National Research Journal of Social Sciences
Volume-10, Issue-1, January-June 2025
PP: 45-51
ISSN: 2348-473X
Peer Reviewed & Refereed Journal (IF: 6.74)
Journal Website: www.nrjss.in

A HISTORICAL REVIEW OF DIGITALIZATION: TECHNOLOGICAL PROGRESS AND SOCIETAL CHANGE

Deepa S V

Associate Professor, Dept. of Sociology, GFGC, Yelahanka

ABSTRACT

This review traces the **historical trajectory of digitalization**, analysing its symbiotic relationship with **technological progress** and profound societal transformation. Beginning with the advent of solid-state electronics and computing in the mid-20th century, digitalization represents a fundamental shift from analog **to digital data representation** and processing. The paper first establishes a conceptual framework, differentiating between digitization (the conversion of information) and digitalization (the use of digital technology to transform business models and interactions), leading to digital transformation (the societal and organizational effects). A review of the extant literature reveals a recurring theme: digitalization serves as both an accelerator of innovation, exemplified by the rise of the internet and AI, and a powerful disruptive force impacting labour markets, social institutions, and individual identity. Sociological perspectives highlight the dual nature of this change, creating opportunities like global connectivity and economic growth, while simultaneously posing challenges related to the digital divide, data privacy, and algorithmic bias. The study identifies research gaps in the long-term ethical governance of generative AI and the disproportionate impact on marginalized communities. Ultimately, this review underscores that digitalization is not merely a technological upgrade but a continuous, complex process of social metamorphosis, demanding proactive policy interventions and interdisciplinary study to maximize benefits and mitigate threats for a globally connected future.

Key Words: Digitalization, Societal Transformation, Technological Progress, Digital Transformation, Algorithmic Bias, Digital Divide, Generative AI, Network Society.

INTRODUCTION

One of the most important and rapidly changing paradigms in human history is digitalisation, which is radically altering how information is produced, stored, shared, and used. It is a process that involves more than just adopting new technology; it consists of integrating digital technologies into organisational procedures and daily life, radically changing social structures, business models, and individual behaviour (Brennen & Kreiss, 2016). From the initial transition from analogue to digital signals to the current hyper-connected, data-driven world, the history of digitalisation is one of rapid technological advancement. In order to understand the reciprocal relationship between advances in computing power and the ensuing profound societal changes, this review offers a historical analysis of this transformation.

CONCEPTUALIZATION

It is critical to distinguish three core terms (Hanelt et al., 2021):

- **Digitization:** The technical process of converting analog information (e.g., paper documents, sound waves) into a digital format (bits and bytes).
- **Digitalization:** The use of digitized data and digital technologies to simplify, improve, or change existing business processes, workflows, and social interactions.
- **Digital Transformation:** The holistic, strategic, and organizational change caused by

ISSN: 2348-473X
Peer Reviewed & Refereed Journal (IF: 6.74)
Journal Website: www.nrjss.in

the widespread adoption and integration of digital technologies, impacting an organization's culture, strategy, and social role. **Digitalization** is the primary mechanism driving **digital transformation**.

OBJECTIVES OF THE STUDY

The primary objectives of this review article are:

1. To provide a historical overview of the key phases of digitalization and associated technological progress.
2. To synthesize and review existing literature on the economic, social, and political impacts of digitalization.
3. To analyse the phenomenon of digitalization through relevant sociological perspectives.
4. To identify current research gaps and forecast future opportunities, challenges, and threats stemming from continuous digital advancement.

REVIEW OF LITERATURE

The body of literature on digitalization is vast and spans multiple disciplines, chronicling its evolution from a niche technical field to a dominant global force. A synthesis of key works reveals distinct phases and recurring themes.

a. **Tapscott, D. (1995). The digital economy:** Promise and peril in the age of networked intelligence: Early Economic Analysis: An early articulation of the internet's potential to reorganize commerce and industry, foreseeing the shift to a knowledge-based economy.

b. **Castells, M. (2000). The rise of the network society (2nd ed**.): Network Society Theory: Conceptualizes society organized around electronically processed information networks, arguing that the flow of capital and information structures contemporary social life. It focuses on Internet/Global Connectivity.

c. **Mokyr, J. (2002). The gifts of Athena: Historical origins of the knowledge economy:** Technological History: Places the current digital revolution within a broader historical context of technological and scientific knowledge accumulation that drives economic growth. This focuses on Pre-Digital and Foundational impact.

d. **Hilbert, M. (2012). How much information is there in the 'information age'?:** Data Quantification: Provides empirical data on the global capacity for storing, communicating, and computing information, offering a quantitative metric for the exponential growth of digitalization. This focuses on Big Data/Quantitative.

e. **Floridi, L. (2014). The fourth revolution: How the infosphere is reshaping human reality:** Information Ethics/Philosophy: Explores the philosophical implications of the digital age, coining "Infosphere" and examining issues of privacy, identity, and moral agency in a digitally saturated world. This focuses on Information Age Philosophy.

f. **Brennen, J. S., & Kreiss, D. (2016). Digitalization and the transformation of the public sphere:** Public Sphere: Differentiates 'digitization' from 'digitalization' in a political context, focusing on the transformation of how citizens communicate and engage in public discourse. This focuses on Social media/Political impact.

g. **Schwab, K. (2017). The fourth industrial revolution: Industry 4.0:** Focuses on the

ISSN: 2348-473X
Peer Reviewed & Refereed Journal (IF: 6.74)
Journal Website: www.nrjss.in

convergence of the physical, digital, and biological spheres through technologies like AI, IoT, and gene editing, emphasizing speed and scope of change. The impact is on AI/IoT/Emerging Tech.

h. **Zuboff, S. (2019). The age of surveillance capitalism:** Surveillance Capitalism: Details how personal data is extracted as a raw material for profit, highlighting the societal threat to individual autonomy and democratic processes. This focuses on Big Data/Mobile Data.

i. **Acemoglu, D., & Restrepo, P. (2019). Automation and new tasks:** How technology complements labor: Labor Economics: Analyzes the impact of automation and robotics, arguing that new technologies both substitute for existing tasks and create entirely new, complementary tasks for labor. This focuses on Automation/Employment.

These sources collectively establish that digitalization is a multifaceted, historically contextualized phenomenon characterized by unprecedented speed and scope of change, with profound implications for both economic productivity and social justice.

RESEARCH GAPS

Despite the extensive literature, several crucial research gaps remain:

- **Long-Term Ethical Management of Generative AI (The "Black Box"):** Ethical governance frameworks have not kept up with the rapid deployment of generative AI (such as LLMs and image generators). Research is required to mitigate the spread of deep fakes and false information and to develop legally binding accountability models for AI-driven outcomes.
- **Systemic Inequality and Digitalization:** The "digital divide" is widely known, but little is known about how, in non-Western, marginalized, or less developed global contexts, digitalization exacerbates pre-existing systemic inequalities (economic, gender, and racial).
- **The Effects of Constant Digital Connection on the Mind:** Beyond preliminary results, more longitudinal, evidence-based research is needed to fully understand the long-term effects of continuous connectivity, particularly on cognitive function, social capital, and mental health across various demographic cohorts.

SCOPE OF THE STUDY

This review primarily focuses on the period from the mid-20th century (the emergence of mainframe computing and the transistor) through the current era of Big Data, AI, and the Internet of Things (IoT). Geographically, the scope is global, contrasting effects in developed economies, which often drive the technology, with developing nations, which are often the recipients or late adopters, leading to differential social impact.

REVIEW FROM SOCIOLOGICAL PERSPECTIVES

The historical process of digitalization is fundamentally a sociological event, not just a technical one. Sociologists analyse how these technologies are adopted, resisted, and, crucially, how they reorganize social power, interaction, and institutions. Two major theoretical lenses dominate the analysis: the Network Society and Surveillance Capitalism.

THE NETWORK SOCIETY AND SOCIAL STRUCTURE

The concept of the **Network Society**, most prominently theorized by Manuel Castells (2000),

ISSN: 2348-473X
Peer Reviewed & Refereed Journal (IF: 6.74)
Journal Website: www.nrjss.in

posits that the fundamental structure of society is no longer defined by industrial production or traditional institutions, but by networks driven by digital information processing.

a. **Flows over Places:** In this framework, "flows" (of information, capital, technology, media, and people) become more important than "places" in determining social outcomes. This digital infrastructure facilitates a globalized, instantaneous economy that bypasses traditional geographical and political boundaries.

b. **Decentralization and Power:** Digitalization often leads to decentralization of information and communication (e.g., social media challenging traditional media), but also to new forms of centralized power concentrated in the nodes (hubs) that control the networks (e.g., large tech platforms).

IMPACT ON SOCIAL INSTITUTIONS

a. **Education:** Digitalization has shifted learning from physical classrooms to blended or fully remote models, challenging the traditional role of the teacher and making educational resources globally accessible, though unevenly distributed.

b. **Politics and Governance:** The rise of e-governance and digital campaigns has democratized information access, but also enabled the rapid spread of misinformation and sophisticated methods of targeted political influence, fundamentally altering democratic discourse (Brennen & Kreiss, 2016).

SURVEILLANCE CAPITALISM AND POWER DYNAMICS

Shoshana Zuboff's (2019) **theory of Surveillance Capitalism** offers a critical counterpoint, arguing that the dominant economic model of the internet era is based on the extraction of vast quantities of "behavioural surplus"—data generated from users' actions—which is then used to predict and modify future behaviour for profit.

a. **The Commodification of Experience:** Digitalization, through platforms and ubiquitous sensing devices (smartphones, IoT), turns everyday human experience into free raw material that is fed into "machine intelligence" products. This commodification fundamentally alters the relationship between individuals and the economy.

b. **Asymmetry of Knowledge and Power:** This model creates a profound asymmetry of knowledge and power. Corporations and states possess predictive capabilities derived from collective data that individuals can neither see nor influence, posing significant threats to personal autonomy and democratic decision-making (O'Neil, 2016).

c. **The Algorithmic Self:** Sociologically, this leads to the "algorithmic self," where identity and opportunity are increasingly mediated and constrained by opaque algorithms (e.g., credit scoring, hiring software, content feeds). This reinforces societal biases and creates new forms of digital exclusion.

In summary, the sociological review reveals a fundamental paradox: digitalization simultaneously offers the utopian promise of global connectivity and decentralized power (The Network Society) while creating a deeply entrenched, opaque system of behavioural control and data exploitation (Surveillance Capitalism).

OPPORTUNITIES, CHALLENGES, AND THREATS OF DIGITALIZATION

Digitalization is a classic example of a "double-edged sword," generating immense positive potential while simultaneously creating substantial risks that must be managed.

ISSN: 2348-473X
Peer Reviewed & Refereed Journal (IF: 6.74)
Journal Website: www.nrjss.in

Dimension	Opportunities (Benefits)	Challenges (Difficulties in implementation	Threats (Existential/Systematic Risks)
Economic	Productivity & Efficiency: Automation, real-time supply chains, and AI-driven optimization (Industry 4.0).	Skills Gap: Rapid obsolescence of traditional skills, demanding massive investment in up-skilling and re-skilling the workforce (Acemoglu & Restrepo, 2019).	Job Displacement: Widespread structural unemployment due to automation of cognitive and manual routine tasks.
Social & Cultural	Global Connectivity: Instantaneous communication, reduced geographic barriers, and access to global knowledge resources.	Digital Divide: Entrenchment of inequality where access to technology, high-speed internet, and digital literacy is unevenly distributed across socioeconomic groups.	Erosion of Privacy: Pervasive surveillance (governmental and corporate) and the loss of anonymity, threatening individual autonomy and freedom (Zuboff, 2019).
Technological & Political	Innovation: Accelerated R&D, creation of entirely new industries (e.g., FinTech, BioTech), and personalized services.	Data Governance: Lack of global or consistent legal frameworks (e.g., GDPR equivalent) to regulate cross-border data flows and enforce platform accountability.	Cyber security & Warfare: Increased vulnerability of critical infrastructure (power grids, financial systems) to sophisticated cyber-attacks and state-sponsored information warfare.
Ethical	Transparency: Potential for Blockchain and open-source models to improve transparency in governance and supply chains.	Algorithmic Bias: Machine learning models that perpetuate or amplify human biases (racial, gender) in automated decision-making (O'Neil, 2016).	Manipulation & Disinformation: The systemic weaponization of digital platforms for mass psychological manipulation, undermining trust in institutions and the democratic process.

IMPACT OF DIGITALIZATION ON TECHNOLOGICAL PROGRESS AND SOCIAL TRANSFORMATION

Digitalization is the fundamental engine driving both technological evolution and large-scale societal metamorphosis.

IMPACT ON TECHNOLOGICAL PROGRESS

Digitalization has not just produced new tools; it has created a feedback loop where digital capacity accelerates the rate of scientific discovery itself. This is evident in two key areas:

ISSN: 2348-473X
Peer Reviewed & Refereed Journal (IF: 6.74)
Journal Website: www.nrjss.in

1. **Artificial Intelligence (AI) and Big Data:** The ability to digitally capture, store, and process petabytes of data (Hilbert, 2012) gave rise to modern machine learning. Example: AI-driven drug discovery, where algorithms analyse millions of chemical compounds and protein interactions in a fraction of the time a human researcher could, dramatically accelerating the drug development pipeline.
2. **The Internet of Things (IoT) and Ubiquitous Computing:** By embedding sensors and connectivity into everyday physical objects, digitalization has merged the physical and digital worlds. Example: Smart Cities use interconnected sensors to optimize traffic flow, manage energy consumption in real-time, and detect structural faults in infrastructure, leading to measurable improvements in urban efficiency and sustainability.

IMPACT ON SOCIAL TRANSFORMATION

Digitalization has profoundly altered the structures of daily life, labour, and citizenship.

a. **Transformation of Work and Labour:** The rise of digital platforms has enabled remote work and the "gig economy," fundamentally decoupling work from a specific physical location. Example: Companies like GitLab operate fully remotely, employing thousands globally, demonstrating a permanent shift away from the centralized office structure. However, this is offset by the precariousness and lack of benefits often associated with digital labour platforms like Uber or TaskRabbit.

b. **Financial Inclusion and E-Governance:** Digital mobile technologies have provided financial access to previously "unbanked" populations, particularly in developing economies. Example: M-Pesa in Kenya, a mobile money transfer system, allows millions to conduct transactions, save money, and access credit via basic mobile phones, drastically improving economic inclusion and reducing reliance on physical cash and infrastructure.

c. **The Transformation of Social Movement and Activism:** Digital platforms offer marginalized groups a powerful tool for self-organization and voicing dissent. Example: Movements like the Arab Spring or #MeToo leveraged social media to rapidly coordinate, share information outside of state-controlled media, and mobilize large-scale social action, demonstrating the democratizing, yet volatile, power of digital communication.

FUTURE OPPORTUNITIES

The continuous evolution of digitalization presents transformative future opportunities, particularly in solving complex global challenges.

a. **Personalized and Precision Everything:** Future digitalization will move towards hyper-personalization, driven by the convergence of AI, biotech, and data. Opportunity: Precision Medicine, where treatments are tailored not just to a disease but to an individual's specific genetic profile and real-time physiological data collected by wearables, promising unprecedented healthcare outcomes.

b. **Sustainable Digitalization:** Digital twin technology and advanced AI optimization can drastically improve resource efficiency. Opportunity: Creating digital twins of entire countries or major industrial complexes allows for large-scale, low-risk simulation of energy transition strategies and climate interventions, optimizing sustainable resource use before real-world implementation.

ISSN: 2348-473X
Peer Reviewed & Refereed Journal (IF: 6.74)
Journal Website: www.nrjss.in

c. **Decentralized Trust (Web3):** Technologies like blockchain and distributed ledger technology (DLT) offer the potential to create trustless, transparent systems. Opportunity: Decentralized Autonomous Organizations (DAOs) could allow for new models of organizational governance and asset management, while secure digital identity systems could empower individuals with sovereign control over their data, mitigating threats of surveillance capitalism.

CONCLUSION

This review article traces the historical evolution of digitalization, distinguishing it from mere digitization and positioning it as the engine of modern digital transformation. Beginning with mid-20th-century computing, digitalization created a feedback loop that accelerated technological progress, leading to the current era of AI, Big Data, and the IoT.

Sociologically, the shift is analysed through the lens of the Network Society, which emphasizes global flows, and Surveillance Capitalism, which critiques the profit-driven extraction of behavioural data, highlighting a profound asymmetry of power. The process offers immense opportunities like global connectivity and economic productivity, but also presents significant threats, including the digital divide, algorithmic bias, and systemic cybersecurity risks. The article calls for proactive governance to mitigate these threats, concluding that digitalization is a continuous social metamorphosis demanding interdisciplinary study and ethical policy-making.

REFERENCES

1. Acemoglu, D., & Restrepo, P. (2019). Automation and new tasks: How technology complements labor. Journal of the European Economic Association, 17(6), 1851–1896.
2. Brennen, J. S., & Kreiss, D. (2016). Digitalization and the transformation of the public sphere. In S. H. K. H. H. B. O. (Ed.), The SAGE Handbook of Social Media (pp. 53–71). SAGE Publications.
3. Castells, M. (2000). The rise of the network society (2nd ed.). Blackwell Publishers.
4. Floridi, L. (2014). The fourth revolution: How the infosphere is reshaping human reality. Oxford University Press.
5. Hanelt, A., Bohnsack, R., Marz, D., & Antunes, J. (2021). Digital transformation and organizational change: Socio-technical perspectives. Electronic Markets, 31(3), 577–598.
6. Hilbert, M. (2012). How much information is there in the 'information age'? International Journal of Communication, 6, 1042–1052.
7. Mokyr, J. (2002). The gifts of Athena: Historical origins of the knowledge economy. Princeton University Press.
8. O'Neil, C. (2016). Weapons of math destruction: How big data increases inequality and threatens democracy. Crown.
9. Schwab, K. (2017). The fourth industrial revolution. Crown Business.
10. Tapscott, D. (1995). The digital economy: Promise and peril in the age of networked intelligence. McGraw-Hill.
11. Zuboff, S. (2019). The age of surveillance capitalism: The fight for a human future at the new frontier of power. Public Affairs.