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Digital Margins: Technological Discrimination and Social Hierarchies in Nepal

Mahendra Bahadur Thapa
PhD Scholar, Department of English, University of Texas at Arlington
Email: mahendrabahadur.thapa@uta.edu

Abstract

This paper examines how digital technologies in Nepal, often embraced as indicators of national development, modernization, digital efficiency, inadvertently reinforce cultural, social, and linguistic hierarchies. By applying Science and Technology Studies (STS) as a critical framework and drawing upon Ruha Benjamin's concept of the "New Jim Code," the study explores how the use of digital technologies in Nepal designed in Western contexts marginalize and discriminate communities when applied uncritically in Nepal. Through an interdisciplinary methodology and illustrative case studies, including Nepal's biometric ID program, skin recognition systems, and language-based digital exclusions, the paper shows how these digital systems disproportionately disadvantage women, rural laborers, and non-dominant language speakers in Nepal. This paper argues that these exclusions are not technical flaws but manifestations of epistemic and cultural disregard. The findings suggest the need for inclusive, decolonial, and locally grounded technological frameworks that prioritize justice over efficiency. Finally, the paper calls for reimagining digital innovation through participatory, context-aware, and equity-centered technological design that not only contributes to the growing discourse on technological inequality in the Global South, but also stresses the need to dovetail digital infrastructures with the lived realities of diverse Nepali communities instead of abandoning technological advancement.

***Keywords**:* Technological discrimination, Science and technology, Digital exclusion, Nepal, Algorithmic bias

Introduction

Over the past decades, Nepal has gone through a rapid shift in the digital technological landscape, the growing trend of digital technologies and infrastructure in the developed countries has led people in Nepal to become deeply fascinated with it and adopted for the daily life. From e-commerce concept to digital education, e-government services to digital health platforms, technology has been not just a talk for common people, even the political leaders in Nepal have incorporated digital projects in their political agendas for gaining sensation and high turnaround of votes in the election. These momentums about new technologies are taken as positive markers for social, cultural, and other forms of advancements in Nepal. However, these modern digital technologies often carry some hidden agendas or politics of designers in the name of efficiency and modernity, which brings neo social hierarchy in front of West, subordinating our cultural and social values and ethos. While these technologies are designed and built in the West, the technologies fail to recognize and adopt the socio-cultural and economic realities of Nepal. Thus, this paper critically examines how modern digital technologies used in Nepal perpetuate forms of discrimination and epistemic violence by failing to account for the country's local knowledge systems, cultural diversity, and socio-economic structures. Drawing on the analytical frameworks of Science and Technology Studies (STS), and using Ruha Benjamin's *Race After Technology (2019)* as the primary theoretical text, this paper investigates the underlying mechanisms through which ostensibly neutral technologies reinforce systemic exclusions. As Benjamin argues, racism and inequality are not bugs in the system but features, "coded inequity" is often embedded within algorithms and technical architectures that reproduce existing hierarchies (Benjamin, 2019). This insight is essential for understanding how Nepal's adoption of Western-centric technologies, without sufficient localization or critical adaptation, has contributed to new forms of digital marginalization.

In Nepal, the dominance of English or standardized Nepali in government portals, educational institutions, and public service apps effectively excludes speakers of over 120 native languages. Similarly, technologies used in various national verification programs like national identity card, passports, and other identity cards often fail to recognize or accurately represent individuals from Nepal's diverse communities, echoing global concerns about racialized algorithmic bias in facial recognition and data validation systems. These issues are not isolated incidents but point to a broader pattern of technological exclusion. In Benjamin's terms, this phenomenon is known as "New Jim Code", a system in which ostensibly progressive and inclusive technologies reproduce social stratification by encoding racism and inequality into their operation (*Benjamin, 2019*). The

digital and non-digital technologies in Nepal systematically overlook the cultural, linguistic, and historical specificities of Nepali communities as they are predominantly developed within Western epistemological frameworks and socio-cultural and economic priorities. These technologies not only fail to recognize the full diversity of Nepal's population but actively reproduce colonial logics of hierarchy, invisibility, and exclusion. This technological bias disproportionately impacts culturally diverse, agrarian, and indigenous populations, whose knowledge systems and lived experiences do not align with the metrics, categories, or operational norms embedded in imported digital systems and infrastructures. Therefore, the uncritical adoption of modern technology in Nepal, without interrogating the socio-political context of its design, risks deepening internal inequalities and perpetuating structural injustices in the name of development.

Critical Framework and Scholarly Context

Over time, the increasing volume of scholarship is being written that intersects race, technology, and structural inequality, with researchers writing how supposedly neutral digital systems can reproduce and even exacerbate preexisting hierarchies. Scholars from the Global North, such as Ruha Benjamin (2019), have profoundly influenced this field by offering critical frameworks like the "New Jim Code," which describes how automated systems reinforce racial bias under the guise of objectivity. In *Race After Technology*, Benjamin writes, "coded inequity is woven into the digital fabric of everyday life," suggesting that technologies are not merely passive tools but active agents in social ordering (p. 6). Her abolitionist critique frames the need for justice-centered design and exposes the embedded discrimination in algorithmic systems that often remain invisible until they malfunction or exclude. Complementing Benjamin's work, Noble (2018) in *Algorithms of Oppression* demonstrates how search engine algorithms reinforce gendered and racial stereotypes. For instance, when searching for terms associated with Black girls, Google's auto-complete functions historically returned pornographic results, indicating algorithmic bias rooted in commercial and cultural logics. As Noble asserts, "these algorithms are not just faulty; they are fundamentally political" (p. 19). These insights prove that algorithmic design is never culturally neutral—it reflects the hidden desire of its creators and the economic imperatives of its sponsors.

Langdon Winner (1980) earlier argued that "artifacts have politics," meaning that technologies shape and are shaped by the power structures of the societies in which they are developed. Winner's thesis is particularly relevant to nations like Nepal, where the wholesale import of technological infrastructure from the West carries embedded assumptions that may not align with local social or cultural realities. Similarly, in the South Asian context, an increasing number of scholars have

highlighted how the deployment of digital technologies reinforces existing social hierarchies, particularly those related to caste. For instance, India's Aadhaar digital ID program has been criticized not only for compromising individual privacy but also for reinforcing systemic inequalities through the exclusion of marginalized populations (*Subramanian, 2024*). This critique draws on the foundational insights of Ambedkarite thought, particularly Dr. B. R. Ambedkar's argument that caste functions as a dynamic system of social control embedded within modern institutions. Building on this framework, scholars like Shailaja Paik (2016) and Suraj Yengde (2019) analyze how caste-based discrimination persists in domains such as education, labor, and citizenship. Paik emphasizes the dual marginalization of Dalit women, while Yengde calls attention to the continued invisibility of Dalit communities within elite political and technological spaces. Furthermore, Payal Arora (2019) challenges dominant narratives of digital inclusion in *The Next Billion Users*, showing through ethnographic research that Global South users are often misrepresented as passive recipients of technology, when in fact they engage with digital platforms in creative and culturally rooted ways that defy the assumptions of policymakers and developers.

Building on these perspectives, Shiv Visvanathan (1997) critiques the notion that science and technology in postcolonial societies are apolitical or universally progressive. He argues that development technologies often perpetuate colonial legacies and caste-based exclusions by privileging elite knowledge systems and actors. Similarly, Banu Subramaniam (2017) examines the convergence of caste and technoscience within the framework of Hindu nationalism. Her work reveals how Brahminical ideologies shape scientific discourse, categorizing upper-caste knowledge as "modern" and rational while rendering other epistemologies "backward." This framing influences not only scientific institutions but also the design and implementation of biometric databases and AI training datasets.

In Nepal's academic discourse, technology scholarship tends to bifurcate into two salient streams: one focusing narrowly on policy frameworks, and another examining identity politics in digital spaces. While scholars like Shailendra Giri (2018) propose comprehensive roadmaps for Nepal's digital transformation, and Singh & Bhuju (2001) provide a historical analysis of technological development, including policy-implementation gaps and the untapped potential of indigenous knowledge, these works largely overlook the sociocultural dimensions of technology access. This oversight becomes particularly evident when contrasted with Dilli Edingo's (2013) critical examination of digital marginalization, which reveals how "indigenous peoples in Nepal are compelled to negotiate their cultural and political identities on digital platforms dominated by

Hindu elites" (p. 22). Edingo's work highlights a critical gap in the broader scholarship: while most studies address either macro-level policy or specific indigenous struggles, few interrogate how systemic digital biases affect Nepal's diverse communities more broadly. This lacuna points to the need for scholarship that bridges technical policy analysis with critical studies of digital inequities across Nepal's multicultural society.

Although global scholarship, especially within Science and Technology Studies (STS), has vigorously explored how race, technology, and power intertwine, almost none of that analytical scaffolding has been applied to Nepal. Existing Nepalifocused research tends to celebrate digital modernization: studies track new fiber backbones, e-government portals, telemedicine pilots, and ICT-enabled "development" initiatives. Yet these accounts rarely probe the social fault lines that those technologies deepen or the algorithmic biases they embed. Questions about how digital systems interact with Nepal's distinctive cultural practices, gender hierarchies, economic precarity, and rural-urban divides remain largely unanswered. This paper addresses that research gap by bringing an intersectional STS lens to bear on Nepali contexts. Through case studies and interviews, it interrogates the ways science and technology both reproduce and mask discrimination, illuminating how seemingly neutral infrastructures can sideline the country's complex social and cultural realities.

Methods and Materials

This paper employs a qualitative, interdisciplinary methodology rooted in the epistemological frameworks of Science and Technology Studies (STS). Drawing upon feminist and decolonial STS approaches (Haraway, 1988; Benjamin, 2019; D'Ignazio & Klein, 2020), the research integrates theoretical analysis with empirical inquiry to diagnosis how currently used digital infrastructures and systems in Nepal cause to socio-technical marginalization. Methodologically, the paper utilizes critical case study analysis to examine concrete examples, such as Nepal's biometric ID program and language-based algorithmic exclusions, as illustrative sites where technological systems reproduce social hierarchies. Data sources include government reports, field interviews with affected populations (e.g., rural laborers, women, and linguistic minorities), and digital ethnographic observations gathered through virtual interactions with Nepali educators and users of AI interfaces. The cases were selected through purposive sampling to foreground voices historically excluded from dominant tech discourses. Analytical emphasis is placed on how these systems show embedded power structures and epistemic biases, in line with Winner's (1986) theory of technological politics and Benjamin's (2019) "New Jim Code." Rather than seeking generalizability, this methodology

prioritizes depth, reflexivity, and contextual richness to excavate how sociotechnical systems encode normative assumptions, thereby facilitating a nuanced critique of technological exclusion in Nepal's evolving digital landscape.

Results and Discussion

Science and Technology Studies (STS) emerged in the mid-20th century as an interdisciplinary field aimed at understanding how science and technology shape, and are shaped by, society, culture, politics, and economics. Rooted in the traditions of sociology, philosophy, and history of science, early STS scholars such as Thomas Kuhn and Robert Merton questioned the objectivity and linear progress of scientific knowledge. Kuhn's (1962) concept of "paradigm shifts" argued that scientific revolutions are not purely rational but are also socially constructed, disrupting earlier notions of cumulative progress. Merton (1942) introduced the idea of "norms" within scientific communities, suggesting that scientific practice is embedded within social structures. These foundational critiques provided the groundwork for STS to question how authority, legitimacy, and power circulate within and through scientific institutions.

Over time, STS expanded to analyze how technologies, ranging from medical instruments to algorithms, are not neutral tools but active participants in shaping human behavior and societal outcomes. Feminist scholars like Donna Haraway and Sandra Harding further pushed the field to consider how race, gender, and class intersect with scientific knowledge production. Their how dominant stressed scientific narratives often marginalize or exclude other ways of knowing. For example, Haraway's (1988) concept of "situated knowledges" argues against the idea of a universal, objective standpoint in science, emphasizing the partial and embodied nature of all knowledge. Similarly, contemporary scholars such as Ruha Benjamin (2019) have used STS to expose how algorithmic systems perpetuate racial biases, thus showing how technological systems can encode and amplify existing social inequalities.

As a critical framework, STS is increasingly applied within the humanities and social sciences to interrogate the cultural, ethical, and political dimensions of technology and scientific practices. It offers scholars tools to examine how values, ideologies, and historical contingencies are embedded in technological artifacts and infrastructures. In media studies, for example, STS offers a deeper understanding of how digital platforms and algorithms influence public discourse and visibility. In anthropology and sociology, STS informs ethnographies of scientific laboratories or digital cultures. The field's interdisciplinary reach makes it valuable for analyzing both the production and

the effects of science and technology. Lastly, STS invites researchers not only to critique but also to imagine alternative, more inclusive technological futures grounded in equity and justice.

Technological Discrimination in Nepal's National ID Program

This research has chosen one prominent examples of how technology in Nepal perpetuates cultural and gendered bias under the pretense of progress is the National Identity Card Program, launched in 2018 by the Department of National ID and Civil Registration (DoNIDCR). Designed to standardize biometric identification and facilitate access to public services, the program captures fingerprints, iris scans, and facial data. Though marketed as a tool of modern governance and administrative efficiency, the program's implementation has revealed clear socio-cultural insensitivities, particularly in its treatment of married women who wear *sindoor*, a red vermillion mark worn on the forehead as a sign of marital status in Nepali tradition. During biometric image collection, these women were asked to remove their *sindoor* because it allegedly interfered with facial recognition software. This requirement, framed as a mere technical necessity, illustrates how algorithmic systems can erase cultural identity and bodily autonomy. The directive effectively suppresses women's right to religious and cultural self-expression and recasts them as noncompliant data subjects within a technocratic regime. From a feminist Science and Technology Studies (STS) perspective, this is not a benign design flaw but a reflection of structural biases embedded in the technical system itself. D'Ignazio and Klein (2020), in *Data Feminism*, argue that technologies claiming objectivity often encode dominant values while marginalizing non-normative practices and embodiments. Similarly, Ruha Benjamin's (2019) concept of the "New Jim Code" elucidates how automated systems reinforce social inequities by disguising them in algorithmic neutrality. The exclusion of *sindoor* from acceptable biometric data demonstrates how secularized, male-centric standards become default benchmarks, echoing Langdon Winner's (1986) assertion that technologies inherently contain political choices.

The case of Nepal's biometric ID initiative operationalizes patriarchal assumptions and disregards cultural pluralism. Its failure to engage with feminist and intersectional perspectives reveals how technologically mediated policies can enforce epistemic violence. The program's approach to identity verification becomes a mechanism for normalizing certain identities while erasing others, particularly those of women whose cultural practices do not conform to technocratic ideals. In this way, the biometric system provides perfect examples of how so-called progressive technologies may in fact re-inscribe historical forms of marginalization.

Infrastructural Injustice and the Erosion of Privacy

Beyond gendered cultural erasure, the digital ID program in Nepal also poses grave risks concerning data privacy and institutional accountability. The government's accelerated deployment of the national digital identity card system—without adequate infrastructure, security protocols, or legal safeguards—has drawn significant criticism. Designed to store highly sensitive biometric and personal data for nearly 30 million citizens, the centralized database lacks rigorous privacy policies or oversight mechanisms. According to *The Kathmandu Post*, the Ministry of Home Affairs bypassed a phased rollout strategy and instead hastily implemented a nationwide system without comprehensive security audits or stress tests (Rai, 2019).

This approach aligns with what Benjamin (2019) describes as the "default settings of discrimination," where technological solutions are adopted without critically evaluating their societal impacts, especially in countries with low digital literacy and fragile data protection laws. Legal scholars such as Bipin Adhikari have questioned the government's capacity and intent to protect this data, citing Nepal's poor track record in data management, including the mishandling of voter ID data in 2008 due to storage failures (Rai, 2019). Such failures reinforce Winner's (1986) concept of "technological somnambulism," the uncritical adoption of complex systems without democratic deliberation or ethical foresight. Moreover, the nature of the data being collected, ranging from marital history to intergenerational information and residential movements, suggests a surveillance infrastructure in the making. Although the project is not driven by commercial interests, its resemblance to what Zuboff (2019) calls "surveillance capitalism" is evident: it extracts deeply personal data without consent mechanisms or user control. The absence of transparent governance, the overlapping jurisdiction between the Department of National ID and local bureaucracies, and the vague promises of data protection further illustrate infrastructural incoherence and democratic deficit.

From an STS standpoint, such top-down data regimes reflect epistemic injustice. As D'Ignazio and Klein (2020) argue, initiatives that lack community engagement and critical reflexivity reproduce unequal power relations under the guise of technological modernity. Instead of enabling civic empowerment, these systems risk transforming individuals into datafied subjects under perpetual observation, reinforcing structural asymmetries rather than dismantling them.

Biometrics and Class Bias

Another example of discrimination has emerged in the biometric registration process for national ID cards and passports, particularly affecting rural laborers engaged in agricultural work. During my most recent winter break from the United States in early December 2024, I returned to Nepal for three weeks and conducted field research in the districts of Jhapa and Ilam. I interviewed local residents, primarily farmers working in the fields, about their experiences with biometric enrollment. Since I am originally from a rural part of Jhapa and Ilam is geographically close to my hometown, I was familiar with the local context and community dynamics.

For the research, I prepared two primary questions: How many times were participants required to pose for ID and passport photographs? How many times did they have to scan their hands for national ID registration?

I interviewed 58 individuals, most of whom were actively engaged in agricultural labor. In response to the first question, 54 participants reported that they had to appear before the camera more than twice to have an acceptable photograph taken. For the second question, 57 shared that they were required to scan their palms more than three times because their fingerprints were unreadable by the biometric scanners. This was because, years of manual agricultural labor had worn away the ridges on their fingers, rendering them "invisible" to the technology. Many participants were instructed to apply chemical gels to make their fingerprints more readable, an experience described by many as humiliating and painful. Similarly, the darkened and roughened skin of these farmers, caused by long-term sun exposure in the fields, affected the quality of their photographs. As a result, many had to pose repeatedly for pictures to meet the system's expectations.

These findings hint not to a technical malfunction, but to a deeply embedded design bias within the biometric systems themselves. These technologies are calibrated to read smooth, clearly defined fingerprints, implicitly privileging urban, less labor-worn bodies. This systemic exclusion echoes the concept of the "New Jim Code," a framework developed by Ruha Benjamin that illustrates how seemingly neutral technologies can reinforce structural inequalities by rendering certain bodies incompatible with digital systems. Just as the now-infamous soap dispenser that failed to detect darker skin tones exposed racial bias in everyday technology, Nepal's biometric registration system privileges bodies unmarked by manual labor while excluding those shaped by physical toil (Benjamin 2019)

Viewed through STS lens, such exclusions are not accidental, they are clearly political. Technology is never neutral; it is shaped by and reproduces specific socio-cultural and economic assumptions. The failure of biometric systems to recognize labor-worn bodies exemplifies how design can institutionalize classist and ableist biases. Those whose bodies do not fit the assumed "default" are subjected to repeated scrutiny, delays, and exclusion from basic civic rights such as identity verification and mobility.

Linguistic Marginalization in Everyday Digital Tools

Discrimination through technology in Nepal also extends into the area of everyday digital tools, affecting users based on linguistic identity and cultural naming conventions. On April 7, 2025, I had participated a virtual discussion with a group of Nepali English teachers from the United States to share my insights on teaching English composition as an ESL Instructor. During the session, some of the participants shared their experiences when using voice technologies such as Google Assistant and ChatGPT. They said that, despite their fluency, the systems frequently misinterpreted their English commands due to their non-native accents, forcing them to repeat inputs multiple times. These experiences illustrate how intelligent systems, despite being highly sophisticated, are programmed to favor native English phonetics over non-native English accents. This sort of subordination to non-native English speaker's accent is an example of creating linguistic hierarchy between native English speakers and non-native English speakers. This shows, from an STS perspective, reflects how technical standards embed assumptions about normative language usage, disadvantaging users from the Global South.

In the same session, one of the participants even recounted instances and shared to us, where typing their Nepali names into Microsoft Word resulted in red underlines as spelling errors and suggested anglicized corrections while attempting to correct or removing errors through MS command. These autocorrections appear a subtle but significant form of algorithmic cultural erasure, wherein dominant naming conventions are encoded as standard while culturally specific names from Global South are treated as errors. Such features may appear benign but serve to delegitimize non-Western identities, reimposing cultural dominance of the West under the guise of linguistic efficiency. As STS scholars argue, these design choices are not merely technical but sociopolitical. By encoding dominant linguistic and cultural norms into everyday tools, developers reinforce global inequities. What appears as minor inconvenience in software functionality thus reveals deeper patterns of exclusion and epistemic injustice.

These exclusions further illustrate how class, labor, and physical embodiment intersect with technological design. While urban elites encounter no such difficulties during registration, rural laborers are pathologized by the system itself. The biometric infrastructure, then, becomes a contemporary instrument of social sorting, one that distinguishes the "fit" from the "unfit" not based on citizenship but on bodily conformity to technocratic norms.

Conclusion

This paper concludes that digital technologies in Nepal, rather than being neutral or universally beneficial, often reproduce and reinforce existing cultural, social, and linguistic hierarchies. By drawing on the theoretical framework of Science and Technology Studies (STS) and Ruha Benjamin's concept of the "New Jim Code," the study demonstrates how seemingly inclusive technologies, such as biometric identification systems, voice assistants like Google Assistant, and other AI-driven tools, frequently marginalize Nepali women, rural laborers, and other underserved populations. These patterns of exclusion are not accidental flaws but systemic outcomes rooted in the uncritical adoption of Western-designed technologies that fail to consider Nepal's diverse socio-cultural realities.

As Nepal advances its digital infrastructure, these findings highlight the urgent need for a justice-centered and decolonial approach to technological development. Rather than assuming digitalization is inherently progressive, policymakers, designers, and developers must question which bodies, languages, and worldviews are prioritized in current systems, and which are rendered invisible. Building a more equitable technological future in Nepal requires inclusive coding practices, culturally and linguistically localized platforms, and community-led innovation. Moreover, the goal should not be to reject technological progress but to reimagine it in ways that align with Nepal's local knowledge systems, serve all communities fairly, and promote meaningful social justice.

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