

From Attappady to TKDL: Digitising Tribal Agricultural Knowledge and the Politics of Agrarian Recognition in Kerala

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Abstract - This article examines the digitisation of tribal agricultural knowledge in Attappady, Kerala, through the institutional lens of India's Traditional Knowledge Digital Library (TKDL). While TKDL was established primarily as a defensive mechanism against biopiracy, its engagement with indigenous farming systems remains limited. Drawing on secondary sources and existing empirical insights from millet cultivation in Attappady, the study situates tribal agriculture within broader debates on agrarian political economy, food sovereignty, and epistemic justice. The paper argues that indigenous agricultural knowledge is not merely a cultural artefact but a contested socio-political resource shaped by historical marginalisation, state-led development, and intellectual property regimes. Through a conceptual-case study approach, the article analyses millet-based livelihoods, seed practices, and community institutions to demonstrate how digitisation initiatives risk reproducing extractive knowledge relations unless grounded in participatory governance. It further explores the potential integration of TKDL with geographical indication frameworks in Kerala as a pathway to strengthen rural livelihoods while cautioning against the commodification of indigenous heritage. The findings highlight the need to reimagine TKDL beyond patent protection toward a rights-based platform that recognises community ownership, supports food sovereignty, and advances agrarian justice. By foregrounding Attappady as a critical site of knowledge production, the paper contributes to agrarian studies by linking indigenous epistemologies with contemporary debates on digital governance and rural transformation.

Keywords: Indigenous knowledge; tribal agriculture; TKDL; agrarian political economy; food sovereignty; geographical indications.

I. INTRODUCTION

Across the Global South, indigenous agricultural knowledge systems are increasingly recognised as critical resources for addressing intertwined crises of climate change, food insecurity, and rural

marginalisation. Traditional farming practices, seed management systems, and ecological knowledge developed over centuries have demonstrated remarkable resilience in fragile agro-ecological contexts. Yet this knowledge systems remain structurally undervalued within dominant development paradigms and intellectual property regimes that privilege formal scientific expertise and market-oriented innovation. In India, this tension is exemplified by the emergence of the Traditional Knowledge Digital Library (TKDL), a state-led initiative designed to document traditional knowledge and prevent its misappropriation through international patent systems. While TKDL represents a significant intervention in global intellectual property governance, its engagement with indigenous agricultural knowledge—particularly that of tribal communities—remains limited and uneven.

The digitisation of traditional knowledge raises fundamental questions about ownership, recognition, and power. Indigenous farming practices are not merely technical methods of production; they are embedded within social relations, cultural identities, and political histories shaped by colonial dispossession and postcolonial development policies. As scholars of agrarian political economy have long argued, rural livelihoods are constituted through complex interactions between land, labour, capital, and state institutions. Knowledge itself functions as a productive force within these relations, shaping access to resources, markets, and policy recognition. Yet efforts to digitise indigenous knowledge often abstract practices from their social contexts, transforming living traditions into data points that circulate within bureaucratic and commercial systems.

This article examines these dynamics through a conceptual–case study analysis of tribal agricultural knowledge in Attappady, Kerala, and its relationship to India’s TKDL framework. Attappady, a tribal-dominated region located in the Palakkad district of Kerala, has historically sustained diverse millet-based farming systems rooted in indigenous ecological knowledge. Communities such as the Irulas, Mudugas, and Kurumbas developed agricultural practices adapted to rainfed conditions, fragile soils, and forested landscapes. These systems prioritised mixed cropping, seed preservation, organic inputs, and collective labour arrangements, ensuring food security and ecological sustainability over generations. However, post-independence agrarian policies, market integration, and welfare-oriented food distribution programmes gradually displaced these practices, contributing to nutritional decline, livelihood insecurity, and cultural erosion.

Recent policy interest in millets framed through discourses of climate resilience and nutrition security has renewed attention to Attappady’s agricultural heritage. State-led initiatives such as the Millet Village Programme have sought to revive millet cultivation through institutional support, procurement schemes, and women-led processing enterprises. At the same time, India’s TKDL has emerged as a prominent mechanism for documenting traditional knowledge, primarily focusing on codified medical systems such as Ayurveda, Unani, Siddha, and Yoga. While TKDL has successfully challenged numerous international patent claims, its orientation remains largely defensive and pharmacological, offering limited pathways for incorporating community-based agricultural knowledge or addressing rural livelihood concerns.

This paper argues that the marginalisation of tribal agricultural knowledge within TKDL reflects deeper structural biases in knowledge governance. Digital archives tend to privilege codified, text-based traditions over orally transmitted and practice-based systems. Moreover, the institutional architecture of TKDL is geared toward protecting national intellectual assets rather than recognising community ownership or supporting agrarian development. As a result, indigenous farmers are positioned primarily as knowledge informants rather than rights-bearing actors within digitisation processes. This raises critical questions about epistemic justice: whose knowledge is preserved,

who controls its circulation, and who benefits from its formal recognition?

Drawing on agrarian political economy and food sovereignty scholarship, this study conceptualises indigenous agricultural knowledge as a contested terrain shaped by historical dispossession and contemporary development interventions. Food sovereignty perspectives emphasise the rights of communities to define their own food systems, control productive resources, and sustain culturally appropriate agricultural practices. From this standpoint, digitisation initiatives that fail to embed community consent and benefit-sharing risk reproducing extractive relationships, even when framed as protective measures. The transformation of traditional knowledge into digital repositories may inadvertently facilitate commodification, enabling external actors to appropriate value while local communities remain marginalised.

The article further explores the potential role of geographical indications (GI) as a complementary governance mechanism capable of linking traditional knowledge with territorial identity and market recognition. Kerala hosts several GI-tagged agricultural products, including Navara rice, Palakkadan Matta rice, and Wayanad Robusta coffee. These cases illustrate how place-based certification can enhance product visibility and rural incomes, albeit unevenly. Integrating TKDL documentation with GI frameworks could, in principle, strengthen indigenous food systems by formalising collective knowledge while anchoring value within local economies. However, without participatory governance structures, GI processes themselves risk reinforcing elite capture and bureaucratic control.

Methodologically, the paper adopts a qualitative conceptual–case study approach, drawing on secondary literature, policy documents, programme reports, and existing empirical insights from Attappady’s millet revival initiatives. Rather than treating Attappady as a bounded locality, the analysis situates it within broader national and global debates on intellectual property, digital governance, and agrarian transformation. This approach enables an examination of how local knowledge practices intersect with state institutions and international regulatory regimes.

The central contribution of this article lies in reframing TKDL from a technical database into a

site of agrarian governance. By foregrounding tribal agriculture, the study challenges dominant narratives that restrict traditional knowledge to medicinal systems and highlights the political stakes of digitising food practices. It argues for a reorientation of TKDL toward a rights-based framework that recognises community ownership, supports food sovereignty, and integrates livelihood objectives. Such a shift would require participatory documentation processes, benefit-sharing mechanisms, and institutional coordination between agriculture, tribal welfare, and intellectual property agencies.

By bringing together indigenous epistemologies, agrarian political economy, and digital governance, this paper advances critical debates within peasant studies on the role of knowledge in rural transformation. Attappady emerges not merely as a site of marginality but as a locus of alternative agrarian futures, where indigenous practices offer valuable insights for sustainable development. At a time when global policy discourse increasingly invokes traditional knowledge as a resource for resilience, this study underscores the importance of addressing the power relations embedded in its digitisation.

The article proceeds as follows. The next section reviews relevant literature on indigenous knowledge, agrarian political economy, and digital governance. Section three outlines the conceptual framework and methodology. Section four examines Attappady's tribal agricultural systems and recent millet revival initiatives. Section five analyses TKDL and its relationship to geographical indication regimes in Kerala. The discussion section reflects on implications for agrarian justice and knowledge sovereignty, followed by concluding remarks on policy pathways for inclusive digitisation.

II. LITERATURE REVIEW

Indigenous Knowledge, Agrarian Political Economy, and Digital Governance

Scholarly engagement with indigenous knowledge systems has expanded significantly over the past three decades, particularly within development studies, agrarian political economy, and environmental governance. Early contributions challenged the dominance of Western scientific epistemologies, arguing that local and indigenous

knowledge represents adaptive, context-specific forms of understanding shaped through long-term interaction with ecological environments. These systems encompass agricultural practices, seed management, biodiversity conservation, and social institutions that collectively sustain rural livelihoods. However, critical scholarship has emphasised that indigenous knowledge cannot be romanticised as static or inherently sustainable; rather, it is produced within historically contingent power relations shaped by colonialism, capitalism, and state-led development.

Within agrarian studies, knowledge is increasingly recognised as a central terrain of struggle. Bernstein's framework of agrarian political economy foregrounds the interrelations between land, labour, capital, and the state, while subsequent scholarship has extended this analysis to include epistemic dimensions. Control over knowledge production and validation influences access to resources, policy recognition, and market integration. Indigenous farming practices are often rendered invisible or inferior within formal agricultural research systems, which prioritise high-yield varieties, chemical inputs, and standardised production models. This marginalisation has contributed to the erosion of diverse agroecological systems, particularly in rainfed and tribal regions.

Postcolonial scholars have further highlighted how colonial epistemologies institutionalised hierarchies between scientific and traditional knowledge. Colonial agricultural policies systematically displaced indigenous cropping systems in favour of export-oriented plantations and monocultures, while post-independence development programmes extended these logics through Green Revolution technologies. The privileging of rice and wheat within India's food policy architecture exemplifies this trajectory, reshaping dietary patterns and undermining millet-based food systems across marginal landscapes. Tribal regions such as Attappady experienced these transformations acutely, as subsidised food distribution and market integration weakened subsistence farming and seed sovereignty.

Recent literature on food sovereignty offers a normative and analytical framework for understanding these processes. Originating from peasant movements such as La Via Campesina, food sovereignty asserts the rights of communities to define their own food systems, prioritise local

production, and protect indigenous knowledge. Scholars argue that food sovereignty challenges neoliberal agricultural models by re-centering smallholders, women, and indigenous peoples as political subjects rather than passive beneficiaries. In this perspective, traditional agricultural knowledge constitutes a collective commons, embedded within social relations and cultural identities. Efforts to document or commercialise such knowledge must therefore confront questions of ownership, consent, and benefit-sharing.

Parallel debates have emerged around the commodification of biodiversity and traditional knowledge under global intellectual property regimes. The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) intensified concerns about biopiracy, whereby corporations appropriate genetic resources and associated knowledge without recognition or compensation to source communities. In response, countries such as India developed defensive mechanisms to establish prior art and prevent illegitimate patents. The Traditional Knowledge Digital Library represents one of the most prominent such initiatives, translating Sanskrit, Arabic, Persian, and regional texts into patent-compatible formats accessible to international examiners.

While TKDL has been widely celebrated for successfully challenging numerous patent claims, critical assessments point to its narrow conceptualisation of traditional knowledge. The database largely focuses on codified medical systems, reflecting state priorities around pharmaceutical protection and national heritage. Agricultural knowledge—particularly that transmitted orally within indigenous communities—remains peripheral. Scholars argue that this bias mirrors broader tendencies to privilege textualised traditions over practice-based epistemologies. Moreover, TKDL's institutional design positions the state as custodian of traditional knowledge, with limited mechanisms for community participation or ownership.

This raises fundamental questions about epistemic justice. Fricker's concept of epistemic injustice highlights how marginalised groups are systematically excluded from knowledge production and validation processes. Applied to agrarian contexts, tribal farmers often experience both testimonial injustice, whereby their knowledge is dismissed, and hermeneutical injustice, whereby

dominant frameworks fail to interpret their experiences adequately. Digitisation initiatives that extract knowledge without addressing these asymmetries risk reproducing colonial patterns of appropriation, even when framed as protective interventions.

Digital governance literature further complicates these dynamics by examining how data infrastructures reshape power relations. Digital archives transform situated practices into abstracted information, enabling circulation across institutional and commercial networks. While proponents argue that digitisation enhances preservation and accessibility, critics warn of "digital enclosure," whereby communal knowledge is subsumed within bureaucratic systems that prioritise state and corporate interests. In agricultural contexts, digitisation often aligns with broader processes of datafication, precision farming, and platform capitalism, raising concerns about surveillance and dispossession.

Geographical indications offer an alternative, though contested, model for protecting traditional knowledge and rural livelihoods. GI frameworks link product quality to territorial identity, theoretically enabling collective ownership and value retention within producing regions. Empirical studies, however, reveal uneven outcomes. While some GI products have achieved market premiums and institutional recognition, others have been captured by intermediaries or elite producers, marginalising smallholders. In India, GI registration has expanded rapidly, yet integration with broader rural development strategies remains limited. Scholars emphasise that GI success depends on strong producer organisations, transparent governance, and supportive state policies.

Kerala presents a distinctive context for examining these issues. The state's history of land reforms, decentralised governance, and social development has shaped unique agrarian trajectories. Tribal regions such as Attappady, however, continue to experience high levels of vulnerability, marked by land alienation, malnutrition, and livelihood precarity. Recent millet revival initiatives highlight both the potential and limitations of state-led interventions. While programmes have enhanced visibility and created new institutional spaces for women's participation, structural constraints related to market access, labour availability, and ecological uncertainty persist.

Existing scholarship on Attappady has documented nutritional crises, ecological degradation, and the erosion of indigenous livelihoods, yet few studies have situated these challenges within debates on digital knowledge governance. Similarly, TKDL-focused research rarely engages with agrarian political economy or rural development, treating traditional knowledge primarily as an intellectual property concern. This disciplinary fragmentation obscures the interconnected nature of knowledge, livelihoods, and power.

This article addresses this gap by bringing tribal agriculture into dialogue with TKDL and GI frameworks. By foregrounding millet cultivation in Attappady, it highlights how indigenous knowledge operates within contemporary agrarian transitions shaped by state policies and market forces. The analysis moves beyond celebratory accounts of digitisation to interrogate its distributive consequences, asking who benefits from knowledge formalisation and under what conditions. In doing so, the paper contributes to peasant studies by conceptualising traditional knowledge as a site of agrarian struggle, embedded within broader processes of rural transformation.

III. CONCEPTUAL FRAMEWORK AND METHODOLOGY

This study adopts a conceptual–case study approach to examine the digitisation of tribal agricultural knowledge in Attappady within the broader institutional framework of India’s Traditional Knowledge Digital Library (TKDL). Rather than treating traditional knowledge as a technical or cultural artefact, the analysis situates it within agrarian political economy, foregrounding its entanglement with power, property relations, and state governance. The conceptual framework draws on three interrelated strands of scholarship: agrarian political economy, food sovereignty, and epistemic justice.

From an agrarian political economy perspective, indigenous agricultural knowledge is understood as embedded within material relations of land, labour, and livelihoods. Building on Bernstein’s analytical framework, the study views knowledge as a productive force that shapes access to resources, markets, and institutional recognition. In tribal regions such as Attappady, farming practices cannot be separated from historical processes of land alienation, forest governance, and development

interventions. The decline of millet-based agriculture is therefore interpreted not merely as a technical transition but as an outcome of structural transformations driven by state policies and market integration.

Food sovereignty provides a normative lens for assessing these transformations. Unlike food security approaches that prioritise availability and access, food sovereignty emphasises community control over food systems, seed autonomy, and culturally appropriate production practices. This perspective foregrounds indigenous farmers as political subjects whose knowledge constitutes a collective common. Digitisation initiatives that abstract traditional practices into databases risk undermining this commons unless they are accompanied by mechanisms that ensure community consent, ownership, and benefit-sharing. The framework thus enables a critical evaluation of TKDL beyond its role in patent defence, examining its implications for rural livelihoods and agrarian autonomy.

The concept of epistemic justice further informs the analysis by highlighting how certain forms of knowledge are privileged within institutional systems while others are marginalised. Tribal agricultural knowledge, transmitted primarily through oral traditions and embodied practices, often lacks legitimacy within bureaucratic and scientific frameworks that prioritise codified texts. TKDL’s emphasis on classical medical manuscripts reflects this bias, privileging textualised traditions over living agrarian systems. By applying an epistemic justice lens, the study interrogates how digitisation processes reproduce or challenge hierarchies of knowledge, asking whose epistemologies are recognised and whose remain invisible.

Methodologically, the paper employs qualitative analysis based on secondary data sources. These include peer-reviewed academic literature on indigenous knowledge, agrarian change, and intellectual property; government policy documents related to TKDL, tribal development, and millet promotion; programme implementation reports from Kerala; and existing empirical studies on Attappady’s agricultural systems. Media reports and publications by civil society organisations are also consulted to capture evolving debates around millet revival and tribal livelihoods. Content analysis is used to synthesise insights across these materials,

identifying recurring themes related to knowledge governance, institutional interventions, and livelihood outcomes.

The choice of a secondary-data-based approach reflects both practical constraints and analytical objectives. While primary fieldwork can provide granular insights into household-level dynamics, the present study seeks to situate Attappady within broader national and global frameworks of knowledge governance. By triangulating multiple sources, the analysis captures the structural dimensions of digitisation and intellectual property that shape local agricultural practices. Existing empirical findings from Attappady's millet initiatives are integrated to ground the conceptual discussion in lived realities, particularly with respect to seed systems, women's participation, and market constraints.

Attappady is treated as a critical case rather than a representative one. Its history of tribal agriculture, coupled with recent state-led millet revival programmes, offers a valuable lens through which to examine the promises and contradictions of digitising indigenous knowledge. The region's ecological fragility, socio-economic marginalisation, and policy visibility render it a strategic site for exploring how traditional knowledge is mobilised within development discourse. Rather than presenting a comprehensive ethnography, the case study highlights key processes and tensions that illuminate broader patterns relevant to agrarian studies.

The analysis also engages with geographical indication frameworks as a complementary governance mechanism. GI documentation in Kerala provides insight into how traditional knowledge is formalised and commodified through legal instruments. By comparing TKDL's database-oriented approach with GI's territorially grounded model, the study examines alternative pathways for recognising indigenous knowledge and supporting rural livelihoods. This comparative dimension underscores the importance of institutional design in shaping outcomes for smallholder and tribal producers.

Ethical considerations are central to this framework. The paper does not claim to speak on behalf of indigenous communities but seeks to critically examine the institutional structures that mediate their knowledge. It acknowledges the risks of

extractive scholarship and emphasises the need for participatory approaches in any future documentation efforts. While relying on secondary sources limits direct engagement with community perspectives, the study draws on published accounts that foreground tribal voices and experiences wherever possible.

The conceptual-case study methodology enables an integrative analysis that bridges micro-level practices and macro-level governance. By linking Attappady's millet cultivation to TKDL and GI regimes, the paper reveals how indigenous knowledge circulates across scales—from local farms to national databases and global patent systems. This multiscale perspective is essential for understanding the political economy of digitisation and its implications for agrarian justice.

In adopting this approach, the study contributes to ongoing debates within peasant studies on rural transformation, knowledge sovereignty, and the role of the state in shaping agrarian futures. It positions traditional agricultural knowledge not as a relic of the past but as a dynamic resource whose digitisation carries profound consequences for community autonomy and development trajectories.

IV. TRIBAL AGRICULTURE AND MILLET REVIVAL IN ATTAPPADY: A CASE STUDY

Attappady, located in the eastern part of Palakkad district in Kerala, represents one of South India's most ecologically fragile and socio-economically marginalised tribal regions. Situated along the Western Ghats, the landscape is characterised by undulating terrain, thin soils, and high dependence on monsoon rainfall. Indigenous communities including the Irulas, Mudugas, and Kurumbas have historically inhabited this region, developing farming systems closely attuned to local ecological conditions. For generations, subsistence agriculture formed the backbone of tribal livelihoods, with millets occupying a central role in food security, cultural identity, and social organisation.

Traditional agricultural practices in Attappady were based on mixed cropping systems that combined finger millet (ragi), little millet, foxtail millet, barnyard millet, sorghum, pulses, and minor tubers. These systems prioritised biodiversity, risk diversification, and low external inputs. Seed preservation was embedded within household and community institutions, with women playing a

central role in selecting, storing, and exchanging seed varieties. Cultivation methods relied on organic inputs, manual labour, and collective work arrangements, reflecting a socio-ecological ethic that emphasised reciprocity between humans and nature.

These indigenous farming systems ensured dietary diversity and resilience in an environment prone to climatic variability. Millets, with their low water requirements and adaptability to poor soils, were particularly well suited to Attappady's rainfed conditions. Beyond their agronomic value, millets carried cultural significance, featuring prominently in rituals, festivals, and everyday meals. Food production was thus inseparable from social life, reinforcing communal bonds and intergenerational knowledge transmission.

However, the post-independence period marked a decisive shift in Attappady's agrarian trajectory. State-led development interventions, forest regulations, and land alienation gradually undermined traditional livelihoods. Large-scale in-migration of non-tribal settlers altered land ownership patterns, while restrictions on forest access curtailed supplementary sources of food and income. The expansion of wage labour and market dependence further eroded subsistence farming. Simultaneously, India's food policy architecture prioritised rice and wheat through public procurement and subsidised distribution, displacing millets from household consumption.

The introduction of the Public Distribution System played a pivotal role in reshaping dietary practices. While providing caloric security, subsidised rice reduced incentives for millet cultivation and weakened seed sovereignty. Over time, traditional cropping systems gave way to fragmented land use, monoculture experiments, and increased reliance on purchased food. These transformations contributed to declining nutritional outcomes, culminating in recurring reports of malnutrition and child mortality in Attappady during the early 2010s. Scholars and activists have argued that these crises reflect not merely food scarcity but the disintegration of indigenous food systems.

In response to growing public concern, the Kerala government initiated targeted interventions aimed at revitalising tribal agriculture. Among these, the Millet Village Programme emerged as a flagship initiative designed to reintroduce millets through

institutional support, input subsidies, and extension services. The programme sought to combine indigenous practices with technical assistance, promoting millet cultivation as a strategy for nutritional improvement and livelihood enhancement. Women's self-help groups, particularly those affiliated with Kudumbashree, were mobilised to undertake processing, value addition, and marketing activities.

These interventions generated mixed outcomes. On the one hand, millet revival contributed to increased dietary diversity and renewed interest in traditional crops. Women-led collectives began producing millet flour, ready-to-cook mixes, and other value-added products, creating supplementary income streams and enhancing women's agency within household economies. Community seed banks were established in select villages, facilitating the preservation and exchange of local varieties. Public awareness campaigns and school nutrition programmes further elevated the visibility of millets as "nutri-cereals," aligning local initiatives with national policy narratives.

On the other hand, structural constraints limited the sustainability of these gains. Agricultural production in Attappady remains highly vulnerable to climatic variability, with erratic rainfall disrupting sowing cycles and reducing yields. Labour shortages pose a persistent challenge, as younger generations increasingly migrate in search of wage employment. Traditional millet cultivation is labour-intensive, involving manual sowing, weeding, harvesting, and post-harvest processing. Rising wage rates and declining availability of collective labour arrangements increase production costs, reducing the economic attractiveness of farming.

Market access represents another significant barrier. While niche urban demand for millets has grown, tribal farmers often lack direct access to remunerative markets. Procurement mechanisms are fragmented, with delays in payments and limited price incentives undermining farmer confidence. Intermediaries capture a substantial share of value, while inadequate storage and processing infrastructure lead to post-harvest losses. Institutional coordination among agriculture, tribal welfare, and food supply departments remains weak, resulting in uneven implementation of support programmes.

Gender dynamics further complicate these processes. Although women play a central role in seed management and processing, their contributions are frequently undervalued within formal policy frameworks. Women's collectives have demonstrated capacity for value addition, yet access to credit, training, and market networks remains constrained. The burden of unpaid care work also limits women's ability to fully participate in income-generating activities. These challenges underscore the importance of addressing social relations alongside technical interventions.

The Attappady case thus illustrates the tensions inherent in contemporary agrarian transitions. While state-led millet revival initiatives acknowledge the ecological and nutritional value of indigenous crops, they operate within development paradigms that prioritise productivity and market integration. Indigenous knowledge is selectively incorporated, often stripped of its cultural and communal dimensions. Farmers are encouraged to adopt standardised cultivation practices and participate in value chains, even as structural inequalities persist.

Importantly, the documentation of Attappady's agricultural knowledge remains largely confined to project reports and academic studies, with limited integration into national knowledge repositories such as TKDL. This absence reflects both institutional priorities and epistemic hierarchies that privilege codified medical knowledge over agrarian practices. Tribal farmers thus remain peripheral to formal knowledge governance, despite their central role in sustaining biodiversity and food systems.

At the same time, Attappady's experience reveals possibilities for alternative pathways. Community seed banks, participatory research initiatives, and women-led enterprises demonstrate the potential for locally grounded approaches to agricultural revitalisation. These efforts highlight the importance of collective institutions in mediating access to resources and sustaining traditional practices. However, their long-term viability depends on supportive policy environments that recognise indigenous knowledge as a living system rather than a static heritage.

By situating Attappady within broader debates on agrarian political economy, this case study underscores the need to move beyond technocratic solutions to rural distress. Millet revival cannot be reduced to crop substitution or nutritional

supplementation; it requires addressing land rights, market structures, and knowledge governance. The next section examines how TKDL and geographical indication frameworks intersect with these dynamics, exploring whether digitisation can contribute to more equitable agrarian futures or merely reproduce existing hierarchies.

V. TKDL, GEOGRAPHICAL INDICATIONS, AND THE POLITICS OF DIGITAL KNOWLEDGE GOVERNANCE

India's Traditional Knowledge Digital Library (TKDL) represents one of the most ambitious state-led attempts to document traditional knowledge and integrate it into global intellectual property governance. Established in the early 2000s, TKDL was conceived primarily as a defensive mechanism to prevent biopiracy by providing patent examiners with access to codified traditional knowledge in searchable, multilingual formats. By translating classical texts from Sanskrit, Arabic, Persian, and regional languages into patent-compatible databases, TKDL has successfully challenged numerous international patent claims related to medicinal formulations and therapeutic practices. These interventions have been widely celebrated as milestones in protecting national heritage within an asymmetrical global patent regime.

However, TKDL's institutional architecture reveals a narrow conceptualisation of traditional knowledge. The database overwhelmingly prioritises codified medical systems such as Ayurveda, Unani, Siddha, and Yoga, reflecting state concerns with pharmaceutical appropriation and commercial value. Agricultural knowledge—particularly that embedded in indigenous farming practices—remains marginal within this framework. This selective inclusion highlights the epistemic hierarchies underpinning TKDL, whereby textualised traditions are privileged over orally transmitted and practice-based systems.

From an agrarian political economy perspective, this bias carries significant implications. Tribal agricultural knowledge, including seed selection, mixed cropping, soil management, and climate adaptation strategies, constitutes a critical resource for rural livelihoods and ecological sustainability. Yet such knowledge resists easy codification. It is embodied in daily practices, social relationships, and cultural norms rather than formal manuscripts. TKDL's reliance on classical texts thus

systematically excludes communities like those in Attappady, whose farming systems are sustained through intergenerational learning rather than written treatises.

This exclusion reflects broader patterns of state-led knowledge governance. Digitisation initiatives often frame traditional knowledge as a national asset rather than a community-held commons. By positioning the state as custodian, TKDL centralises control over documentation and access, leaving limited space for community participation or ownership. Indigenous farmers become sources of information rather than rights-bearing actors, reinforcing extractive dynamics in which knowledge is appropriated for national or commercial purposes without meaningful benefit-sharing.

The implications of this model become clearer when contrasted with geographical indication (GI) frameworks. GI regimes link product quality to specific territories and cultural practices, offering a potential pathway for recognising collective knowledge while retaining value within producing regions. Kerala hosts several GI-tagged agricultural products, including Navara rice, Palakkadan Matta rice, and Wayanad Robusta coffee. These cases demonstrate how place-based certification can enhance product visibility and, in some instances, improve producer incomes.

Yet GI outcomes are uneven and contingent on institutional arrangements. Research indicates that GI benefits often accrue to larger producers or intermediaries, while smallholders and tribal farmers face barriers related to certification costs, compliance requirements, and market access. Moreover, GI registration alone does not guarantee equitable distribution of value; it must be accompanied by strong producer organisations, transparent governance structures, and supportive state policies. Without these safeguards, GI frameworks risk reproducing existing inequalities.

Integrating TKDL with GI mechanisms could, in principle, create synergies between knowledge protection and rural development. Documentation of indigenous agricultural practices within TKDL could strengthen claims to territorial authenticity, while GI certification could provide market recognition for traditional products. In the context of Attappady, such integration might support millet-based livelihoods by formalising community knowledge and linking it to value-added markets.

However, this potential remains largely unrealised. TKDL operates primarily within intellectual property domains, disconnected from agricultural policy and rural development frameworks. GI processes, meanwhile, are administered through separate bureaucratic channels with limited engagement with traditional knowledge repositories. This institutional fragmentation reflects siloed governance structures that treat knowledge protection, agricultural development, and tribal welfare as discrete policy arenas.

More fundamentally, both TKDL and GI regimes are shaped by logics of commodification. Digitisation transforms living practices into data, while GI certification converts cultural heritage into marketable labels. These processes risk detaching knowledge from its social contexts, enabling external actors to extract value while local communities remain marginalised. Scholars of digital governance describe this phenomenon as “digital enclosure,” whereby communal resources are subsumed within bureaucratic and commercial systems that prioritise efficiency and scalability over relational accountability.

In Attappady, the absence of tribal agricultural knowledge from TKDL exemplifies these tensions. Despite renewed policy interest in millets, documentation efforts remain project-based and fragmented, lacking integration into national knowledge infrastructures. Indigenous farmers thus continue to occupy a peripheral position within knowledge governance, even as their practices are invoked in development discourse. This disjuncture underscores the need to rethink TKDL not merely as a patent defence tool but as a platform for agrarian recognition.

A rights-based approach to digitisation would require substantial institutional reform. First, documentation processes must be participatory, ensuring that communities retain control over how their knowledge is represented and used. Free, prior, and informed consent should be foundational, accompanied by mechanisms for collective ownership and benefit-sharing. Second, TKDL should expand its scope to include agricultural knowledge systems, recognising farming practices as integral components of traditional knowledge. Third, integration with GI frameworks should prioritise smallholder and tribal producers, supported by investments in producer organisations, processing infrastructure, and market access.

Such reforms would entail a shift from extractive to relational governance. Rather than treating traditional knowledge as a static archive, TKDL could function as a living platform that supports community-led innovation and sustainable livelihoods. This would align digitisation efforts with food sovereignty principles, recognising indigenous farmers as custodians of agroecological heritage and agents of rural transformation.

The Attappady case highlights both the urgency and complexity of this task. Climate change, market volatility, and demographic shifts pose growing challenges to tribal agriculture. At the same time, indigenous knowledge offers valuable insights for building resilient food systems. Whether digitisation initiatives contribute to these goals depends on how power is distributed across knowledge infrastructures.

By situating TKDL within agrarian political economy, this section demonstrates that digital governance is not neutral. It reflects and reinforces existing hierarchies unless deliberately reconfigured. The next section builds on this analysis to discuss broader implications for agrarian justice and outline policy pathways for inclusive knowledge governance.

VI. DISCUSSION AND POLICY IMPLICATIONS: TOWARD AGRARIAN JUSTICE AND KNOWLEDGE SOVEREIGNTY

The analysis of Attappady's tribal agriculture and India's TKDL framework reveals a fundamental contradiction at the heart of contemporary knowledge governance. While indigenous knowledge is increasingly celebrated in policy discourse as a resource for climate resilience and sustainable development, institutional mechanisms for its documentation and protection remain shaped by extractive logics. TKDL's emphasis on codified medical systems and its orientation toward patent defence illustrate how traditional knowledge is selectively incorporated into state agendas, often detached from the material realities of rural livelihoods.

From an agrarian political economy perspective, this selective recognition reflects deeper power asymmetries embedded in development trajectories. Tribal farmers in Attappady occupy marginal positions within land markets, labour regimes, and policy frameworks. Their agricultural knowledge,

though central to sustaining biodiversity and food security, is rendered peripheral within formal governance structures. Digitisation initiatives that fail to address these structural inequalities risk reproducing epistemic injustice, transforming indigenous practices into abstract data while leaving producers vulnerable to market volatility and institutional neglect.

The Attappady case underscores the limitations of technocratic approaches to rural development. Millet revival programmes have generated important gains in dietary diversity and women's participation, yet their impact remains constrained by fragmented governance, inadequate market access, and labour shortages. These challenges cannot be resolved through documentation alone. Rather, they require integrated interventions that address land rights, producer organisation, and value-chain equity. Knowledge governance must therefore be embedded within broader strategies for agrarian transformation.

Food sovereignty provides a critical framework for reimagining these interventions. By foregrounding community control over food systems, this perspective challenges dominant models that prioritise productivity and commodification. Applied to TKDL, a food sovereignty lens calls for a shift from state-centric custodianship toward community-led knowledge governance. Participatory documentation processes, grounded in free, prior, and informed consent, are essential to ensure that indigenous farmers retain agency over how their knowledge is represented and utilised. Benefit-sharing mechanisms must move beyond symbolic recognition to deliver tangible livelihood support.

The potential integration of TKDL with geographical indication frameworks offers both opportunities and risks. GI certification can enhance product visibility and territorial identity, but its distributive outcomes depend on institutional design. Without strong producer collectives and transparent governance, GI schemes may exacerbate inequalities by privileging intermediaries and elite producers. For tribal regions such as Attappady, GI initiatives must be accompanied by investments in community organisations, processing infrastructure, and market access to ensure that value remains within local economies.

This analysis also highlights the importance of inter-departmental coordination. TKDL operates largely within intellectual property domains, disconnected from agricultural extension, tribal welfare, and rural development agencies. Bridging these silos is crucial for translating knowledge documentation into livelihood outcomes. Integrated policy frameworks could align TKDL documentation with millet procurement programmes, public nutrition schemes, and community seed banks, creating synergies between knowledge protection and agrarian development.

At a broader level, the digitisation of indigenous knowledge raises questions about the future of agrarian commons. Digital archives have the potential to democratise access and preserve endangered practices, yet they also enable new forms of enclosure. As traditional knowledge enters bureaucratic and commercial circuits, safeguards are needed to prevent its appropriation by external actors. Legal recognition of community intellectual rights, coupled with collective governance models, can help mitigate these risks.

Ultimately, advancing agrarian justice requires re-centering indigenous farmers as knowledge producers and political agents. This entails recognising traditional agriculture not as a relic of the past but as a dynamic system capable of informing sustainable futures. Attappady's millet revival initiatives demonstrate the resilience of indigenous practices, yet they also expose the fragility of these systems in the absence of structural support. Reimagining TKDL as a platform for agrarian recognition rather than merely patent defence represents a crucial step toward more equitable knowledge governance.

VII. CONCLUSION

This article has examined the digitisation of tribal agricultural knowledge in Attappady, Kerala, through the institutional framework of India's Traditional Knowledge Digital Library, situating these processes within broader debates on agrarian political economy, food sovereignty, and epistemic justice. By foregrounding indigenous millet-based farming systems, the study demonstrates that traditional knowledge is not merely cultural heritage but a living socio-political resource shaped by historical marginalisation, state interventions, and market integration.

While TKDL represents a significant postcolonial intervention in global intellectual property regimes, its primary orientation toward codified medical traditions reveals persistent epistemic hierarchies. Tribal agricultural knowledge—embodied in seed practices, cropping systems, and community institutions—remains largely excluded from formal documentation frameworks. This selective recognition risks reproducing extractive knowledge relations, whereby indigenous farmers are positioned as informants rather than rights-bearing actors.

The Attappady case illustrates both the resilience of indigenous farming systems and the structural constraints that undermine their sustainability. Recent millet revival initiatives have contributed to dietary diversification and women's participation, yet fragmented governance, insecure markets, and labour shortages continue to limit livelihood outcomes. Digitisation efforts that operate in isolation from agrarian development policies are therefore unlikely to deliver meaningful transformation.

The article argues for reimagining TKDL as a rights-based platform that integrates traditional knowledge protection with rural development objectives. Linking TKDL with geographical indication frameworks, community seed systems, and institutional procurement mechanisms could strengthen indigenous livelihoods, provided these processes are grounded in participatory governance and collective benefit-sharing. Such integration requires dismantling policy silos and recognising tribal communities as custodians of agroecological heritage.

By connecting indigenous epistemologies with digital governance, this study contributes to critical agrarian scholarship on knowledge sovereignty and rural transformation. It underscores that digitisation is inherently political, shaping who controls knowledge and who benefits from its circulation. As climate change and food insecurity intensify, indigenous agricultural systems offer vital insights for sustainable futures. Ensuring that these systems are protected and revitalised demands not only technical documentation but a broader commitment to agrarian justice and epistemic equity.

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