the field test of a GM organism. The Communal elites are now aware that they are being taken for granted, that everything in their geographical niche is exclusive and in equilibrium. All biotic and abiotic elements of their environment possess 'Soul' (Atma) or a 'life force' and is to be appreciated, respected and worshiped, as we know every element is interrelated and interconnected, a defacement, alteration or unnatural defilement of any part affects directly or indirectly to the whole ecological system (Cram et al. 2004p. 15).

The biotechnology and the culture of Indigenous People familiarity are unrelated, hence, the general attitude towards acceptance faces constraints (Cook

& Fairweather, 2005). The present research tried to establish a sound link with ample evidence between post-materialist values and spiritual beliefs of the Paraja people of the Koraput district of Odisha. It is also further clarifying that ‘indigenous’ standpoints on biotechnology are not inevitably about anti-progress, but rather fundamental to a culture’s belief system.

Table 5: Paraja rejected some flora and fauna for rituals

Sl. No.	Category	Rejected for Rituals
	Faunas	Hybrid Fowl, Goat, Milk of hybrid Cow, Buffalo.
2.	Flora	Hybrid seeds, Paddy, Millet, Water gourd, Pumpkin, Beans, Cowpeas, Dal, etc. Hybrid flower, Fruits (Banana, Mango, etc.).
3.	Leaf	Hybrid Mango leaf.
4.	Water	Supply water (Pipe Water).
5	Products	Machine process Turmeric Powder, Machine process rice flour, Madia Flour. Machine Process Oil, etc. Processed Ghee, Machine-processed or imported Liquor,



The above table categorizes different hybrid flora and fauna, along with different items processed other than their traditional are rejected for use in the practice of religious ritual activities or worship purposes. In this regard, Paraja *Guumain* says that, “all the flora and Fauna made against the natural process and created through injection, hence it will not be accepted by God and Goddess of the Paraja.

In this study, the philosophy of attitudes of the Indigenous community has been minutely observed. The acceptance and rejection of certain things are very much upon their knowledge system, which is part and parcel of their life. According to Eagles and Chaiken (1998) form of attitude-built strength is an ‘inter-attitudinal’

asset that is highly linked to other attitudes and values, and that makes the boldness of resistance to change, as it is embedded in a broader sense of socio-religious value system. Clearly, to change Paraja perspectives towards biotechnology may be challenging unless the research is done in alignment with values towards nature, spiritual beliefs on Atma and Paramatma (life force).

Culture and Bio-technology

As I already discussed, Indigenous knowledge, also known as Traditional Knowledge or Traditional Ecological Knowledge, is a valuable resource for biotechnology and other fields of science. The Indigenous knowledge system comprises beliefs, practices, observations, and innovations passed down through generations. It is founded on a direct connection with the environment through long-term practices and cohabitation with it. The traditional knowledge systems of indigenous peoples are relevant today and can be helpful across a variety of fields in human life, including biotechnology, ecological management, and the biological world. The deep analysis of cultural themes and data contributed the following facts on the cultural link with biotechnology:

- 1. Sustainable development:** The central theme of the Indigenous knowledge system can support ample cultural elements for sustainable development, helping conserve and use biological diversity sustainably. Indigenous peoples like Paraja are often found in areas of Odisha with diverse genetic resources and topography. So, the knowledge of conservation biodiversity in their own way, based on Indigenous practices, leads to the sustainability of the environment and livelihood where they live. However, indigenous knowledge and community practices may be incorporated into the process of sustainable Development.
- 2. Protect Biodiversity:** Indigenous people Paraja developed the idea of ecological management in the name of sacred grooves, sacred tree, sacred place, place of spirits (Bhut Peret), Ancestor (Duma), God (Debta; Jan Bel) etc. it also helps to promote biodiversity at the local level in the form of religious and ritual practices and contribute towards maintenance of healthy ecosystems.
- 3. Exchange with science:** Indigenous knowledge is developed after long interaction with a particular geographical area. The indigenous community developed the knowledge by understanding every available natural resource, i.e., land, forest, stream (water resources), river, air, weather, etc., that can be exchanged with scientific knowledge to develop a balance between both the Indigenous

Knowledge system and biotechnology. This exchange can occur in areas such as wildlife biology, environmental management, and ecosystem management.

4. **New applications:** Indigenous knowledge can be applied to new settings by incorporating new data that may be somewhat different, as the landscape and topography. For example, indigenous people have developed modern applications of traditional knowledge by using new resources to produce traditional tools and crafts, such as machine and manufacturing techniques. Hence, traditional knowledge, when applied alongside modern science in a moderate form, may enhance environmental sustainability.

Indigenous people in India have used natural supplements and products like poultices, decoctions, skin creams, cough syrups, and herbal teas. Indigenous and ethnic people in India play a role in conserving biodiversity. Indigenous communities understand the nature of the natural resources and interact with them accordingly. Biotechnology can be used to address environmental issues, such as waste disposal and climate change. Biotechnology and India's biotech sector are sunrise sectors expected to contribute to the country's economy. India is a leader in biopharmaceuticals, bio-agriculture, and bio-industrial processes. In India, four ministries are working to regulate the ecological and environmental system: a) Ministry of Science and Technology, b) Ministry of Environment and Forests, c) Ministry of Chemicals and Fertilizers, and d) Ministry of Health and Family Welfare. India faces challenges in the biotechnology sector, including regulatory inefficiencies, political opposition, and the need to secure national interests.

Paraja Indigenous Knowledge and Science

The gap between indigenous knowledge, biotechnology, and environmental sustainability can be described as follows:

1. **Exclusion of Indigenous Knowledge:** At the time of the decision-making process and preparation for local advancement of Indigenous people, Indigenous knowledge is often overlooked, which is Environment Act approaches, also often bomb to include indigenous peoples in decision-making processes.
2. **Ignorance of Indigenous Knowledge:** The rights of Indigenous people are often not respected in climate action strategies, and it is ignored as local tribal archive knowledge.

3. Non-recognition: Indigenous knowledge is not well recognized, and a lack of recognition is consistently reflected in existing adaptation efforts.
4. Lack of incorporation: Non-Indigenous scientific research and management have only recently considered Indigenous knowledge. So, the Indigenous Knowledge is lagging of the incorporation into the knowledge system.

However, indigenous knowledge and technologies can be essential for human survival as well as environmental sustainability. As per the interaction with different people and analyzing different collected data, I came across the following points:

- (a) Local biodiversity: After long interaction between the community and with local environment, Indigenous peoples are often best able to deliver evidence on regional biodiversity and environmental change.
- (b) Systematic management leads to Conservation: Indigenous peoples are often at the forefront of conservation, because of their acquaintance with a particular environmental system, they prove themselves as good conservers of the environment.
- (c) Climate change: Indigenous knowledge and technologies can help to recognize the impacts of climate change and provide effective solutions for the environment.
- (d) Biocultural diversity and sustaining of Ecosystem: Indigenous peoples' ecological knowledge and ways of knowing are essential for sustaining the Earth's ecosystems.

Biotechnology can also contribute to ecological sustainability by reducing greenhouse gas releases and food left-over. For example, cover crops can provide sustainable biofuels, and fruits and vegetables can stay new extensive.

Challenges

Paraja Indigenous knowledge and science are somehow gone, with two parallel paths. It is a long way to alleviate the distance between the two. My studied tribe is not in a position of comfort that accepts and incorporates the knowledge in it; instead, they set up a matrix that outlines the biotechnology with their traditional knowledge in order to understand the intensity of the issue. Here, it is observed that they experience greater discomfort when the researcher discusses cross-species and cross-gene comparisons. As per the application of science to produce insulin human

gene was put into bacteria, which defines the cross-breeding or biodiversity made with putting artificial agency that never relates to the indigenous system of life of the Paraja. The manipulation of biodiversity is associated with the livelihood of the Paraja; rather, they abstract from nature with purely natural processes. At the end, the Paraja culture, their livelihood, and spiritual tradition are still supported for survival and continuity of life in that particular geographical area or environment. In the present world, Paraja also depends on science for immunisation, some medications, nutrition, etc., so they are not opposed to the development of science and have paved the way for modern science and technology. In general, it is also not possible, but it may take some middle path to incorporate both indigenous practices and clinical science.

Application of Bio-Technology and Genetic Engineering in Bio-diversity

The term 'Biotechnology' is self-explanatory, which refers to the technique that utilizes living organisms or parts of them to make modified products to improve the plants, animals that are developed for specific purposes (Hobbelink, 1991). If we deeply go through this opinion, we come to know that biotechnology is as old as humankind. Ancient people, or the Indigenous community, were domesticating and cross-pollinating plants. Crossbreeding and taming of wild animals were also practised by people around the world. Indigenous biotechnology has prevailed in society from time immemorial (surgical evidence from the Burzahum site). As part of the biotechnology process, tribal people used brewing technology (Philippine fermenting Techniques, wines, and other food preparations), and they also domesticated different animals and plants with this knowledge.

Traditional or Indigenous biotechnologies encompass fermentation; the preparation of Tappe (rice Beer) is unique among Igorot people in the Cordillera region of the Philippines. Basi is the brew prepared from sugarcane wine since time immemorial. Tappe is made with a native yeast called 'Bubod', which is made by the women. Basi, on the other hand, is prepared with some seeds called 'Gamu', which come from the forest. Another important alcoholic drink is 'Pendum' of Paraja, 'Handia, by Kolha, Munda, Santal, Ho community of Odisha, all of them prepared by them and apply flour of some herbal roots or fruits (Called 'Ranu' / 'Mulikia') for final preparation.

Now, Scientists are trying to collaborate with Indigenous Knowledge, as they can collaborate with indigenous communities, which helps to better understand their

knowledge and gain insights. Here we know that 'Biotechnology' is a field of science that uses natural as well as engineering sciences that create the products and services of organisms. Genetic engineering techniques have led to a key biotechnology that allows scientists to modify the genetic makeup of organisms.

Application of both Biotechnology and Indigenous Knowledge

The definition of health by the World Health Organization is: "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity". Indigenous people incorporate traditional medicine and healing practices with a list of plant and animal product-based therapies and spiritual practices as part of traditional medicine. It is observed from secondary sources that up to 80% of people in African and Asian countries rely on Indigenous medicines, which fulfil their basic need for health care practices. We found health care practitioners like herbalists and diviners in South Africa. Similarly, in Paraja society diviner is called 'Gurumain' (Shaman), and an Herbalist is 'Gunia) Use plants to prescribe remedies for ailments. Paraja Diviner communicates with ancestral spirits (through Gurumain Basiba) in order to establish health problems and ailments of the people. As per some secondary sources. Another important fact of Africa, traditional doctors rely on up to 4000 plants for remedies. Pygnum, a traditional medicine, has been used in Africa and elsewhere to treat early forms of cancer, for example.

With the advance of science and technology, the medicine and treatment process, i.e. The health care system for many diseases is constrained by high costs, so it is very difficult to manage by general people. Therefore, recently there has been a focus on ethnomedicine or old traditional medicinal practices systems, which depend on which societies survived for millions of years on Earth. The traditional communal medicine has always had healing properties that have been recognized over time and space. Of course, the traditional healing practices and administration of herbal medicinal ingredients are reflected in the cultural system and social practices. Because it can reach the grassroots at lower cost, it has been attempted to integrate it into the country's well-being and health care systems.

Invention of Modern Medicine and Bio-technology

Presently, the knowledge of biotechnology helps to a great extent to prepare modern medicines. New and updated drugs have been developed through extensive medical research, aided by technology. So, it is challenging to separate modern medicine

from biotechnology. Modern medical research is founded on and follows the scientific methods. Therefore, these processes of cures are founded on investigations whose results are reproducible. We will scrutinize five accomplishments of modern medicine and discuss the fundamental and ethical issues, such as:

1. Cloning Process
2. Process of Blood Transfusions
3. Immunity and vaccines
4. Antibiotics
5. Stem cell research

1. Cloning process: Cloning is the artificial production of an identical copy of DNA. It creates a genetically identical copy of an organism from whom DNA has been extracted. In this system, biotechnology is used to produce asexually different flora and fauna, such as plants, bacteria, and insects. It copied the genetic material, which is found in various types, such as: a) Gene Cloning, b) Reproductive Cloning, and 3) Therapeutic Cloning

Gene cloning: The process of cloning involves cloning small units or specific parts of DNA.

Reproductive cloning: the copying of whole animals or cells:

Therapeutic cloning: This type of cloning is used for therapeutic purposes; it produces stem cells for experiments aimed at replacing damaged, injured, or diseased tissues.

As we know, some plants produce similar plants to themselves, which may be called 'identical clones' of themselves in the natural process, as a gift of nature for millions of years. For example, in strawberry crops, which produce genetically identical progenies, the new plant is referred to as a clone. In grasses, potato crops, and onions, a similar process of cloning occurs. Either vegetative propagation or artificial cloning via tissue culture is used. Another process is 'Propagation'. It is which existing organisms that produce more offspring.

The 'Vegetative propagation' is one of the ancient forms of cloning plants. In this process, a leaf can be cut from a plant and grown into a new plant. It occurs due to the presence of a mass of unspecialized cells called 'Callus'. These callus cells divide, grow, and form numerous specialized cells, such as stem, roots, and eventually induce plant growth.

Recently, another important concept developed in Biotechnological science, which is well known as “Tissue culture”. Under this process, a piece of specialised roots is taken, the cells are isolated, and the cells are grown in a nutrient-rich culture. As per this technological application a specialized cells transformed into homogenous cells. Then the calluses get treated with chemicals, which trigger the growth of new plants, and all of them are identical to that exclusive plant. Cultivating new plants under this method is known as: ‘Tissue culture’.

Artificial way of cloning to Organism

The Artificial way of cloning technique is used to clone whole animals, such as sheep is referred to as reproductive cloning. In generative cloning, scientists remove a mature somatic cell from the organism for the cloning process. For reproductive purposes, no somatic cell of the body is used. In these circumstances, both sets of chromosomes (from the mother and father) are present. An example of a somatic cell is a skin cell. The nucleus is removed from the donor’s Somatic cell.

added → a donor’s Somatic cell and added → a recipient’ cell.

The nucleus of the egg cell is usually removed; as a result, only the cytoplasm remains in that denucleated cell. Therefore, the clone produced can then be transferred into a surrogate mother’s womb. In this regard, a surrogate organism acts as a substitute for another. In this case, the clone is transferred to a surrogate so that the embryo can develop.

2. Blood Transfusions & Immune System: Blood is one of the essential components of the human body, so blood transfusion very often saves the lives of people who have lost significant amounts of blood due to accidents and surgery. The blood type of every person doesn’t match that of others, which can be fatal. Before a transfusion, the blood has to be typed to match the recipient’s blood type. There are four major blood groups, such as A, B, AB, and O, found as per the presence of antigens in red blood cells. An antigen is a small particle that is recognized by the immune system. Blood recipients can only receive blood that is compatible with their own blood.

To determine adequate blood group compatibility, the Rhesus (Rh) factors of both donor and recipient are also determined through a specific process. The Rh factor is another type of antigen. It is found on the surface of the red blood cells. Nearly 85% of the population carries the ‘Rh’ protein and is Rhesus positive (Rh+), while the remaining 15% do not carry it on their red blood cells and are Rhesus

negative (Rh-). As a result, it is essential to ensure that the Blood group and Rh factor of both the recipient and the donor are compatible.

3. Immunity and vaccination: ‘Immunity’ refers to the protective power of the body that resists infection by different bacteria, Viruses, and pathogens. The immune system protects the body from infections; it also provides defence against a variety of mechanisms of infection through Chemical, physical, and cellular barriers. Physical barriers are parts of the body that create barriers, such as the skin, saliva, hairs in the lining of the respiratory tract (known as Cilia), tears, and mucus. Inflammation or swelling is included among the chemical barriers. It is a process by which the body protects itself through chemical responses, releasing chemicals to attack foreign invaders. White blood cells known as eosinophils are typically responsible for the allergic response. Another crucial immune system is the ‘Cellular’ mechanisms. It exists to fight bacterial infections. These include neutrophils, macrophages, which attack ‘pathogens’ and “engulf” them through a process called “phagocytosis.

The above-described defence mechanisms are part of the innate immune system. The physical body itself also has an adaptive immune system. It remembers each pathogen that invades the body based on the specific markers it carries. These markers are known as ‘antigens. When a foreign organism invades, the adaptive immune system mounts a particular response to the invading antigen, destroying the infectious agent.

Vaccination of the population is the most effective scientific method for eradicating infectious diseases. Earlier, it led to the eradication of smallpox worldwide and has dramatically reduced diseases such as measles, Tetanus, and polio. As per the Vaccination system, it involves injecting components that trigger an infectious agent in a non-toxic form, thereby inducing the individual’s adaptive immune system. An immune comeback is shaped against the vaccine, resulting in the production of T-lymphocyte memory cells. When a repeat infection occurs, the body can mount an effective, rapid immune response thanks to memory cells.

4. Bio-Technology Advances the Medicines: The development of Antibiotics is another example of a biotechnological advancement in medicine. Antibiotics are used to stop or inhibit the growth of certain disease-producing bacteria. These constituents were initially found in organisms such as fungi and can now be chemically manufactured. Antibiotics can be administered to patients intravenously as injections or in tablet, syrup, or suspension form.

Findings

Primarily, when I interacted with the Paraja people on the concerned topic, most of them could not get to the core points, but after the explanation, they answered almost all the questions I asked. Some of the interviewees shared their own views on biotechnology, and in some cases, they offered contrasting views. They are not prepared to accept the change brought about by the introduction of Genetic Modification in Biotechnology. It suggests that, in some instances, the way of fulfilling the requirements contradicts the god or goddesses' desire and the formation of the world; all of them opined that it may bring devastation to society, the environment, and the world (Machhpur Nasijiba). In this whole study, I found the complex relationship between biotechnology and indigenous knowledge. Some issues in this regard are given below:

1. **Protection of Traditional Knowledge:** Traditional knowledge and genetic resources are indispensable for the existence of human beings, but that knowledge is confronted with some legal difficulties for protection. Traditional knowledge is often passed down through generations and is considered communal property rather than private property (Behera & Dash, 2015).
2. **Vulnerable to Biopiracy:** As Traditional communities like the Paraja are unable to understand the concept of private property, they are vulnerable to biopiracy. They may also be ignorant of intellectual property rights (IPR) regimes and lack the resources to enforce them (Behera & Dash, 2017).
3. **Indigenous apprehensions:** Indigenous people may oppose biotechnology because they have experienced colonization and appropriation of their resources. They may also be concerned that new biotechnologies place greater emphasis on monetary benefits than on the rights of local and Indigenous people in a particular environment.
4. **Advantage of Biotechnology:** Biotechnology can increase the value of traditional knowledge and genetic resources. The Knowledge can also be used to develop new materials and processes for packaging, cosmetics, biofuels, and more. Biotech crops can also be more efficient than conventional crops, thereby lowering consumer prices.
5. **Non-Acceptance for Rituals:** Paraja never accepts the new and genetically modified Flora and Fauna for their observation of religious rituals.

Asundhari Paraja (Gurumain) said some interesting things in this regard that “Tui babu kahilus je Muin Jibar algeijibar bidua ke bujhilini hele magi aanla saag ke kaai bharsaa, petke nai, ki Mundke nai. “I agreed that biotechnology is helping people, but it is like borrowed knowledge. I don’t have any question on the invention of biotechnological acquaintances. Still, with the new process of creation or genetically modified organisms, I think it needs a tight mechanism to hold control over it” Again, he also said, it is somehow difficult to accept because of how, when and who is implementing it for the welfare of the people like the almighty.

Issues of Biotechnology

While biotechnology offers immense potential for good, its applications can also pose risks to human society, including ethical concerns, safety issues, and potential environmental harm.

1. Ethical Concerns

- (a) Genetic manipulation in humans and unexpected consequences: The possibility of genetic manipulation or altering human genes raises complex ethical questions about who decides what modifications are acceptable and what unintended consequences might arise.
- (b) Judged based on genetic makeup in Embryos: The ability to select specific traits in embryos could lead to a society where genetic diversity is diminished and where individuals are judged based on their genetic makeup.
- (c) Intellectual property and access: Patenting of genes and genetic technologies raises concerns about who controls access to these technologies and whether they are available to everyone who needs them.

2. Safety Concerns

- (a) Health risks of genetically modified Organisms: Some groups have raised concerns about the potential health risks of genetically modified organisms (GMOs), such as allergenic reactions or the development of antibiotic resistance.
- (b) Unexpected gene interactions may cause harm: Modifying the genetic makeup of organisms can lead to unpredictable and potentially harmful interactions between genes or with the environment.

- (c) Use as biological weapons or Bioterrorism: The potential for biotechnological tools to be used to create biological weapons or to spread diseases is a serious concern.

Suggestion to resolve the Issues

Nowadays, we are getting genetically modified vegetables, food grains, fruits, and animal products such as chicken, goat, sheep, Cow, and buffalo for food or various domestic and non-domestic uses. Few instances of a biochemical reaction are there. Still, people of the world are not confident enough about the foreseeable Contributions of biotechnology (Positive or Negative). As a result, many issues related to biotechnology arise daily. As we all know, the human population and culture have been developed and well maintained by our ancestors from time immemorial, using their own knowledge and technology without causing any harm to human society. Presently, man is searching for alternatives to clinical science and biotechnology for smooth maintenance of human society and survivability; the “Indigenous knowledge System” of the concerned society. In this regard, my present research may suggest as following:

- (a) Anthropological or Ethnographical research should be widely undertaken for identifying the different indigenous knowledge and its survival techniques.
- (b) Care should be taken for proper documentation of the same.
- (c) It should be carefully incorporated in planning and implementing different development projects to address the issues of human society.
- (d) ‘Indigenous knowledge’ is a long human experimental science of nature, causes little harm or easily repairable harm if any, and may be implemented hand in hand with biotechnology or clinical science.
- (e) Creating property rights for local knowledge and hereditary resources.
- (f) Developing a comprehensive legal framework to protect traditional knowledge and resources.
- (g) Build the capacity of local people to contribute to the decision-making process.
- (h) Government or public sector intervention is needed to respect and preserve the UN Declaration on the ‘Rights of Indigenous Peoples’.

Conclusion

This research paper sought to deeply explore the knowledge of the indigenous Paraja people of the Koraput district of Odisha. Here, Paraja's perceptions of biotechnology, in response to censors who argued that indigenous people like Paraja have fundamental opinions on the topic, were explored (Dash and Behera 2010). Here I found the characteristics of indigenous knowledge, which was practiced by Paraja knowingly or un-knowingly deeply understood bio-diversity (Ellen & Harris, 2000) and its maintenance, form of practice more or less equates with present day biotechnology and being influenced by everyday interactions, that constantly changing of nature and natural habitats both biotic and abiotic along with atmospheric condition holistically that sharing to their neighbour community. It was clear from the respondents that Indigenous knowledge is now more influenced by biotechnology is solely responsible for their poor health condition. We have minimal options in this changing world, which means that attitudes towards biotechnology were more tolerant and 'culturally changeable', if there were clear health benefits for Paraja. Hence, traditional values were not seen as 'immutable' and could respond to changes in society. Further, Paraja Shamans (Gurumain), who might be seen as 'guardians of Indigenous knowledge' (Abstracted Science of Nature), were also fully integrated in their Paraja communities and shared many aspects of different personal and communal activities.

These findings suggest that the perceived gaps between indigenous peoples and science, especially in biotechnology, might be more due to communication issues than to intrinsic, intractable differences. This is because the respondents in the present study reported that cultural attitudes towards biotechnology are more stable when the benefits are greater and more readily available to their people. Related to this, the lack of influence on financial benefits, Paraja showed little willingness to accept biotechnology despite cultural challenges. They also recognize the differences and obstacles to embracing biotechnology, which directly holds potential for health benefits, were not similarly evident in their cultural insights into it. Hence, understanding biotechnology from the perspective of Paraja cultural values is essential, as it may ensure that guardians of traditional indigenous knowledge, along with the intervention of biotechnology and the inclination of both, engage in a positive manner for human comfort and survivability.

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