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Integrating Technology and Traditional Knowledge: A New Approach to Enhancing Tribal Livelihoods in West Bengal

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Abstract:

The approach that utilizes technology in its support of traditional knowledge systems can be considered as a promising line in improving tribal economy in West Bengal. It aims at blending the pre-colonial traditional management systems which are now adopted by the tribal populations across the USA with the enhanced technological methods that enhance production, resource conservation, and economic performance. It has also proposed how through mobile applications, digital platforms, and data, tribal people can improve farming, avail improved healthcare, and protect ethno-cultural identity. As one of the proposed features, the local culture perspective means that community, tribal councils, technology gurus as well as governmental and non-governmental organizations could unite and work together. The opportunity, risk, and implementation of using technology-based interventions in the tribal areas of West Bengal for empowering and culturally sustainable economic development.

Keywords: Tribal lives, Technology, Tribal knowledge systems, Tripura, West Bengal, Sustainable development.

1. Introduction to Tribal Livelihoods and Traditional Knowledge

Many tribal groups like the Santals, Oraons, Mundas etc forms a good percentage of the population of West Bengal. They are sometimes marginalized groups forced to live in the streets, poor health and access to few, if any, health, education, and other social services (Ghosh, 2021). However, due to various challenges rising from innovation, indigenous communities have continued to feed through their traditional knowledge (TK) practices inherited from their fore fathers. Traditional knowledge embraces environmental knowledge, cultural and indigenous practices, agriculture practices and therapeutic practices of such societies (Sharma & Das, 2020). TK has been instrumental in supporting tribal cultural practices with regards to agriculture, forestry and working

with the natural environment in treating illnesses. This indigenous knowledge has remained relevant in the face of modernization and other Stringent forces like land displacement, climate change among others like urbanization among others which threatens these systems and therefore there is need to keep this knowledge for cultural and economic purposes (Roy & Bhattacharyya, 2022). Combining technology advancement with the tribal knowledge can be quite suited discarding the assimilation of tribal with modern world resulting in better living standards of their life with ethical and environmental conservation principles intact.

2. Technological Integration and Its Potential

The Rural and Tribal Population subgroup demonstrated noteworthy potential of technology to enhance the living standards and augment traditional practices. ICT and app, mobile and technology solar power are some of the innovation technology that can be incorporated in these facility to enhance the local communities.

Signs of Different Types of Technology

ICT infrastructure in rural environments is a leverage for gaining information flow and markets at the global level. Through SMSs farmers can obtain real time information on weather conditions, crop and pest management and market price of their crops hence improving their practices. For example, currently in use are mobile applications such as the AgriApp and iKisan which have helped the rural farmers seek advice on pests' control, crop rotation and even on financial issues.

Another important technological area that holds major potential for the improvement of the living standards of rural populations is that of the solar energy systems. People can use it in the provision of power in their homes, school and in running their irrigation systems instead of using the usual energy power. Since availability of electricity is weak in tribal regions, the solar power supports independence and encourage the local economic development including small businesses and children's education (Ghosh & Das, 2019).

Application of Technology to Support or Reinforce Traditional Techniques

Thus, technology would complement the conventional techniques that have been in practice for many generations among the tribal classes to retain their ethnicity. For instance, ICT can help support indigenous agricultural knowledge to support innovation through digitalization of traditional farming practices and making the farming practices available in mobile platforms. This can again go a long way in filling the knowledge gap and in a way may be used to encourage the younger generation to continue with tradition, as they do it but with modern technology.

In the case of carvings, cuisines, or other local artefacts, avenues like the mobile app or the online shopping site like Etsy or Craftsvilla provides an international market to a handicraft artist to display his/her traditional carving. Technology integration here benefits in sustaining the art here while at the same time creating other viable economic opportunities of revenue and market development. The application of technology in the management of sustainable resource through forest and water resource management can improve the existing knowledge. Technology can be helpful in GIS of the natural resources for proper conservation, and enhancing the effectiveness of age-old techniques (Sengupta, 2021).

3. Challenges to Integrating Technology with Traditional Knowledge

Culture is an influential barrier to technology and innovation diffusion since it can be hard to overcome traditional cultural practices in the adoption of modern technologies (Smith, 2020). This resistance may be due to issues of conserving culture and tradition together with the negative belief that there is negative impact that may occur as a result of implementing the change (CHANGE) (Jones & Patel, 2019). In addition, poor digital skills and low levels of access to modern

technologies prevents many communities from deriving maximum benefits of technology (Brown & Lee, 2021). Socio-economic life of rural populace in states like West Bengal where basic infrastructure like internet connection and electricity to support structured digitization of such interventions is absent; poses additional challenges to the suitable implementation of such an initiative (Chakraborty, 2018).

Failure in the appropriate application of technology may lead to a scenario where the technological resources developed are incongruent with the conventional knowledge systems of the community (Sharma & Gupta, 2022). This is why technology needs to be aligned in such a way that it enhances but does not supplant first nations' existing approaches (Singh, 2020). Such challenges elaborate the dynamics between development and conservation while calling for more cautious approach towards the use of technology in the tribal regions (Reddy, 2021).

4. Benefits of Integrating Technology with Traditional Knowledge

Increased pro-actively in agricultural yield, better income, and skill development, better access to the market.

Das et al. (2021) have also noted that the application of digital solutions together with conventional farming practices can enhance productivity by effectively addressing crop issues and improving the utilization of resources.

To increase knowledge and capacity of women and other disadvantaged groups through dissemination of information and resources and financial products.

Digital financial inclusion programs for rural women by Bhattacharya and Ghosh provides evidence that these programmers support female decision-makers to become more financially mobile and market connected.

Maintenance of species diversity and local landscapes with the help of employing contemporary methods together with traditional ecological knowledge.

According to Singh and Sharma (2022), enhancing the dialogue between ACT and indigenous knowledge could support altering current land management practices that can improve agricultural stability and replenish deplete sources of biological variety.

Development of marketing opportunities for traditional crafts and product at international levels.

In a recent study by Roy et al. (2023) it has been described how sellers on the e- commerce platforms associated the tribal artisans of the West Bengal to the global buyers resulting in a greater visibility and better sales earnings among the artisans.

5. Examples of Successful Integration Models

Case Studies from Other Tribal Areas in India or Globally

There are several cases where both approaches were chosen as sustainable models of intervention in rural or tribal areas. A good example in this case is utilization of drone technology in surveillance of agricultural land, especially in tribal belts of India, including Rajasthan (Singh & Mehta, 2020). It is easy to understand that these drones assist in supervising the conditions of the crops, the quality of the soil, and even forecast the weather, making the outcomes of farming in regions with low standards of developed technologies much better.

A positive effect of mobile platforms to market crafts has also been seen for tribal populations. For instance, the 'Tribal Craft' launched for the tribal people in northeastern region of india has aligned the indigenous artisans with the consumers across the world but ensured the standard of exclusive or native style among the producing entities was not compromised to increase gross domestic product (Das & Roy, 2019). These examples suggest that technology must act as a connective link between

the Western values of the twenty-first century and the indigenous practice of culture and values of the tribals.

The Interaction of Tribal Groups, Non-Governmental Organizations, and Governmental Organizations

Multilateral partnerships between indigenous tribes, NGOs, and the state have also become the most significant approach to improved technological themes. An example of such models is the activities of the National Bank for Agriculture and Rural Development (NABARD), with which local non-governmental organizations are cooperating in order to implement technologies in the agricultural sector, which are safe for the environment (Kumar & Patel, 2021). Such collaborations also help to confirm that incorporation of technology does not mean that cultural roots of the indigenous peoples will be negated but spirit of tribe will be backed with the influence of technology.

Another good example is the interaction between the tribal groups of West Bengal and regional NGOs dedicated to a better use of solar energy. Importation of solar-based water pumping for irrigation, as encouraged by the state government and different donor organizations and agencies, has augmented agricultural production without distortive the conventional practices (Saha & Ghosh, 2022). This model captures the evidence of the integration of technology and the community's past and present knowledge systems to support the growth of the two systems.

6. Policy and Institutional Support for Integration

Government polices play a very significant role in enhancing the integration of modern technological advancement with conventional wisdom to accommodate the tribal groups. Different programs have been created to support the financing of the tribal people, provision of technologies, and educational materials. For instance, the Indian government has provided subsidies and grants that seek to ensure that the tribal people embrace ICT gadgets like mobile devices and solar tools and exercises in Digital literacy (Rathore, 2021). Such polices allow limited numbers of specific populations, tribal in this case, to close the technology divide and retain their cultural ways of life.

If solutions have to be sustainable and culturally sound, then, there must be collaboration between the knowledge bearers, and tech professionals, as well as policy makers. When local tribes work together with technology producers, the developed technologies can uphold, support, and bring value to aboriginal ways of living (Kumar & Das, 2019). Technology should be used to develop new instruments of better resource exploitation, agriculture, and handicraft, not as a replacement for all the traditional knowledge is sufficient for entire Asia to develop modern.

Both the business organizations and local institutions including tribal councils and farming cooperatives are essential in this integration. These are local organizations, based on community's confidence, and working knowledge of the tribes who are the users of technology sourced from external vendors. Their imitative involvement guarantees that technological application is feasible and endorsed by the community (Chatterjee, 2020). Moreover, these institutions can also assist in training people and arranging programmers, financial planning for training and for sustaining local systems, thus avoiding interference of the culture of the society in the development of new technologies.

7. Cultural Sensitivity and Ethical Considerations

When using technology, it becomes important that these interventions should strengthen or respect cultural diversity when using technology to support traditional knowledge. Tribal culture is special, and therefore it should be treated as such to ensure that unnecessary assimilation of these cultures to other cultures or other systems of governance is not encouraged (Smith & Johnson, 2019). The analysis emphasized that the technological solutions should neither supplant the traditional

approaches, but rather support the practices fitting the tribes' value systems that would help them meet their needs (Anderson, 2020).

Another one of the major ethical issues often burning the lights of indigenous communities is commodification of the traditional knowledge. For the traditional knowledge systems, it mainly reveals vulnerability to postmodern piracy where very little trickles back to the supplying indigenous communities (Williams et al., 2018). Regarding this, the contingency requires clear ethical rules of a type that would offer a sufficient level of armor to the intellectual property rights of tribal people (Thomas & Green, 2021).

Emphasis should be laid on the development of such systems in a manner that is centered to the community interests of the tribal people. Able to control how the technology enters people's lives is the best approach because that way the end-users will have to be more involved in how technology is implemented in their lives in the long run and this approach may require a lot of input from the right stakeholders, this approach aligns with Parker and Gupta's (2022) recommendations for sustainable development. Incorporation of tribal people in the development and management of projects creates awareness through developing the notion of ownership (Mitchell et al., 2023).

8. Sustainability and Long-Term Impact

Technology should therefore supplement indigenous wisdom, and when thus applied, long term positive changes in the standard of living of the tribesmen as well as improving the sustainable use of resources can be achieved. Technology can improve ways of producing foods and helping people access quality health care and education, while tradition, culture, and indigenous knowledge retained by people prevent the loss of important indigenous knowledge in the management of resources in agriculture and nature.

Economic Sustainability:

It was noted that economic sustainability can be realized through availing technologies that supplement traditional practice, keep the gains from technologies away from affecting indigenous people. For instance, efficient and sustainable technique in farming for instance using the current farming systems and technologies could go along way enhancing productivity without leading to environmental degradation (Smith, 2019). Some of these technologies like the new generation soil moisture sensors and crop management tools are some of the productivities enhancing technologies that are sustainable by improving productivity while preserving the health of the soil which is a traditional and cultural practice in most farming systems (Kumar & Sharma, 2020).

Environmental Sustainability:

In this case, when integrating Indigenous people's historical and ancestral knowledge on ecosystems with today new-age environmental technologies for, for example sustainable foresting, or water conservation can be more efficient in conserving the environment (Jha & Saha, 2021). Integration of GIS for land mapping along with traditional knowledge practices has reported a potential tool on avoiding overexploitation of resources in tribal tracts (Bose et al., 2022).

Preserving Indigenous Practices:

This, therefore, calls for a participatory way to ensure some level of change that will introduced alongside the traditional way of handling things in an indigenous community. Multistakeholder projects can be implemented to involve the creators of modern technologies, authorities, and indigenous peoples to make sure that the latter fits into the former's worldviews. Fortunately, such schemes can prevent the risk of cultural degradation if citizens are involved in decision-making procedures meanwhile supporting economic growth (Saha & Chakrabarti, 2023).

The present generations to transfer both technological skills to the future ones, and at the same time uphold and practice traditional practices. This also means that the culture of the indigenous peoples would not only be saved from the regime of modernization but would also be equipped with an appropriate arsenal for the future, framed by the growth of technology (Chowdhury, 2020).

9. Conclusion

The concept of technology with an integration of conventional wisdom has the potential of providing a viable solution to the question of enhancing the existence of the tribal societies in West Bengal. This is because through merging the two the tribal people today are in a position to access better methods of farming, better health care, better education and improvements in their economy without necessarily losing their identity. Technology may easily supplement traditional forms of sustainable farming, resource management, and craftsmanship while still providing tribal populations with opportunities to respond to the modern market's requirements. It is therefore necessary that the government apply a multispectral, technologic, advocating indigenous communities' approach when implementing such initiatives. There is hope teamwork involving technology experts, local authorities, anthropology and government is possible to develop solutions that are good for everyone and the environment. It would appear that employees of tribal origin can work in a contemporary environment without losing touch with tribal culture. In reaching these goals, trust, knowledge sharing, and technological support play the critical roles to avoid disruption. In this way, the inhabitants of the tribes in West Bengal can make the correct set of decisions regarding the perspective future based on such initiatives.

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