

“The Impact of Digital Transformation on the Efficiency and Productivity of Nepalese Commercial Banks.”

**Presented By: Umesh Giri
2426565**

Background of the Study

- The global banking industry is experiencing rapid digital transformation due to ICT advancements and fintech competition.
- Banks are adopting mobile banking, cloud computing, data analytics, and automation to cut costs and improve service quality.
- COVID-19 significantly accelerated reliance on digital channels, making digital capability essential (He et al., 2021).
- Digital transformation, however, is costly and raises questions about whether it truly improves efficiency and productivity.

Need for Efficiency Measurement

- Despite high digital investments, actual performance gains remain unclear .
- Many international studies report mixed effects of digitalization on performance due to technological, organizational, and regulatory differences.
- Advanced tools like DEA and the Malmquist Index help quantify real efficiency and productivity changes (Coelli et al., 2005; Zhang et al., 2024).

The Banking Sector in Nepal

- Nepal's financial system is dominated by Class A commercial banks, holding most financial assets and deposits.
- Regulatory reforms and mergers have strengthened capital, governance, and risk frameworks.
- NRB has promoted digitalization with connectIPS, QR interoperability, and the National Payment Switch.
- Digital transactions have grown rapidly, especially mobile and QR payments.

Digitalization Challenges in Nepal

- Banks still operate legacy core systems alongside modern platforms, causing integration challenges.
- Cybersecurity and data protection risks are increasing (He et al., 2021).
- Uneven digital adoption across rural vs. urban areas limits inclusive progress.
- These challenges make Nepal an ideal context to study the impact of digital transformation on efficiency.

Objectives of the Study

- Evaluate the extent of digital transformation implemented across Nepalese commercial banks.
- Assess the relationship between digital transformation and operational efficiency.
- Analyse the impact of digital transformation on employee productivity.
- Identify organisational, technological, and regulatory barriers constraining successful digital adoption.

Research Questions

- To what degree have Nepalese commercial banks adopted digital transformation initiatives?
- How does digital transformation influence operational efficiency within commercial banks?
- In what ways does digital transformation affect employee productivity?
- What key challenges inhibit the effective implementation of digital transformation?

Significance of the Study

- This paper will combine theory of digital transformation and the Paradigm shift Theory of Thomas Kuhn to conceptualise the evolution of the banking system in the setting of emerging economies
- Helps banks understand whether digital investments yield measurable performance benefits.
- Supports NRB's policymaking in modern payment systems, digital finance, and cybersecurity.

Literature Review & Theoretical Foundation

Evolution of Nepalese Banking

- Nepal's banking sector expanded through reforms, consolidation and technology-driven service diversification (NRB, 2024).
- Digital channels—mobile banking, QR payments and online transfers—have grown rapidly since 2020 (IFC, 2025).

Historical Reforms and Mergers

- NRB's consolidation policies created larger banks with greater capacity for digital investment **(NRB, 2024)**.
- Post-merger integration enabled core system upgrades and strengthened digital infrastructure **(IFC, 2025)**.

Digital Transformation in Nepal

National initiatives such as QR interoperability, connectIPS and national payment switch accelerated digital adoption **(NRB, 2024)**.

COVID-19 restrictions pushed customers toward mobile and online channels, boosting transaction volumes **(Republica, 2024)**.

Digitalization Challenges in Nepal

- Legacy core banking systems and integration complexity slow full-scale digital transformation **(IFC, 2025)**.
- Cyber security and privacy concerns have significantly affected customers' willingness to use e-banking in Nepal **(Joshi, 2025)**.

Global Digital Transformation Evidence

- Global studies report that digitalisation improves bank productivity and cost efficiency after initial investment stages (Ayadi et al., 2025).
- Efficiency gains vary by bank size, technology readiness and digital maturity (Gherțescu et al., 2024).

Evidence from Emerging Markets

- Emerging markets show a U-shaped trend where digital investments initially reduce efficiency before generating long-run gains (Chen et al., 2021).
- Bank efficiency improvements depend on infrastructure quality, regulation and customer adoption rates (Phan et al., 2020).

Digital transformation theory

- Technology Adoption
- Process transformation
- Customer Centric Approach
- Business innovation center

Theoretical Frameworks (Overview)

Kuhn's Paradigm Shift Theory

- Kuhn argues that paradigms shift when existing systems can no longer solve emerging problems (Kuhn, 1996).
- COVID-19 accelerated this shift toward a digital-first operational paradigm (He et al., 2021).

Kuhn's paradigm shift in banking

Traditional “Branch-Centric” Paradigm:

- Banking historically operated through physical branches, paper processes, and face-to-face services
- Improvements were incremental (extra counters, minor process tweaks).
- Performance assessed using branch numbers, staff ratios, and basic financial metrics.

Accumulation of Anomalies

- FinTechs, mobile wallets, and BigTech platforms challenged traditional models
- Customer expectations shifted toward 24/7 access, instant payments, and seamless digital experiences
- In Nepal, rapid adoption of QR payments, mobile banking, and interoperable platforms signaled a new service model

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Crisis Trigger: COVID-19

- Branch-centric model proved vulnerable during lockdowns
- Digitally advanced banks maintained service continuity; others struggled.
- Regulators accelerated digital payment reforms

Relevance to This Research

- Digital transformation represents a **structural paradigm shift**, not just technology adoption in Nepal's banks
- DEA & Malmquist align with paradigm theory:

Efficiency change = catching up to new best practice and Technical **change** = the frontier shifting as the paradigm evolves

- Transition is **uneven**: some banks lead, others lag
- The Digital Transformation Index captures how far each bank has moved into the new paradigm
- Paradigm-sensitive metrics (DEA & productivity) reveal performance changes better than traditional metrics

Literature Gap

- No Nepalese study combines digitalization indicators with DEA and Malmquist productivity analysis.
- Lack of Digital Transformation Index (DTI) construction in Nepalese context.

Research Design

Quantitative Phase

- DEA & Malmquist for efficiency and productivity
- Panel econometrics for determinants
- Panel of Nepalese commercial banks with annual data 2016–2025. Aim for all banks with complete annual reports (target 20 banks).
- **NRB Banking & Financial Statistics and commercial bank** (balance sheet, income, staffing)
- **NRB Payment System Reports** (digital transaction volume/value)

Qualitative phase

- Qualitative data collected via **semi-structured interviews** with bank staff.
- Interviews will be conducted face-to-face or via secure online platforms, depending on feasibility, and are expected to last between 30 and 45 minutes. With informed consent, interviews will be audio-recorded and later transcribed; where recording is not permitted, detailed notes will be taken.

DEA Inputs & Outputs

- Based on the intermediation approach (Sealey & Lindley, 1977; Berger & Humphrey, 1997):
 - **Inputs**
 - Loanable funds (deposits + borrowings)
 - Labour (FTE employees)
 - Physical capital (fixed assets including IT capital)
 - Interest expense (price of funds)
 - **Outputs**
 - Loans and advances
 - Interest income
 - Fee and commission income
 - Digital transactions (volume/value)

Digital Transformation Index (DTI)

DTI constructed using multiple indicators:

- ICT expenditure (% of assets)
- IT capital (% of fixed assets)
- Active digital users (% of customers)
- Digital transaction share (volume/value)
- Indicators are normalized and combined using **PCA** or standardized averaging

Data Envelopment Analysis (DEA)

- An **input-oriented DEA** model evaluates technical efficiency under:
- **CRS (CCR model)**: overall efficiency
- **VRS (BCC model)**: pure managerial efficiency
- Scale efficiency = CRS / VRS .
- Model rationale: banks control inputs more than outputs (Berger & Humphrey, 1997).

Malmquist Productivity Index

- **What it does:** MPI looks at entire sample bank performance **over time** (e.g., from last year to this year). It measures if bank **productivity** has improved or declined.
- **How:** It compares efficiency this year to last year, but it also considers another crucial factor: what if the "best-practice" standard itself has changed? (Maybe a new oven technology exists).
- The Malmquist Index measures **TFP change** (Färe et al., 1994):
- **Efficiency change** (catch-up): Did bank go closer to be the best bank.
- **Technical change** (frontier shift): Did the "best-practice" standard itself improve because of innovation?

Second-Stage Econometric Models

- DEA scores & Malmquist components analyzed with:
- **Fractional logit/Tobit** for efficiency (bounded 0–1) (Simar & Wilson, 2007).
- **Fixed/random effects** for productivity components (Wooldridge, 2010).
- **System GMM** for dynamic relationships and endogeneity (Arellano & Bond, 1991).

Stakeholder

- Nepal Rastra Bank (Regulator)-Sets digital banking regulations, cybersecurity standards, and payment system directives.
- Commercial Banks-Invest in digital platforms (mobile banking, core upgrades, APIs).
- Payment Service Providers / Payment System Operators- Manage digital payment infrastructure (IPS, RTGS, wallets, QR networks).
- Government & Policy Bodies-Promote Digital Nepal Framework and national digital payment ecosystem.
- Commercial Bank Staffs

Ethical Considerations

Quantitative:

- Uses publicly available NRB and bank data.
- Confidential or unpublished data stored securely

Qualitative:

- Ethical clearance obtained.
- Informed consent from participants.
- Confidentiality and anonymity maintained.
- Secure storage and controlled access to recordings and transcripts.

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