

ROLE OF AI AND BIG DATA IN ENHANCING ACCESS TO TRADITIONAL KNOWLEDGE SYSTEMS

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Abstract :

Traditional Knowledge Systems (TKS) encompass Indigenous, local, and community-based knowledge developed over centuries. These systems include medicinal practices, ecological wisdom, agricultural techniques, and oral traditions that are critical for cultural preservation, biodiversity conservation, and sustainable development. However, much of this knowledge remains undocumented, fragmented, or inaccessible. The integration of Artificial Intelligence (AI) and Big Data technologies presents new opportunities to digitize, preserve, analyze, and democratize access to TKS. This paper explores the role of AI and Big Data in enhancing access to TKS, examines key initiatives and case studies, and discusses the ethical, legal, and cultural implications of these technologies. By analyzing real-world examples, such as India's Traditional Knowledge Digital Library (TKDL) and the use of AI in endangered language preservation, the paper underscores how technological innovation, when guided by inclusive and ethical frameworks, can revitalize traditional wisdom and empower knowledge holders.

Introduction :

Traditional Knowledge Systems (TKS) refer to the holistic and intergenerational knowledge accumulated by Indigenous peoples and local communities. This includes knowledge about medicinal plants, traditional healing practices, farming techniques, environmental management, rituals, and language. Despite its significance, TKS is often under-documented, orally transmitted, and threatened by globalization, cultural erosion, and environmental changes.

The advent of Artificial Intelligence (AI) and Big Data offers a transformative opportunity to document, analyze, and share TKS more effectively. These technologies can help bridge gaps between traditional and modern systems by making knowledge more searchable, interpretable, and accessible.

Defining Key Concepts :

- **Artificial Intelligence (AI) :** Refers to the simulation of human intelligence in

machines capable of learning, reasoning, and problem-solving (Russell & Norvig, 2021).

- **Big Data** : Extremely large datasets that can be analyzed computationally to reveal patterns, trends, and associations (Mayer-Schönberger & Cukier, 2013).
- **Traditional Knowledge Systems (TKS)** : Indigenous and local knowledge that is culturally embedded, dynamic, and holistic in nature (Battiste, 2002).

Applications of AI and Big Data in Accessing TKS :

1. Digitization and Archiving :

AI-powered Optical Character Recognition (OCR), Natural Language Processing (NLP), and image enhancement tools are used to digitize ancient manuscripts, palm leaf texts, and audio-visual records.

Case Example : The *Asiatic Society of India*, in collaboration with IITs, has used AI to restore and transcribe ancient manuscripts using hyperspectral imaging and ML algorithms (Times of India, 2025).

2. Indigenous Language Preservation :

AI-driven NLP tools can translate and transcribe endangered languages, enabling the recording of oral histories, chants, and traditional narratives.

Case Example : A research team developed a multimodal indigenous recipe dataset from India, using AI to transcribe and translate endangered languages for cultural preservation (Upadhyay et al., 2024).

3. Knowledge Discovery and Integration :

Big Data analytics allow integration of traditional ecological indicators with scientific datasets to inform climate models, biodiversity monitoring, and agricultural practices.

Case Example : In biodiversity conservation, AI models are being used to integrate Indigenous ecological knowledge with satellite data for habitat management (Patil & Joshi, 2023).

4. AI Chatbots and Interfaces :

Conversational AI systems can act as digital knowledge carriers, offering users an interactive way to access traditional medicinal or agricultural knowledge.

5. Legal Protection and Intellectual Property :

Big Data tools help document prior art and prevent the biopiracy of Indigenous

formulations by making TKS searchable and verifiable.

Case Example : India's *Traditional Knowledge Digital Library (TKDL)* uses AI to classify and codify traditional medical knowledge, preventing unethical patent claims (CSIR, 2023).

Challenges and Ethical Considerations :

- **Data Sovereignty :** Ensuring that Indigenous communities retain control over how their knowledge is used.
- **Consent and Access :** The use of AI must be preceded by Free, Prior, and Informed Consent (FPIC) from knowledge holders.
- **Misrepresentation and Bias :** AI models may misinterpret cultural nuances if not trained on context-specific data.
- **Technological Gaps :** Infrastructure, digital literacy, and resource limitations can hinder implementation in rural or marginalized regions.

Policy and Governance Implications :

Governments and institutions must:

- Support **community-led digitization efforts**.
- Develop **ethical AI frameworks** respecting Indigenous rights (aligned with UNDRIP).
- Invest in **language and cultural AI tools** for underrepresented groups.
- Establish **data governance models** ensuring equity and accountability.

Conclusion :

AI and Big Data technologies offer powerful tools to preserve and enhance access to Traditional Knowledge Systems. When implemented ethically and inclusively, they can ensure intergenerational transmission, empower Indigenous communities, and foster cross-cultural learning. However, success depends on prioritizing consent, equity, and long-term sustainability. As we move toward digital futures, traditional wisdom must not be left behind—but carried forward through responsible innovation.

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