



The Society 5.0 Concept: A Framework for Societal Evolution

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Abstract

The study focuses on the idea of Society 5.0 as a comprehensive framework for understanding the development of human societies through various technological and socio-economic shifts. It traces Nepal's historical journey from early hunter-gatherer societies (Society 1.0) to the upcoming data-driven and AI-enhanced future (Society 5.0). The article describes key historical changes, such as the use of metal, the introduction of farming machines, the rise of factories, and advances in digital technology. It discusses the specific challenges and opportunities in Nepal and explains how technologies like Artificial Intelligence, automated systems, and smart infrastructure can help build a better society by prioritizing people's well-being and sustainable progress. This study is based on a general review used a narrative approach to analyze sources on Society 5.0 from 2018–2024, focusing on technology, social change, and policy in infrastructure, education, governance, and socio-economic development. The study emphasizes the need for strategic policymaking, infrastructure development, and inclusive technology adoption to fully harness the potential of Society 5.0, providing valuable insights for policymakers, researchers, and practitioners working to guide societies toward smarter and more resilient futures.

Keywords: societal evolution, agrarian society, industrialization, information technology, AI, Society 5.0, digital transformation

1. Introduction

The progression of human civilization is often conceptualized through stages of societal development, commonly denoted as Society 1.0 to Society 5.0. These classifications are not



formal policy decrees but rather theoretical frameworks used by academics, researchers, and policymakers to analyze profound societal transformations driven by shifts in technology and economic structures.

Society 5.0, a concept initially put forward by the Japanese government, envisions a future in which advanced technologies like artificial intelligence (AI), the Internet of Things (IoT), big data, and robotics are fully integrated into society to effectively tackle complex issues (Kato, 2019). Unlike the industrial and information ages that came before it, Society 5.0 takes a human-centered approach aimed at combining economic development with efforts to solve social challenges, ultimately fostering a more inclusive and sustainable society (Nakagawa & Kondo, 2019).

The categorization of society into stages serves as a conceptual tool to understand the technological and economic evolution of human civilization. Emerging from critical historical transitions, these terms help delineate major phases in societal development. This paper explores the characteristics of these stages, emphasizing their evolutionary nature and the catalysts behind their progression in the context of Nepalese Society.

2. Methodology

This review adopted a narrative strategy to collect and interpret academic literature related to Society 5.0. An extensive search was carried out in databases such as Google Scholar, JSTOR, Web of science and published government reports websites and books, using search terms like “Society 5.0,” “digital governance,” “educational technology,” and “Nepal.” The study included peer-reviewed papers, government documents, and authoritative institutional publications released between 2018 and 2024. Selection criteria emphasized sources that addressed technological progress, social change, and policy development. After examining abstracts and full texts, 50 key references were selected and analyzed focusing on core themes such as infrastructure, education, governance, and socio-economic evolution. The objective of this study is to provide an in-depth understanding of how Nepalese society can improve skills, small businesses, and farming to advance from Society 3.0 to Society 4.0, facilitating a smooth transition towards Society 5.0 at regional, national, and international levels.

2.1 Theoretical foundations

Society 5.0, proposed by Japan, envisions a human-centered society where digital and physical systems work together to solve social issues. It aligns with sociotechnical systems theory, which stresses the need to develop technology alongside social structures for effective and accepted solutions (Trist, 1981). Society 5.0’s use of AI, robotics, and IoT to tackle challenges such as an aging population and urban growth demonstrates the integration of both social and technological systems. Additionally, human-centered design (HCD) plays a key role by ensuring that innovation prioritizes human needs and values over mere economic gain (Norman, 2013), which aligns with Society 5.0’s emphasis on inclusivity and quality of life.

Technological determinism and SCOT present contrasting perspectives on whether technology influences society or society influences technology. Society 5.0 integrates both views by promoting the simultaneous development of technology and social values (Bijker et al., 1987). Its effectiveness also relies on the diffusion of innovations, as described by Rogers’

theory, which emphasizes the importance of addressing various categories of adopters (Rogers, 2003).

Society 5.0 is based on the principles of sustainable development, leveraging technology to tackle environmental and social issues while fostering economic progress (World Commission on Environment and Development, 1987). It depends on cyber-physical systems to seamlessly connect the digital and physical worlds, enabling more intelligent services (Lee, 2008). Additionally, its success requires cooperation among various stakeholders, as emphasized in the Triple, Quadruple, and Quintuple Helix innovation frameworks (Carayannis & Campbell, 2010).

3. Characterizing Societal Stages: From Society 1.0 to 5.0

3.1 Conceptual Foundations

The classification of societal development into discrete stages—designated as Society 1.0 through Society 5.0—constitutes a theoretical framework for analyzing the techno-economic evolution of human civilization. Unlike formal policy designations, these stages are heuristic constructs employed in interdisciplinary scholarship (encompassing sociology, economics, and science and technology studies) to demarcate pivotal transitions in socio-technical systems. The framework underscores the dialectical relationship between technological innovation and structural economic change as the primary drivers of societal transformation. Society 5.0 is founded on the fusion of cutting-edge technologies such as AI, IoT, big data, and robotics to build a society centered on human needs, aiming to combine economic progress with the resolution of social issues. It advances beyond the digital emphasis of Society 4.0 by leveraging technology to enhance life quality, promote sustainability, and ensure inclusiveness. Through autonomous systems and data-informed decision-making, it empowers individuals and communities to effectively tackle challenges like population aging, environmental problems, and urban growth (Sutthichaimethee et al., 2020).

3.2 Evolutionary Models: Theoretical Lineages and Analytical Utility

The conceptual segmentation of societies into developmental phases—such as hunter-gatherer (Society 1.0), agrarian (Society 2.0), and industrial (Society 3.0)—finds its intellectual roots in 19th-century social evolutionism. Early theorists, including Montesquieu (stages of subsistence), Comte (law of three stages), and Morgan (ethnical periods), sought to systematize societal progression from rudimentary to complex organizational forms. While these models have been critiqued for their often-linear and Eurocentric assumptions, their contemporary utility lies in their function as analytical lenses. They enable comparative historical analysis and facilitate the identification of macro-level patterns in institutional and technological change.

Crucially, Societies 1.0 through 4.0 are retrospective classifications, derived *ex post facto* through interdisciplinary synthesis. These epochs—marked by dominant modes of production (e.g., foraging, agriculture, mechanization, digitalization)—are not the product of deliberate institutional design but emergent outcomes of path-dependent socio-technical coevolution. For instance, the "Information Society" (Society 4.0) was not legislated into being; rather, the term emerged from scholarly discourse to describe the systemic effects of computing

and telecommunications on economic and social organization.

3.3 Society 5.0: A Prospective Paradigm

In contrast to its predecessors, Society 5.0 represents a prospective and normative vision. Formally articulated in Japan's Fifth Science and Technology Basic Plan (2016), it is framed as a "Super Smart Society" wherein cyber-physical integration (e.g., IoT, AI, robotics) optimizes socio-economic systems. Unlike earlier stages, which were identified through historical analysis, Society 5.0 is a policy-driven construct aimed at steering innovation to address grand challenges (e.g., aging populations, sustainability). This reflects a shift from descriptive periodization to prescriptive futurism, blending technological determinism with institutional agency.

3.4 Key Dimensions of Societal Development

The transitions between societal stages are characterized by multidimensional shifts, analyzable through four interdependent axes:

- Technological – The emergence, diffusion, and institutionalization of transformative technologies (e.g., irrigation → steam engines → machine learning).
- Economic – Structural changes in production regimes, labor relations, and value creation (e.g., subsistence economies → capitalism → platform-based digital economies).
- Social – Reconfigurations of power, identity, and collective norms (e.g., kinship-based hierarchies → nation-states → networked individualism).
- Transformational Dynamics – The mechanisms (e.g., innovation clusters, crisis responses) and actors (e.g., states, firms, social movements) that catalyze phase transitions.

4. Stages of Societal Development (Nepalese Context)

4.1 Society 1.0: The Prehistoric Era (Lithic Age)

Nepal's earliest form of social organization was characterized by a hunter-gatherer way of life, relying on basic tools made from stone and wood. This phase corresponds to the ancient Kirat period, noted for its animistic belief systems, oral traditions, and scattered communities in the Himalayan foothills (Gurung, 1996).

A key turning point was the introduction of metal tools, which significantly enhanced hunting capabilities, allowed for the clearing of land for farming, and encouraged permanent settlement. These innovations laid the essential foundation for the rise of an agricultural society—marking the evolution from nomadic groups to a more structured, settled civilization.

4.2 Society 2.0: The Agrarian Society

During the Lichchavi and Malla dynasties, Nepal experienced a crucial shift in its agricultural foundation. This period was marked by the widespread adoption of terrace farming in the hills and paddy cultivation in the Terai. Additionally, cash crops such as *pāt* and jute were introduced, and land management systems like *jagga pratha* were established. Local trading hubs (*hāt bazaars*) also emerged, enabling the exchange of surplus farm produce (Gurung, 1996).

A pivotal movement toward industrialization began with the gradual replacement of manual farming tools like *hasiya*, *khukuri*, and *khurpa* with motorized and electric equipment. Innovations such as rice mills, grain grinders, and electric irrigation pumps boosted agricultural output and minimized manual labor. These technological advancements contributed to structural economic shifts—lowering the need for farm labor, improving processing efficiency, and prompting population movement from rural to urban areas. This transformation mirrors Rostow’s “take-off” phase, signifying the commercialization of agriculture and the early development of rural industrial hubs (Rostow, n.d.).

4.3 Society 3.0: The Industrial Society

Nepal's transition into an industrial society, or Society 3.0, began during the Rana regime and the early Shah dynasty in the 19th and 20th centuries. This period saw the inception of foundational industries such as the Biratnagar Jute Mill—Nepal’s first major industrial establishment—as well as the development of tea plantations and early hydropower projects. These initiatives marked the beginning of mechanized production through electrical machinery, which significantly enhanced output and efficiency (Gurung, 1996; UNIDO, 2020).

Following this was the emergence of Society 4.0, characterized by the integration of information technology with industrial processes. Technological advancements have enabled remote control of machines—such as irrigation pumps, grain mills, and paddy dryers—through mobile applications. These innovations allow users to manage speed, automate operations, and receive task completion alerts, resulting in increased efficiency and reduced manual labor (MoCIT, 2019).

Despite these advancements, Nepal's industrial development has been limited. The country has struggled to transform its agriculture-based economy into an industrial one. Without substantial investment in agro-industrial sectors and IT infrastructure, the shift to a fully realized Society 4.0 remains incomplete. This delay has left Nepal largely rooted in its agrarian past, impeding progress toward the digital and information age (World Bank, 2023; Asian Development Bank, 2021).

4.4 Society 4.0 – Emerging: The Information Technology Society

Nepal began transitioning into an Information Technology (IT) society following the political reforms of 1990 (2046 BS), which introduced liberalization and encouraged private sector participation. These changes led to a rapid expansion in telecommunications infrastructure, significantly increasing internet access and mobile phone usage. This digital expansion transformed government services, communication methods, and commercial practices (MoCIT, 2019; World Bank, 2023).

A defining feature of Society 4.0 is the large-scale collection and analysis of data. The emergence of artificial intelligence (AI) and autonomous technologies marks a pivotal shift toward Society 5.0. These advancements allow machines and devices to function with greater independence, responding to real-time data without human intervention (Japan Science and Technology Agency, 2023).

For example, modern agricultural tools—such as paddy dryers, wheat grinders, or irrigation systems—can now automatically adjust their operations based on factors like grain quality or soil moisture levels. These smart technologies not only enhance productivity but also

enable machines to respond more intelligently to human needs. This evolution represents the conceptual transition toward a "Super Smart Society" that integrates cyber and physical systems for human-centered innovation (Cabinet Office, Government of Japan, 2019).

4.5 Society 5.0 – Future Society: The Data Society

Nepal is currently navigating the initial stages of Society 5.0—often called the Data Society—with major initiatives beginning around 2020. This emerging phase is marked by the adoption of cutting-edge technologies such as artificial intelligence (AI), the introduction of smart city concepts, and the implementation of the government-led *Digital Nepal Framework*, which targets key sectors like e-health, financial technology (fintech), and smart infrastructure (Ministry of Communication and Information Technology [MoCIT], 2019; Government of Nepal, 2022).

A defining feature of this societal model is the strategic application of AI and the integration of data-driven systems, which allow machines and services to function autonomously based on real-time analytics. These smart systems build upon those introduced in Society 4.0, now evolving to respond more intelligently to human needs through automation and contextual awareness (Japan Science and Technology Agency, 2023).

Ultimately, Society 5.0 aspires to use technological innovation not merely for economic growth, but to address complex social challenges and improve the overall quality of life for all citizens (Cabinet Office, Government of Japan, 2019).

5. The Concept of Society 5.0 in the Nepali Context

Nepal, though facing development challenges, has strong potential to adopt the Society 5.0 model. The Digital Nepal Framework highlights key sectors for technological growth, but realizing the full vision of Society 5.0 calls for wider reforms in education, cultural attitudes, and infrastructure to ensure that technological advancements are inclusive and benefit the entire population fairly.

Nepal's societal development isn't linear; instead, it's a "multi-speed society," where various developmental stages coexist simultaneously. Historically, Nepal's industrial journey began with the Biratnagar Jute Mill, established in 1936 A.D. (1993 B.S.). However, Nepal also boasts a rich industrial heritage in handicrafts like handmade paper, metalwork, woolen textiles, and woodwork, which are globally acclaimed (UNESCO, 2022). Nepal's societal evolution is transitioning from a handicraft-based economy towards a more inclusive, technology-driven, and export-oriented trajectory. The IT/ITES sector contributed 1.2% to Nepal's GDP in fiscal year 2078/79 (World Bank, 2023), highlighting its growing significance.

Achieving Society 5.0 in Nepal demands strong involvement from both the public and private sectors, along with robust leadership from the government, industries, and local communities. Prioritizing the development of integrated digital infrastructure is crucial. This infrastructure will enable the efficient and secure sharing of data, which is essential for developing smart cities and autonomous tools. Furthermore, Nepal must embrace Artificial Intelligence (AI), robotics, and other cutting-edge technologies to boost efficiency and effectiveness. Citizens need to be empowered to participate in the digital economy through accessible education and training. By addressing these key areas, the advancement of science,

technology, and innovation becomes paramount for realizing Society 5.0 in Nepal.

AI technologies can expand healthcare services in rural regions, and smart farming solutions can increase agricultural productivity. Digital learning systems can address educational inequalities in isolated areas. Furthermore, considering Nepal's vulnerability to natural disasters, incorporating IoT and real-time data analytics can greatly strengthen disaster preparedness and emergency response.

5.1 Nepal's Industrial Development Timeline

Here's a timeline outlining Nepal's industrial development, showing how various stages were influenced by policy shifts and external factors.

a. **Until 2000 (B.S. 2056/57): Dominance of Traditional and Cottage Industries**

During this period, Nepal's economy was primarily characterized by traditional handicrafts and cottage industries. Agriculture was the main economic base, with limited industrial activity.

b. **2010–2030 (B.S. 2066/67 – 2086/87): Establishment of Government-Initiated Public Industries**

In this era, the government began actively promoting industrial development. State-owned public industries were established across the country, aiming to reduce reliance on imports and boost the production of essential goods.

c. **1990 (B.S. 2046): Commencement of Liberalization**

Following the political changes of 1990 (B.S. 2046), Nepal started its liberalization policies. This opened up the economy, creating opportunities for the private sector and foreign investment.

d. **1993–2013 (B.S. 2050/51 – 2069/70): Growth in Private and Foreign Investment, and SMEs**

As a direct result of liberalization, these decades saw a significant increase in private sector investment, Foreign Direct Investment (FDI), and the growth of Small and Medium Enterprises (SMEs). This helped create jobs and expand economic activities.

e. **2013–2022 (B.S. 2070/71 – 2078/79): Development of Digital, ICT, Tourism, Hydropower, and SEZs**

More recently, Nepal has broadened its development focus. Key priorities have shifted towards the development of digital technologies, Information and Communication Technology (ICT), tourism, hydropower, and Special Economic Zones (SEZs). This highlights a focus on expanding the service sector and boosting energy production.

5.2 Nepal's Industrial State and Transition Towards Society 5.0

Nepal is currently a nation in transition, moving from a predominantly agrarian economy towards an industrial society. Although the journey of industrial development began after adopting globalization and liberalization policies in 1990, a significant portion of Nepal's workforce remains engaged in traditional agriculture or the informal sector even today. Over 60% of Nepal's population is involved in agriculture, with the income sources for laborers dependent on this profession often being daily, monthly, or annual, lacking formal regularity. Conversely, the number of individuals involved in formal industry or technology-based services is considerably low [4] (Source: Central Bureau of Statistics, 2080).

How is an Industrial Stage Determined?

A country's industrial stage can be determined by the following criteria:

Nature of the Workforce (Livelihood Status):

In an agrarian-based society, daily sustenance relies on farming, labor, or foreign employment.

An industrial society is characterized by stable employment, growth in the manufacturing sector, and regular salaries/income.

5.3 Transition towards Society 5.0 in Nepal

1. Digital connectivity expansion

A digital society (Society 5.0) features knowledge-based, data-centric, and AI-assisted occupations. In Nepal, the economic condition of most citizens remains uncertain and informal, reflecting its transitional state. Digital connectivity has been expanded. Companies like Ntc and Ncell have expanded 4G internet service nationwide, improving digital access especially in rural areas which is foundational smart services (Nepal Telecommunications Authority, 2023).

2. E governance initiatives

The government has introduced digital platforms like the Online Company Registration System and Digital Tax Filing to simplify administrative procedures and enhance transparency (Government of Nepal 2022)

3. Smart agriculture initiatives

Trial initiatives employing drone technology and IoT sensors assist farmers in tracking crop conditions and boosting yields, including projects backed by the International Finance Corporation (IFC) in the Terai region (IFC, 2021).

4. Smart grid and renewable energy

Initial smart grid projects combine IoT technology with hydropower facilities to improve energy management, with ongoing efforts in the Kathmandu Valley (Asian Development Bank, 2022).

5. Industry's Contribution to GDP:

In Nepal, the industrial sector's contribution to Gross Domestic Product (GDP) is less than 15% (World Bank, 2023).

In industrialized nations, this figure typically exceeds 30%.

6. Access to Technology and Infrastructure:

The use of smart factories, IoT, robotics, and data systems is a key indicator of industrial development.

In Nepal, especially in rural regions, access to modern technologies is still scarce. Many industries depend mainly on raw materials such as herbs and agricultural products, with minimal investment in processing. Similar to Japan's Society 5.0, Nepal's digital shift presents both opportunities and challenges for its youth, entrepreneurs, and government. Over the last 36 years, Nepal has seen steady but moderate industrial development.

5.4 Key Industrial Indicators (2046 vs 2082)

Here's the translated table summarizing Nepal's industrial development indicators from 1989 (2046 B.S.) to 2025 (2082 B.S.):

Nepal's Industrial Development Indicators: 1989 to 2025

This table illustrates key indicators of industrial transformation in Nepal over a period of 36 years, highlighting progress and areas still requiring significant growth.

Table 1: Key Indicators of Industrial Transformation in Nepal

Indicator	1989 (2046 B.S.)	2025 (2082 B.S.)	Growth Rate	Source
Industry's GDP Contribution	~6% of GDP	~15% of GDP	+9%	World Bank, Nepal Rastra Bank
Manufacturing Sector's Contribution	4% of GDP	~6% of GDP	+2%	ADB, Central Bureau of Statistics, Nepal Electricity Authority
Electricity Generation	~300 MW	~2,800 MW	+ 833%	Ministry of Physical Infrastructure & Transport
Paved Road Network	~7,000 km	~18,000 km	+157%	Ministry of Physical Infrastructure & Transport
Foreign Direct Investment (FDI)	Negligible	~USD 150 Million/year	Still low	Nepal Rastra Bank, UNCTAD
Export-Oriented Industries	Primarily Agriculture	Textiles, Handicrafts, IT Services	Diversification	Trade and Export Promotion Centre

1.1. Digitalization of Nepal's Economy: The digitalization of Nepal's economy has introduced new market dynamics and business models. E-commerce platforms like Daraz, Sastodeal, and Foodmandu have made "shopping from home" increasingly popular, changing how consumers traditionally behave. Additionally, the FinTech revolution through digital payment systems such as eSewa, Khalti, and mobile banking has improved financial inclusion by providing access to financial services even in remote rural areas.

The gig economy, with platforms such as Upwork and Fiverr for freelancing, along with ride-sharing services like Pathao, InDrive, and Tootle, has changed how Nepali youth work by offering more flexible job options.

1.2. Shift from "Product Consumption" to "Experiential Focus", Changing Consumer Preferences: Nepali consumers are increasingly prioritizing "What do we experience?" over "What do we purchase?", evident in:

Tourism & Experience-Based Services: Growth of Airbnb-style homestays, trekking experiences, and cultural tourism.

Subscription Models: OTT platforms (Sanalikai, Cineplex) and music streaming services

(Sareeram, Nepali Jukebox) challenging traditional media consumption. This shift highlights the evolving nature of Nepal's digital economy, where convenience, accessibility, and personalized experiences drive market trends.

- Skill Demand in Nepal and Leveraging Digitalization for Development

In recent times, there's a growing need in Nepal to digitize its cultural heritage. Technology can be leveraged to present Nepal's rich history and diverse tourism offerings to the global market. To achieve this, it's crucial to provide Nepali youth with essential digital skills.

Nepal's development potential is underscored by its recent upgrade from a Least Developed Country (LDC) category, marked by an increase in Gross National Income (GNI) per capita from US\$1,196 to US\$1,230. This signals significant investment opportunities. This study further analyzes the potential for crowdfunding in Nepal, considering its financial development, technological advancements, regulatory requirements, and legal framework. The Government of Nepal and Nepal Rastra Bank are actively contributing to digital technology development under the Digital Nepal Framework 2019. The synergy of FinTech and Information and Communication Technology (ICT) is progressively making the implementation of crowdfunding in the Nepali financial system more feasible and practical

- Bridging the Digital Divide in Rural Nepal

Despite these advancements, significant work remains to expand digital access in rural areas of Nepal. Millions of citizens still lack reliable, affordable, and high-quality internet access. According to the Digital Nepal Framework (MoCIT, 2019), extending internet services to rural regions is a key opportunity for development. This digital inclusion is vital for ensuring equitable access to opportunities and fostering comprehensive societal transformation.

1.3. The Imperative for a New Model of Knowledge and Innovation

To foster sustainable digital development and construct an inclusive economy, Nepal must institutionally promote knowledge production and innovation. Drawing inspiration from Japan's "Open Innovation" paradigm, Nepal needs to cultivate a novel model rooted in collaborative research, entrepreneurship promotion, and localized innovation. This approach will be crucial for accelerating its developmental trajectory.

- Community-Based Innovation and Digitalized "Juga" Culture

Nepal's traditional cooperative labor culture, locally known as "Juga" or "Arma-Parma," presents a unique opportunity for digitalization. By transforming this inherent collaborative spirit onto digital platforms, Nepal can effectively stimulate community-based innovation. For instance, crowdfunding platforms could be utilized to mobilize financial support for local projects, thereby fostering digital autonomy and a sense of community ownership [7]. This approach leverages indigenous social capital to facilitate contemporary digital transformation.

- EdTech and Digital Education

Platforms like OLE Nepal and eLearn are actively providing quality digital content to students in rural and underserved areas. However, these initiatives require more

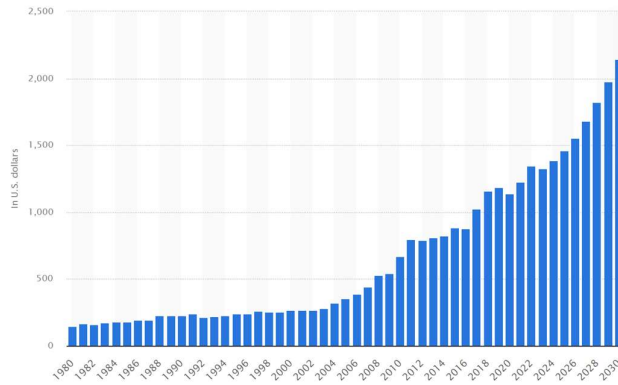
institutional support and expanded access to technology. The integration of digital tools and platforms into the education system significantly enhances the potential for knowledge transformation and fosters inclusive education.

5.5 Challenge: Low Investment in Research and Development (R&D)

A significant current challenge in Nepal is the limited collaboration between universities and the industrial sector. Investment from both government and private sectors in research is extremely low, which impedes the generation of new knowledge and innovation.

- **Nepal's Potential for "Society 5.0": Localizing the Transformation**
A digitally empowered, inclusive society, characteristic of Society 5.0, is achievable for a developing country like Nepal with a long-term vision. Society 5.0 aims to solve societal problems by utilizing technologies based on the Fourth Industrial Revolution (e.g., AI, IoT, Big Data, Robotics). Nepal can advance its localized version of this concept through "digital inclusivity" and "innovation in public services."
- **Strengthening Digital Infrastructure**
To lay the foundation for Society 5.0 in Nepal, the implementation of 5G networks, smart city initiatives, and robust cybersecurity policies is essential. The Digital Nepal Framework 2019 prioritizes Information Technology Infrastructure as the first among its eight key areas [6]. Smart city development (with initial efforts seen in Dharan, Pokhara, and Lalitpur, for instance) needs to be integrated with AI, IoT, and Geographic Information Systems (GIS) for comprehensive planning and execution.
- **Promoting Youth Entrepreneurship and Startup Culture**
The fundamental drivers of Society 5.0 are young innovators and entrepreneurs. While Nepal's startup ecosystem is nascent, it faces significant weaknesses in policy, investment, and structural support. Key challenges include the absence of a dedicated Startup Act, complexities in tax and registration processes, and the instability of Startup Funds. There is an urgent need to strengthen mentorship programs, innovation hubs, and university-industry collaboration.
- **Localization of Technology and Social Impact**
Nepal should develop a strategy for Society 5.0 that goes beyond merely "importing technology." Instead, it must focus on utilizing technology to address local problems and generate meaningful social impact. This localized approach will ensure that technological advancements genuinely serve the needs and context of Nepali society.

Figure 1: *Gross domestic product (GDP) per capita from 1980 to 2030 in Nepal (in U.S. dollars)*



- Nepal's Position in the Global Innovation Index**
 According to the Global Innovation Index (GII) 2024, Nepal ranks 109th out of 133 countries. This index assesses countries' innovation capabilities based on 80 distinct indicators, encompassing various inputs like academic and infrastructural development, and institutional frameworks, as well as outputs such as technology, knowledge creation, and creative goods. Nepal's current ranking highlights the imperative for further enhancements within its national innovation system.

Figure 2: Nepal's Global Innovation Index 2024 Ranking

Science and innovation investment				
Scientific publications	R&D investments	Venture capital		International patent filings
		Deal numbers	Deal values	
▼ -17% 2022 - 2023	n/a	n/a	n/a	n/a
▲ 11% 2013 - 2023	n/a	n/a	n/a	n/a

Technology adoption				
Safe sanitation	Connectivity		Robots	Electric vehicles
	Fixed broadband	5G		
▼ -0.1% 2021 - 2022	▼ -2.3% 2020 - 2021	n/a	n/a	n/a
▲ 5% 2012 - 2022	▲ 28.4% 2011 - 2021	n/a	n/a	n/a
50.6 per 100 inhabitants in 2022	4.2 per 100 inhabitants in 2021	n/a	n/a	n/a

Nepal ranks 109th among the 133 economies featured in the GII 2024. The Global Innovation Index (GII) ranks world economies according to their innovation capabilities. Consisting of roughly 80 indicators, grouped into innovation inputs and outputs, the GII aims to capture the multi-dimensional facets of innovation

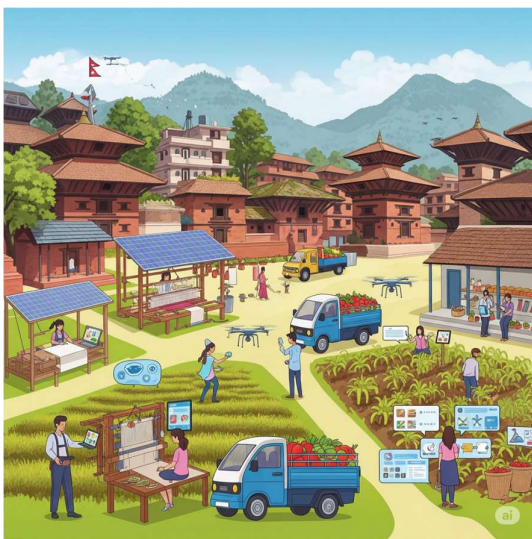
5.6 From Society 4.0 to Society 5.0: The Role of Data and Digital Transformation

- The transition from Society 4.0 to Society 5.0 aims to build a human-centered society fundamentally driven by technology. While Society 4.0 primarily emphasized data

generation through the use of digital tools in industries (e.g., Internet of Things, sensors, robots, internet access), Society 5.0 embraces the analysis, processing, and autonomous decision-making capabilities derived from this data, largely facilitated by Artificial Intelligence (AI) technology. This entire transformative process is termed digital transformation.

- **Transforming Nepali Agriculture: The Potential for Multidimensional Development**
The agricultural sector encompasses numerous dimensions and can be categorized based on its system or inherent characteristics. While some agricultural practices remain deeply traditional, others have begun to adopt features of Society 5.0. Although Nepali agriculture, as a whole, is still in an earlier developmental stage, developing it into an industry—and creating conditions where this industry is controlled by technology-driven systems—could enable the resulting data structures to shape the future of society. This implies that if we can rapidly industrialize agriculture, our society could experience a two or three-dimensional transformation within a single phase. This would significantly ease the transition directly from Society 2.0 (Agrarian Society) to Society 5.0 (Super Smart Society).
- The concept of "Society 4.0" is intrinsically linked to the Fourth Industrial Revolution, which necessitates the integration of digital technologies into production systems. This involves developing systems where factories are equipped with IoT (Internet of Things), sensors, and robots to generate data. These advancements not only make industries smarter but also fulfill society's need for robust digital infrastructure.
- To enter Society 5.0, the generated data is then leveraged by Artificial Intelligence (AI) to make decisions that streamline human lives. This vision proposes automated, smart, and human-friendly solutions across various sectors including education, healthcare, energy, agricultural systems, and transportation.

Figure 3: *Concept of society 5.0*



Source: *Concept of society 5.0, AI Generate Image*

5.7 Nepal's Industrial Transformation Journey: From Micro and Cottage Industries Towards an Industrial Society (3.0)

Nepal is currently in the initial stages of an industrial society. The industrial sector's contribution to Nepal's Gross Domestic Product (GDP) currently stands at approximately 15% (Source: Nepal Rastra Bank, 2080 B.S.). In contrast, a minimum of 30% industrial contribution to GDP is generally considered necessary for a country to be classified as an Industrial Society (Industry 3.0), according to World Bank standards. This indicates that Nepal largely remains in the "Society 2.0" (agrarian society) phase, where the economy is based on traditional agricultural systems and production processes are still predominantly manual or low-tech.

Path to Solution: Micro and Small Enterprises, and Local Production Cycles

For Nepal to progress towards an industrial society, it's essential to initiate economic transformation from the grassroots level. Key strategies include:

- Promoting micro and small enterprises (SMEs) to boost employment and local production.

- Developing multi-chain companies to effectively link agriculture, industry, and markets.

- Encouraging self-income generation to engage youth and farmers in entrepreneurship, thereby initiating the shift towards an industrial system.

Table 2: Transformation Strategy: Society 2.0 → 3.0 → 4.0

Stage	Characteristics	Nepal's Current Status	Goal
Society 2.0	Agrarian-based society	Agriculture's GDP contribution > 25%, Industry < 15%	Establish small-scale industries
Society 3.0	Industrial society	Industry's contribution < 30%	Develop mini-factories and chain models
Society 4.0	Digital, Smart Industry	Initiation of IoT, Robotics	Data production and AI readiness

5.8 Implementing Society 5.0 in Nepal: A Phased Approach

Nepal's advancement toward Society 5.0—a technology-enabled, human-centered societal model—demands a carefully phased strategy rather than a rapid, uncoordinated transition. Central to this evolution is the purposeful use of digital transformation to tackle pressing societal challenges (Cabinet Office, Government of Japan, 2019).

Phase 1: Strategic Entry Point Selection

The first step involves selecting an issue with significant societal relevance. Ideal criteria include wide-reaching impact (e.g., on farmers), scalability across urban and rural settings, compatibility with technologies such as IoT and AI, and alignment with existing government policies. One promising example is the deployment of "Smart Crop Monitoring" systems. With more than 60% of Nepal's population engaged in agriculture and up to 40% of crop yields lost due to poor decisions, data-driven farming solutions could deliver transformative results (IFC, 2021).

Phase 2: Development of a Minimum Viable Product (MVP)

A practical MVP should integrate the following components:

- **Hardware:** Soil sensors and solar-powered IoT devices to support remote and off-grid locations.
- **Software:** A mobile-friendly platform accessible via SMS or USSD to ensure broad usability, even on basic phones.
- **Data Integration:** Real-time environmental inputs, including weather and soil data, fed into AI algorithms to guide decisions on irrigation, fertilization, and harvesting.

For instance, a farmer in Dang might receive an automated text message: “Soil moisture is low for mushroom crops—consider irrigating between 3–4 PM today.”

5.9 From Society 4.0 to Society 5.0: Leveraging Data for Human-Centric Outcomes

The transition from Society 4.0, characterized by digitally optimized industrial processes using technologies like IoT, robotics, and sensors, to Society 5.0 involves utilizing that same digital data in more autonomous and people-oriented ways. Through artificial intelligence, this data is transformed into actionable insights that enable self-operating systems across sectors such as agriculture, energy, healthcare, education, and transportation. This marks the foundation of a full-scale digital transformation where technology proactively supports human well-being (Japan Science and Technology Agency, 2023; Keidanren, 2018).

5.10 Nepal's Path to Society 5.0: Building an Industrial Foundation

For Nepal to fully transition into Society 5.0—a highly advanced, data-driven, and human-centric society—it must first develop a solid industrial foundation aligned with the principles of Society 4.0. At present, Nepal’s economy is still heavily reliant on agriculture, and most of its industries are engaged in basic operations such as raw material collection. These sectors lack the digital infrastructure needed for advanced technologies like robotics, IoT, and smart data-driven systems (National Planning Commission [NPC], 2020).

5.11 Agricultural Transformation as a Catalyst for Multidimensional Development

Nepal’s agricultural sector, though largely traditional, holds transformative potential. Certain segments have begun to incorporate modern, smart agriculture features consistent with Society 5.0. If agriculture can be industrialized and governed by automated, technology-based systems, the resulting data structures could serve as the backbone of a future smart society (Sharma & Gautam, 2022). This strategy would enable Nepal to bypass incremental development stages and potentially leap directly from Society 2.0 (agrarian) to Society 5.0 (super-smart), resulting in layered or multidimensional socioeconomic transformations within a single generational shift.

5.12 Pathway to Society 5.0: Ground-Up Industrialization

A crucial step for Nepal is initiating economic transformation at the grassroots level. To move into Society 3.0 (industrial society), the industrial sector’s contribution to GDP must exceed 30%. This can be achieved by promoting micro-enterprises, cooperative-based value chains, and locally sustained ventures (Bhattarai, 2021). These foundational efforts are prerequisites for the transition to Society 4.0, where data generation and digital tools such as AI and IoT become central.

Ultimately, achieving Society 5.0 in Nepal requires a clear focus on local industrial development, capacity-building for a skilled workforce, and establishing market-responsive production systems. These efforts collectively pave the way toward an inclusive, efficient, and data-enabled smart future (Japan Science and Technology Agency [JST], 2023).

For example:

Traditional Agriculture (Society 2.0): A farmer tills the land manually, sows seeds based on weather predictions, and uses traditional methods for pest control. Data collection is not systematic, and decisions are based on experience.

Toward a Technology-Controlled Agricultural Industry (Moving toward Society 5.0):

The farmer uses smart sensors to measure soil moisture and nutrient levels.

Drone-captured images are analyzed using artificial intelligence (AI) to detect diseases or pests in crops.

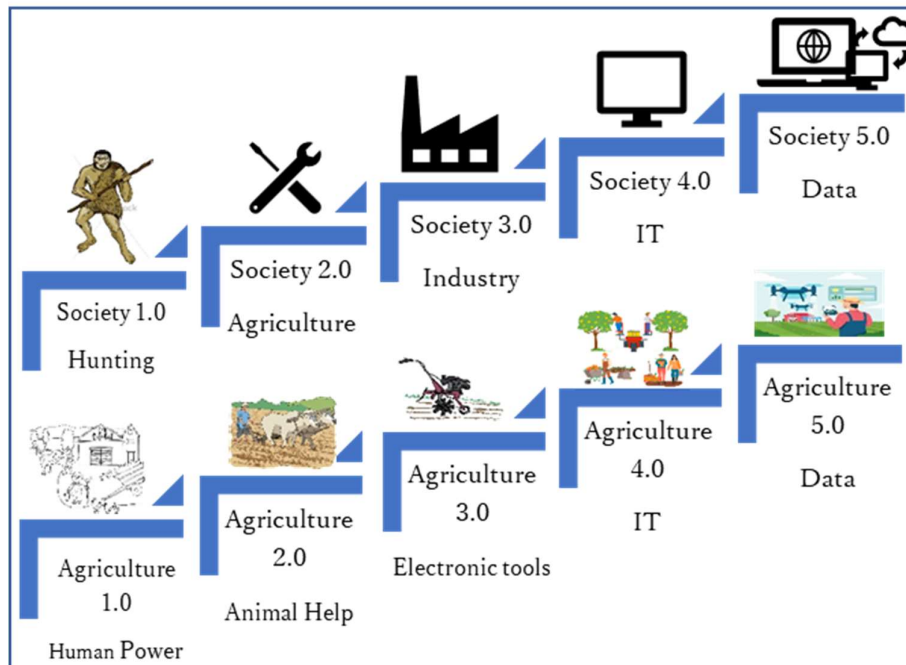
Irrigation systems are automated and provide water only when necessary.

Data related to production, weather, soil conditions, and market prices is recorded digitally.

This data is analyzed to make smart decisions, such as selecting the best crops for future seasons, determining the appropriate amount of fertilizer and water, and aligning production with market demand.

Thus, the use of technology in agriculture transforms it from a mere means of livelihood into a high-productivity, data-driven industry, accelerating the overall development of society.

Figure 4: *Evaluation of Society*



6. Challenges in the Nepalese Context

While the vision of Society 5.0 presents transformative potential for Nepal, several structural and systemic obstacles must be addressed for its successful implementation.

6.1 Inadequate Infrastructure

Across many parts of the country, Nepal struggles with underdeveloped infrastructure—such as inconsistent electricity, limited broadband access, and inefficient transportation systems. These gaps hinder the deployment of smart technologies and limit the reach of digital services in sectors like healthcare, education, and agriculture (National Planning Commission [NPC], 2020).

6.2 Weak Policy and government Mechanism

Although the Digital Nepal Framework has been introduced, the absence of integrated policy coordination, clear regulatory frameworks, and a unified strategic direction remains a barrier. This hampers the seamless and ethical incorporation of advanced technologies like artificial intelligence (AI), the Internet of Things (IoT), and big data (Bhattarai & Sharma, 2021).

6.3 Limited Digital Literacy and Skills

A significant portion of the population—including farmers, educators, and healthcare workers—lacks the foundational digital competencies required to engage meaningfully with emerging technologies. Without targeted digital literacy campaigns and capacity-building programs, inclusive participation in Society 5.0 will be difficult to achieve (UNDP Nepal, 2022).

6.4 Brain Drain and Human Capital Deficit

Nepal faces persistent challenges in retaining its skilled workforce. Many trained professionals in fields such as IT, engineering, and innovation migrate abroad for better career prospects, weakening the country's ability to build and sustain a knowledge-based digital economy (Khanal, 2020).

6.5 Cybersecurity and Data Privacy Issues

As digitalization progresses, cybersecurity threats and data privacy concerns become increasingly pressing. Nepal currently lacks comprehensive data protection laws and well-defined cyber governance protocols, which undermines trust in digital systems and poses risks to sensitive information (Cyber Security Policy of Nepal, 2021).

6.6 Widening Digital Divide

Digital inequity between urban and rural areas continues to be a major concern. Many remote communities lack access to reliable internet, smart devices, and ICT education, effectively excluding them from participating in a digitally connected society (World Bank, 2023).

7. The way forward

Achieving the vision of Society 5.0 in Nepal—a society centered on human needs and driven by advanced digital technologies—requires a comprehensive, multi-stakeholder approach. This strategy involves coordinated efforts from the government, private sector, academia, civil society, and global development agencies. Such collaboration ensures that digital transformation is not only technically effective but also inclusive, locally relevant, and sustainable (National Planning Commission [NPC], 2020).

7.1 Major Strategic Focus Areas for Advancing Society 5.0 in Nepal

7.1.1 Strengthening Digital Infrastructure

Establishing widespread access to high-quality internet, consistent electricity, and intelligent communication networks is essential. These infrastructures must be extended beyond urban areas to ensure rural populations also benefit from the digital revolution (World Bank, 2023).

7.1.2 Advancing Digital Literacy

Digital competencies should be integrated into both formal education and continuous learning initiatives. Targeted training is especially important for disadvantaged groups to enable their full participation in the digital economy (UNDP Nepal, 2022).

7.1.3 Encouraging Innovation and Research

Investment in local innovation ecosystems—through research funding, academia-industry collaboration, and joint ventures—can lead to context-specific technological solutions that align with Nepal’s development goals (Bhattarai & Sharma, 2021).

7.1.4 Establishing inclusive policies and regulations

Policy frameworks need to cover aspects such as equitable access to technology, data ethics, AI usage, and privacy protection. These regulations must balance innovation with individual rights and social justice (Cyber Security Policy of Nepal, 2021).

7.1.5 Supporting Startups and Entrepreneurship

Empowering startups, particularly in areas like agriculture, education, and health technologies, can stimulate job creation and innovation. Providing financial support, mentorship, and incubation platforms is key to nurturing this ecosystem (Khanal, 2020).

7.1.6 Promoting Public Awareness and Cultural Alignment

Transitioning to Society 5.0 requires cultural readiness. Awareness campaigns and community dialogues can help bridge the gap between people and technology, fostering trust and adaptability (Asian Development Bank [ADB], 2021).

7.1.7 Developing Cybersecurity and Data Protection Mechanisms

With the growth of digital platforms, Nepal must implement strong cybersecurity frameworks to protect personal data and digital systems. Institutional development and comprehensive legal provisions are critical to achieving digital trust and resilience (Cyber Security Policy of Nepal, 2021).

8. Discussion

Society 5.0 signifies a shift towards a human-centered society driven by technologies like AI, IoT, big data, and robotics (Sutthichaimethee et al., 2020). Unlike earlier stages that mainly concentrated on industrial or digital growth, it emphasizes innovation aimed at promoting inclusivity, sustainability, and well-being (Cabinet Office, Government of Japan, 2019).

In Nepal, digital tools are already enhancing governance and education by increasing transparency, improving service delivery, and expanding access to learning (Government of Nepal, 2022; MoCIT, 2019). Nevertheless, challenges such as insufficient infrastructure, low levels of digital literacy, and uneven connectivity remain obstacles to progress (World Bank, 2023; Asian Development Bank, 2021).

Agriculture provides a critical opportunity for digital transformation, with smart farming technologies showing promise for boosting productivity and livelihoods (IFC, 2021). To achieve success, Nepal needs to adopt coordinated strategies involving government, academia, and industry, modeled on the “triple helix” framework (Carayannis & Campbell, 2010).

Aligned with the Sustainable Development Goals, Society 5.0 offers a framework to tackle broader societal challenges through technology (World Commission on Environment and Development, 1987). For Nepal, advancing this vision requires strategic investment, inclusive policymaking, and a gradual approach to build a resilient and fair society.

9. Conclusion

Nepal should prioritize promoting small entrepreneurship and startups to advance toward Society 3.0, aiming for industry to contribute at least 30% of GDP. While agriculture remains traditional, increased mechanization and direct market access can drive progress to Society 3.0. The integration of app-controlled machinery and data generation can create jobs and propel Nepal into Society 4.0. Eventually, automation and smart farming will reduce labor and usher in Society 5.0. Given that over 60% of Nepal’s population depends on agriculture, even an agrarian society can achieve this future by adopting industrial characteristics. For Nepal’s multi-speed development, a strategic, phased approach focused on building a robust industrial base and embracing smart, data-driven industries is essential for successful digital transformation.

The adoption of Society 5.0 digital technologies is transforming Nepal’s government and education sectors by boosting efficiency, transparency, and accessibility. In governance, AI and automation facilitate more citizen-centered services, while digital education tools improve access and customize learning experiences. To build a smart and inclusive society in line with the global vision of Society 5.0, Nepal needs to focus on strengthening digital infrastructure, enhancing skills, and implementing inclusive policies that ensure technological benefits reach everyone.

Agriculture, as a high-impact sector, offers Nepal a practical entry point for digital development. Initiatives like AI-powered “Smart Crop Monitoring” can improve farmers’ decisions and reduce crop losses, potentially accelerating Nepal’s leap from Society 2.0 directly to Society 5.0. Success hinges on local industrialization, skill development, market-

focused production, and robust digital infrastructure. By promoting innovation and inclusive policies, Nepal can achieve a smart, equitable, and sustainable future aligned with the global vision of Society 5.0.

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