

Digital Empowerment through Saving and Credit Cooperative Societies in Nepal: Evidence from a National Mixed-Methods Study

 Radhika Ojha¹,  Ramesh Chandra Paudel²,  Nirmal Kumar Raut^{3*}

¹Department of Economics, Damak Multiple Campus, Tribhuvan University, Jhapa, Nepal.

^{2,3}Central Department of Economics, Tribhuvan University, Kirtipur, Kathmandu, Nepal.

*Corresponding author: Nirmal Kumar Raut (Email: nirmal.raut@cdec.tu.edu.np)

ABSTRACT

This study examines digital empowerment through Saving and Credit Cooperative Societies (SACCOS) in Nepal by assessing changes in digital empowerment before and after joining SACCOS, comparing outcomes between female and male members, and identifying factors associated with digital empowerment. The study used primary data from 638 SACCOS members, comprising 319 women and 319 men, selected from 20 SACCOS across all seven provinces of Nepal during fiscal year 2023/24. Quantitative data were analyzed using descriptive statistics, paired-sample t-tests, and Ordinary Least Squares (OLS) regression, complemented by evidence from Focus Group Discussions and Key Informant Interviews. Digital empowerment increased significantly after joining SACCOS among women ($t = 25.657$, $p < 0.001$), men ($t = 28.869$, $p < 0.001$), and the overall sample ($t = 38.285$, $p < 0.001$). Improvements were observed in mobile banking, ATM use, social media, email, online learning, and digital business activities. However, men recorded higher post-SACCOS digital empowerment than women. Training participation, higher education, and non-agricultural occupation were positively associated with digital empowerment, whereas female gender and older age were negatively associated. SACCOS are associated with substantial improvements in members' digital empowerment, although gender and age disparities remain. Strengthening digital training, financial literacy, and inclusive digital services through SACCOS could help reduce these disparities.

Keywords:

Digital empowerment, Digital financial inclusion, Digital literacy, Digital training, Gender differences, Mixed-methods study, Nepal, Saving and credit cooperative societies (SACCOS).

1. INTRODUCTION

Digital empowerment is a widely accepted tool and a new phenomenon for improving the living standards of people in recent years. Therefore, digital transformation is reshaping how individuals access financial services and fintechs, communicate, obtain information, and participate in economic activities. Recently, [Kasparian and Lopez-Perez \(2026\)](#) have extensively discussed various dimensions of digital empowerment for workers in cooperatives, which have contributed to upgrading the overall status of workers in the firm. The expansion of mobile banking, digital payments, online communication, and other technology-enabled services has reduced geographical and transaction barriers and created new opportunities for financial participation and livelihood improvement ([Demirgüç-Kunt, Klapper, Singer, & Ansar, 2022](#); [Suri & Jack, 2016](#)). However, access to digital technologies alone does not ensure that individuals can benefit from them. Effective participation also depends on the knowledge, skills, confidence, and opportunities required to use digital technologies meaningfully ([Gigler, 2015](#); [Heeks, 2018](#)). This distinction is particularly important in developing economies, where digital inequalities remain associated with differences in education, socioeconomic status, gender, and access to infrastructure and skills ([van Dijk, 2020](#)). Digital financial inclusion has consequently become an important dimension of inclusive development because digital technologies can expand access to financial services, facilitate transactions, reduce information and transaction costs, and improve financial decision-making ([Lyons & Kass-Hanna, 2021](#); [Ozili, 2022](#)). Nevertheless,

the developmental benefits of digitalization depend not only on access but also on individuals' capacity to use digital technologies effectively and independently.

Cooperatives provide an important institutional setting for strengthening such capacity. Saving and Credit Cooperative Societies (SACCOS) mobilize members' savings, provide credit, facilitate financial education, and promote member participation through collective and democratic institutional arrangements (Birchall, 2003). With the increasing digitalization of financial services, cooperatives are also adopting digital banking, electronic transactions, digital communication, and technology-enabled member services. Such institutional changes may provide members with opportunities to acquire digital skills, use digital financial services, and participate more actively in the digital economy (International Cooperative Alliance & Euricse, 2024).

The relevance of this process is particularly evident in Nepal, where the digital financial ecosystem has expanded rapidly through mobile banking, digital payments, QR-based transactions, digital wallets, and internet banking. Government policy has also emphasized digital infrastructure, literacy, and technology-enabled services as components of socioeconomic transformation (Ministry of Communication and Information Technology, 2019). Nepal Rastra Bank has promoted the development of digital payment systems and broader financial inclusion through the modernization of the country's financial infrastructure (Nepal Rastra Bank, 2025). Within the cooperative sector, Nepal Federation of Savings and Credit Cooperative Unions Ltd (2025) reports increasing adoption of digital financial services and technology-enabled systems among affiliated cooperatives.

Despite these developments, evidence on digital empowerment through SACCOS remains limited. Previous studies in Nepal have primarily examined cooperatives in relation to savings and credit access, livelihoods, entrepreneurship, and broader socioeconomic empowerment (Koirala, 2023; Poudel & Pokharel, 2018; Sharma & Shahi, 2022). Recent evidence has also highlighted the importance of education, socioeconomic characteristics, and digital access in shaping technology use in Nepal (Chand, Subin, & Maharjan, 2024). Basyal (2025), for example, provides recent evidence of the contribution of SACCOS participation to several dimensions of women's empowerment. However, national-level evidence specifically examining digital empowerment among both female and male SACCOS members remains scarce.

This study addresses this gap by examining the contribution of SACCOS to digital empowerment in Nepal. It has three objectives: first, to assess changes in members' digital empowerment before and after joining SACCOS; second, to compare digital empowerment between female and male members; and third, to identify socioeconomic and institutional factors associated with digital empowerment. The study draws on a national survey of 638 SACCOS members from all seven provinces and complements the quantitative evidence with focus group discussions and key informant interviews.

The study contributes to the literature in three ways. First, it extends research on cooperatives beyond conventional financial and economic outcomes by examining digital empowerment as a multidimensional outcome. Second, it provides a gender-comparative national assessment rather than focusing exclusively on women or a single geographical area. Third, it identifies factors associated with members' digital empowerment while accounting for provincial differences. The findings therefore provide evidence relevant to the design of cooperative-based strategies for more inclusive digital transformation in Nepal.

The remainder of this paper is structured as follows. Section Two presents a brief literature review, followed by the research methodology in Section Three. We discuss the results from the analysis in Section Four, and the final section concludes.

2 LITERATURE REVIEW

2.1. Theoretical Perspectives

The relationship between SACCOS participation and digital empowerment is grounded in three complementary perspectives: the Capability Approach, Empowerment Theory, and Cooperative Theory. Together, these perspectives explain how participation in SACCOS can expand members' opportunities and capabilities to use digital technologies, strengthen their knowledge, skills, agency, and confidence, and provide institutional support through financial services, training, participation, and collective action. The Capability Approach emphasizes the expansion of individuals' capabilities and opportunities; Empowerment Theory highlights agency, skills, resources, and participation; and Cooperative Theory explains the institutional mechanisms through which member-owned organizations can support these processes.

2.1.1. Capability Approach

The Capability Approach developed by [Sen \(1999\)](#) and further advanced by [Nussbaum \(2000\)](#) evaluates development in terms of people's substantive freedoms and capabilities rather than solely in terms of income or material resources. Applied to digital transformation, this perspective suggests that meaningful digital inclusion requires more than physical access to technology; individuals must also possess the capabilities necessary to use technology to pursue valued economic and social activities. [Gigler \(2015\)](#) similarly emphasizes the importance of digital capabilities in enabling individuals to obtain information, communicate, access services, and participate in socioeconomic activities.

SACCOS can contribute to these capabilities by providing financial services, training, information, and opportunities to engage with digital financial technologies. From this perspective, digital empowerment represents an expansion of members' capabilities to access, use, and benefit from digital technologies. The Capability Approach therefore provides the foundational explanation for examining digital empowerment as an outcome of cooperative participation.

2.1.2. Empowerment Theory

Empowerment Theory emphasizes the development of individuals' knowledge, skills, confidence, resources, and capacity to influence decisions affecting their lives ([Narayan, 2002](#); [Zimmerman, 1995](#)). Empowerment is therefore not simply possession of resources but the ability to use those resources effectively and exercise agency.

In the digital context, empowerment involves the ability to use digital technologies independently for communication, learning, financial management, and economic activities. SACCOS may strengthen these capabilities through financial education, training, access to digital financial services, and participation in cooperative activities. Digital empowerment can therefore be viewed as a process through which members acquire greater competence and agency in using digital technologies.

2.1.3. Cooperative Theory

Cooperative Theory emphasizes member ownership, democratic participation, mutual assistance, and collective action as mechanisms through which cooperatives address members' common economic and social needs ([Birchall, 2003](#)). Unlike conventional financial institutions, SACCOS operate through member-oriented structures that can facilitate not only access to financial resources but also information, training, participation, and collective learning.

The increasing integration of digital technologies into cooperative services creates additional opportunities for members to develop digital competencies. Digital banking, electronic transactions, online communication, and technology-enabled financial services can expose members to practical applications of digital technologies ([International Cooperative Alliance & Euricse, 2024](#)). Cooperative Theory therefore explains the institutional pathway through which participation in SACCOS can create an enabling environment for digital empowerment.

2.1.4. Theoretical Synthesis

The three perspectives provide complementary rather than competing explanations of digital empowerment through SACCOS participation. The Capability Approach emphasizes the expansion of individuals' opportunities and capabilities to access and use digital technologies; Empowerment Theory focuses on knowledge, skills, agency, confidence, and the ability to exercise choice; and Cooperative Theory explains the institutional role of SACCOS in creating opportunities for access, participation, training, learning, and collective support. Together, these perspectives provide a coherent framework for examining whether and how participation in SACCOS is associated with members' digital empowerment and whether digital empowerment differs by gender and socioeconomic characteristics.

2.2. Empirical Review

Empirical research on digital financial inclusion shows that digital technologies can broaden access to financial services and improve economic opportunities, particularly among underserved populations. Evidence from mobile-money expansion indicates positive effects on household welfare and poverty reduction ([Suri & Jack, 2016](#)) while

global evidence demonstrates substantial growth in digital account ownership and digital payment use among women and lower-income populations (Demirgüç-Kunt et al., 2022). Ozili (2022) further emphasizes that digital financial inclusion can reduce transaction and geographical barriers by integrating financial services with mobile and digital technologies. However, these benefits depend not only on access but also on users' digital capabilities and financial literacy.

Research on digital empowerment emphasizes the importance of skills and effective use of technology. Giger (2015) conceptualizes digital empowerment in terms of capabilities that enable individuals to access information, communicate, learn, and participate in socioeconomic activities. Heeks (2018) similarly highlights the importance of digital capabilities for inclusive digital development, while van Dijk (2020) demonstrates that inequalities in digital access and skills remain closely associated with socioeconomic characteristics. Evidence on digital financial literacy also indicates that knowledge and confidence influence the effective adoption and use of digital financial services (Lyons & Kass-Hanna, 2021). These findings suggest that digital empowerment should be examined as a multidimensional outcome extending beyond simple access to digital financial services. Paudel and Acharya (2022) analyzing the role of cooperative members in economic development in Nepal, conclude that there is a positive association with economic growth. Collectively, these studies suggest that digital empowerment should be examined as a multidimensional outcome extending beyond access to digital financial services.

Cooperatives provide a potentially important institutional mechanism for developing these capabilities. Cooperative institutions traditionally facilitate savings, credit, financial education, and member participation (Birchall, 2003). With the increasing digitalization of financial services, cooperatives have opportunities to expose members to mobile banking, electronic payments, digital communication, and other technology-enabled services (International Cooperative Alliance & Euricse, 2024). Recent evidence further suggests that education, training, and institutional support are important for effective digital technology use (Funlayo, Adeleke, Ifunanya, & Igbolekwu, 2024). Nevertheless, empirical evidence directly linking cooperative participation with members' broader digital empowerment remains limited.

Evidence from Nepal has primarily focused on the economic and social outcomes of cooperative participation. Studies report improvements in savings, access to credit, entrepreneurship, livelihood opportunities, and socioeconomic empowerment among cooperative members (Koirala, 2023; Poudel & Pokharel, 2018; Sharma & Shahi, 2022). Recent research also demonstrates the contribution of SACCOS to women's empowerment across several socioeconomic dimensions (Basyal, 2025). At the same time, differences in education and socioeconomic conditions have been associated with unequal access to and use of digital technologies in Nepal (Chand et al., 2024). Nepal's expanding digital financial infrastructure has created further opportunities for technology-enabled financial participation (Nepal Rastra Bank, 2025) while Nepal Federation of Savings and Credit Cooperative Unions Ltd (2025) documents increasing digitalization among affiliated cooperative institutions.

2.3. Research Gap

Despite growing research on digital financial inclusion, technology adoption, and cooperatives, limited attention has been given to digital empowerment as a multidimensional outcome covering digital knowledge, communication, learning, information access, and online economic participation. In Nepal, existing studies are often geographically or population-specific, with limited national-level evidence across all seven provinces. Moreover, few studies combine quantitative and qualitative evidence to examine how SACCOS participation, training, and institutional support are associated with digital empowerment. Limited research has also simultaneously examined before-and-after changes, gender differences, and factors associated with post-SACCOS digital empowerment. This study addresses these gaps using data from 638 SACCOS members (319 women and 319 men) across 20 SACCOS in all seven provinces. It applies an eight-indicator Digital Empowerment Index and integrates quantitative and qualitative evidence to examine changes, gender differences, and socioeconomic and institutional factors associated with digital empowerment.

3. RESEARCH METHODOLOGY

3.1. Research Design

This study employed a cross-sectional mixed-methods research design with a retrospective before-and-after approach to examine the contribution of Saving and Credit Cooperative Societies (SACCOS) to digital financial

inclusion and digital empowerment in Nepal. The quantitative component assessed changes in digital empowerment before and after joining SACCOS and identified its socioeconomic and institutional determinants, while the qualitative component explored members' experiences, perceived benefits, and challenges related to digital financial services and technology adoption. The integration of quantitative and qualitative evidence enhanced the validity of the findings through methodological triangulation.

3.2. Conceptual Framework

Figure 1 presents the conceptual framework of the study. It illustrates how SACCOS, through the provision of financial and capacity-building services, contribute to digital empowerment as measured by eight digital indicators. These indicators are aggregated to construct the Digital Empowerment Index before joining SACCOS (DEIB) and after joining SACCOS (DEIA). The framework also shows that digital empowerment is influenced by socio-demographic and institutional factors, while province fixed effects are included as control variables in the OLS regression analysis.

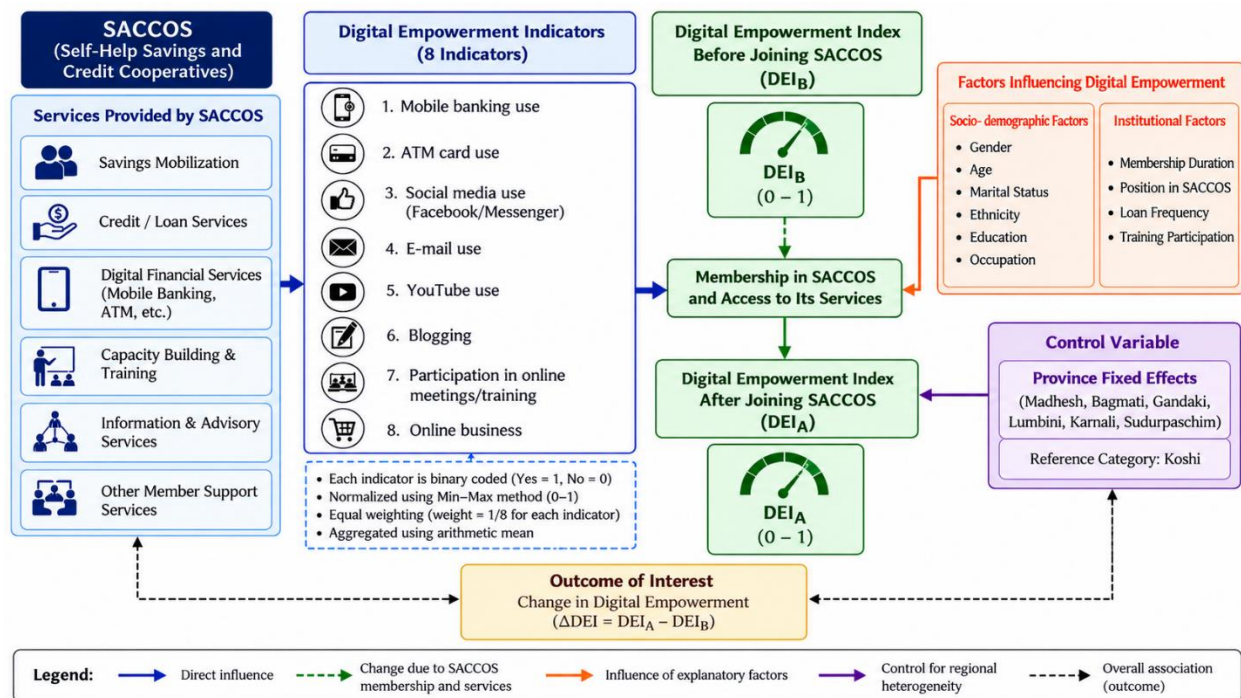


Figure 1. Conceptual Framework of Digital Financial Inclusion and Digital Empowerment through SACCOS.

3.3. Data Collection and Sampling

The study was conducted in 20 NEFSCUN-affiliated Saving and Credit Cooperative Societies (SACCOS) across all seven provinces of Nepal, representing a target population of 607,448 cooperative members. A multistage sampling technique was employed by first stratifying Nepal into seven provinces, purposively selecting 20 SACCOS based on institutional performance and provincial representation, and finally selecting respondents through simple random sampling.

The minimum sample size was determined using Yamane (1967) formula:

$$n = \frac{N}{1 + N(e)^2}$$

where n is the required sample size, N is the population size, and e is the sampling error. Based on a population of 607,448 members and a 5% margin of error, the minimum required sample size was 400 respondents. To improve statistical precision, ensure gender balance, and achieve adequate provincial representation, the final sample comprised 638 respondents, including 319 female and 319 male cooperative members.

Primary data were collected during FY 2023/24 through face-to-face interviews using a structured questionnaire covering respondents' socioeconomic characteristics, SACCOS participation, and digital empowerment before and after joining SACCOS. Qualitative data were obtained from four FGDs (40 participants) and 10 KIs with cooperative managers, board members, and subject experts. Secondary data were sourced from NCRA, NEFSCUN, NRB, DoC, MoF, and relevant reports, policy documents, and published literature. Qualitative and secondary evidence complemented and validated the quantitative findings through methodological triangulation.

3.4. Variable Measurement and Coding

The dependent variable is the Digital Empowerment Index (DEI), constructed from eight binary indicators: (i) knowledge of mobile banking, (ii) ATM card use, (iii) Facebook and Messenger use, (iv) email use, (v) YouTube use for learning and information, (vi) blog writing and publishing, (vii) participation in online meetings and training, and (viii) engagement in online business activities. Each indicator was coded as 1 = Yes and 0 = No.

Following the composite indicator framework proposed by [Nardo et al. \(2005\)](#) the Digital Empowerment Index (DEI) was constructed by assigning equal weights to all eight indicators and calculating their arithmetic mean. This approach is consistent with previous empowerment studies, including [Talukder, Mathbor, and Toma \(2017\)](#):

$$E_j = \frac{\sum_{i=1}^n X_{ij}}{n}$$

where E_j represents the empowerment index for the j th dimension, X_{ij} denotes the value of the i th indicator (1 = Yes; 0 = No), and n is the number of indicators in the dimension. Two indices were constructed for each respondent: the Digital Empowerment Index Before joining SACCOS (DEIB) and the Digital Empowerment Index After joining SACCOS (DEIA).

The explanatory variables were selected based on the conceptual framework and relevant empirical literature. They include gender, age, marital status, ethnicity, education, occupation, membership duration, cooperative position, loan-use frequency, and training participation. Province fixed effects were included to account for systematic differences across the seven provinces. Categorical variables were entered into the OLS models as dummy variables, with one category omitted as the reference group. Specifically, male, below 31 years, married, upper Hill ethnicity, primary or below education, agriculture, 5-10 years of membership, board member/staff, 0-5 loan uses, and no training participation served as the respective reference categories.

3.5. Data Analysis Technique

Quantitative data were analysed using IBM SPSS Statistics Version 26. Descriptive statistics were used to summarize respondents' characteristics and the level of digital empowerment. Percentage change analysis assessed improvements in the eight digital empowerment indicators before and after joining SACCOS, while paired-sample t -tests examined changes in the Digital Empowerment Index before joining SACCOS (DEIB) and after joining SACCOS (DEIA). Ordinary Least Squares (OLS) regression was employed to identify the socioeconomic and institutional determinants of the Digital Empowerment Index after joining SACCOS (DEIA). Qualitative data from FGDs and KIs were analysed thematically and integrated with the quantitative findings to strengthen interpretation through methodological triangulation.

3.6. Model Specification

The determinants of digital empowerment were estimated using the following Ordinary Least Squares (OLS) regression model:

$$DEI = \beta_0 + \beta_1 GEN_i + \beta_2 AGE1_i + \beta_3 AGE2_i + \beta_4 SIN_i + \beta_5 JAN_i + \beta_6 MAD_i + \beta_7 NAG_i + \beta_8 DUR1_i + \beta_9 DUR2_i + \beta_{10} LOAN1_i + \beta_{11} LOAN2_i + \beta_{12} TRN_i + \beta_{13} GMEM + \beta_{14} EDU1_i + \beta_{15} EDU2_i + \beta_{16} PRO1_i + \beta_{17} PRO2_i + \beta_{18} PRO3_i + \beta_{19} PRO4_i + \beta_{20} PRO5_i + \beta_{21} PRO6_i + \epsilon_i$$

where DEI represents the Digital Empowerment Index, β_0 is the intercept, β_1 - β_{21} are the estimated regression coefficients, i denotes the individual respondent, and ϵ is the random error

4. RESULTS AND DISCUSSIONS

4.1. Socio-Demographic and Institutional Characteristics of Respondents

The socio-demographic and institutional characteristics of the respondents provide an overview of the study sample and establish the context for analysing digital empowerment and its determinants. These characteristics include age, gender, education, marital status, ethnicity, occupation, membership duration, position in SACCOS, loan frequency, and training participation. The respondents were drawn from all seven provinces of Nepal, ensuring broad national representation with an equal distribution of 319 females and 319 males. The detailed socio-demographic and institutional profile of the respondents is presented in [Table 1](#).

Table 1. Socio-demographic Characteristics of Respondents by Gender (N = 638).

Characteristics	Category	Female n (%)	Male n (%)	Total n (%)
Age group	18–30	55 (17.2)	54 (16.9)	109 (17.1)
	31–50	197 (61.8)	173 (54.2)	370 (58.0)
	Above 50	67 (21.0)	92 (28.8)	159 (24.9)
Marital status	Married	272 (85.3)	285 (89.3)	557 (87.3)
	Single	47 (14.7)	34 (10.7)	81 (12.7)
Ethnicity	Upper Hill	200 (62.7)	225 (70.5)	425 (66.6)
	Janajati	44 (13.8)	43 (13.5)	87 (13.6)
	Madhesi/Others	75 (23.5)	51 (16.0)	126 (19.8)
Occupation	Agriculture	117 (36.7)	65 (20.4)	182 (28.5)
	Business	78 (24.5)	96 (30.1)	174 (27.3)
	Job holder	124 (38.9)	158 (49.5)	282 (44.2)
Education Level	Up to primary	171 (53.6)	137 (42.9)	308 (48.3)
	Secondary	72 (22.6)	79 (24.8)	151 (23.7)
	Higher	76 (23.8)	103 (32.3)	179 (28.1)
Duration of membership	5-10 years	167 (52.4)	156 (48.9)	323 (50.7)
	10-15 years	73 (22.9)	73 (22.9)	146 (22.9)
	Above 15 years	79 (24.8)	90 (28.2)	169 (26.4)
Position in SACCOS	Board members/Staff	85 (26.6)	100 (31.3)	185 (29.0)
	General members	234 (73.4)	219 (68.7)	453 (71.0)
Loan Frequency	0-5 times	235 (73.7)	242 (75.9)	477 (74.8)
	5-10 times	59 (18.5)	51 (16.0)	110 (17.2)
	10 times above	25 (7.8)	26 (8.2)	51 (8.0)
Training participation	Yes	226 (70.8)	239 (74.9)	465 (72.9)
	No	93 (29.2)	80 (25.1)	173 (27.1)
Province	Koshi	63 (19.7)	64 (20.1)	127 (19.9)
	Madhesh	48 (15.0)	47 (14.7)	95 (14.9)
	Bagmati	64 (20.1)	64 (20.1)	128 (20.1)
	Gandaki	64 (20.1)	64 (20.1)	128 (20.1)
	Lumbini	48 (15.0)	48 (15.0)	96 (15.0)
	Karnali	16 (5.0)	16 (5.0)	32 (5.0)
	Sudurpaschim	16 (5.0)	16 (5.0)	32 (5.0)

Source: Authors' calculation based on Field Survey, 2023/24.

As shown in [Table 1](#), most respondents (58.0%) were aged 31-50 years, and the majority (87.3%) were married. Upper Hill respondents constituted the largest ethnic group (66.6%), while job holders accounted for the highest occupational category (44.2%). Nearly half (48.3%) had education up to the primary level, and 50.7% had been SACCOS members for 5-10 years. General members represented 71.0% of the sample, whereas 72.9% had participated in SACCOS training programmes. Most respondents (74.8%) had borrowed from SACCOS up to five times. The balanced representation of female and male respondents and the diversity of socioeconomic

characteristics provide a reliable basis for analysing digital financial inclusion and digital empowerment among cooperative members in Nepal.

4.2. Change in Digital Empowerment Before and After Joining SACCOS

Digital empowerment refers to individuals' ability to access, use, and benefit from digital technologies and digital financial services. SACCOS can support digital empowerment by facilitating members' exposure to mobile banking, ATM services, social media, digital communication, online learning, and online business activities through financial services, training, financial literacy, and digital awareness programmes. These opportunities can strengthen members' digital knowledge, skills, access to information, and participation in the digital economy. Table 2 presents changes in digital empowerment indicators before and after joining SACCOS, together with paired-sample *t*-test results for the Digital Empowerment Index (DEI).

Table 2. Changes in Digital Empowerment Indicators and Paired-Sample *t*-Test Results Before and After Joining SACCOS by Gender (N = 638).

Panel A: Digital empowerment indicators	Female Before (%)	Male Before (%)	Female After (%)	Male After (%)	Female Change (percentage points)	Male Change (percentage points)
Knowledge of mobile banking	3.4	9.7	51.7	71.2	+48.3	+61.5
Use of ATM card	7.8	17.6	61.1	79.3	+53.3	+61.7
Facebook/Messenger use	41.1	41.4	88.4	92.2	+47.3	+50.8
Email usage	5.6	12.8	39.2	58.9	+33.6	+46.1
YouTube watching	12.2	19.1	79.3	82.1	+67.1	+63.0
Blogging	3.1	6.0	31.0	44.2	+27.9	+38.2
Online meeting/training	1.9	6.3	42.6	55.8	+40.7	+49.5
Online business activity	1.3	3.8	15.0	27.3	+13.7	+23.5
Panel B: Paired-sample <i>t</i>-test for DEI	Mean difference (DEIA – DEIB)			<i>t</i>-value (SD)		
Female (N = 319)	0.413			25.657*** (0.287)		
Male (N = 319)	0.493			28.869*** (0.305)		
Overall (N = 638)	0.453			38.285*** (0.299)		

Note: DEIB = Digital Empowerment Index Before; DEIA = Digital Empowerment Index After. Changes in Panel A are calculated as the difference between the after and before percentages and are therefore expressed in percentage points. ****p* < 0.001.

Source: Authors' computation from field survey data, 2023/24.

The results in Panel A show substantial increases across all eight digital empowerment indicators for both female and male respondents after joining SACCOS. Among female respondents, the largest increase was observed in YouTube use, which rose by 67.1 percentage points, followed by ATM card use (53.3 points), knowledge of mobile banking (48.3 points), and Facebook/Messenger use (47.3 points). Participation in online meetings or training increased by 40.7 points, while email use increased by 33.6 points. Blogging and online business activities recorded comparatively smaller increases of 27.9 and 13.7 percentage points, respectively.

Male respondents also recorded substantial increases across all indicators. The largest increases were observed in ATM card use (61.7 percentage points), knowledge of mobile banking (61.5 points), YouTube use (63.0 points), and Facebook/Messenger use (50.8 points). Email use, online meetings or training, blogging, and online business activities increased by 46.1, 49.5, 38.2, and 23.5 percentage points, respectively. Although male respondents generally reported higher levels of digital technology use both before and after joining SACCOS, the results show considerable improvement among both groups.

Panel B further indicates statistically significant increases in the overall Digital Empowerment Index. The mean DEI increased by 0.413 among female respondents and by 0.493 among male respondents. These differences were statistically significant (*t* = 25.657 and 28.869, respectively; *p* < 0.001). For the full sample, the mean DEI increased by 0.453, with a corresponding *t*-value of 38.285 (*p* < 0.001). Thus, the evidence indicates substantial improvement in members' digital empowerment following SACCOS participation, although the observed before-after differences should be interpreted as changes associated with SACCOS participation rather than causal impacts, given the study

design. The findings also show that male members experienced a somewhat larger increase in digital empowerment than female members, while both groups demonstrated substantial gains across the measured dimensions.

4.4. Determinants of Digital Empowerment

An Ordinary Least Squares (OLS) regression analysis was performed to identify the factors associated with the Digital Empowerment Index after joining SACCOS (DEIA). The model included socio-demographic, institutional, and provincial (fixed effects) variables, and the estimated coefficients are presented in Table 3.

Table 3. OLS Regression Results for the Digital Empowerment Index After Joining SACCOS (DEIA) (N = 638).

Variables	Coefficient (S.E.)
Constant	0.602*** (0.067)
Gender	-0.103*** (0.021)
Age 31-50	-0.071** (0.034)
Age Above 50	-0.250*** (0.040)
Single	-0.054 (0.036)
Janajati	-0.003 (0.024)
Madhesi	-0.018 (0.026)
Non-agriculture occupation	0.094*** (0.025)
Secondary education	0.020 (0.013)
Higher education	0.060*** (0.010)
General member	-0.086*** (0.025)
Membership 10-15 years	0.039 (0.027)
Membership above 15 years	0.025 (0.029)
5-10 loans	0.007 (0.026)
Above 10 loans	0.015 (0.035)
Training participation	0.149*** (0.024)
Province fixed effect	Yes

Note: Model Summary: Observations = 638; $R^2 = 0.482$; Adjusted $R^2 = 0.459$; F-statistic = 20.836 ($p < 0.001$); Province fixed effects = Yes; Standard errors are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$.

The OLS regression results indicate that the model explains approximately 48.2% of the variation in digital empowerment ($R^2 = 0.482$) and is statistically significant ($F = 20.836$, $p < 0.001$). Training participation emerged as the strongest positive determinant of digital empowerment ($\beta = 0.149$, $p < 0.01$), highlighting the importance of cooperative-led digital literacy and capacity-building programmes. Higher education ($\beta = 0.060$, $p < 0.01$) and engagement in non-agricultural occupations ($\beta = 0.094$, $p < 0.01$) were also positively associated with digital empowerment. In contrast, older age and general membership status were negatively associated with digital empowerment. The significant coefficient for gender indicates persistent gender disparities in digital empowerment even after participation in SACCOS, suggesting the need for targeted digital inclusion interventions. The model includes province fixed effects, indicating that the estimated relationships are robust after controlling for unobserved regional heterogeneity across Nepal's provinces.

4.5. Qualitative Insights into Digital Empowerment

The findings from the Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) support the quantitative results by showing that SACCOS have enhanced members' digital empowerment through mobile banking, ATM cards, digital payment systems, social media, financial literacy programmes, and digital skills training. Participants reported that these initiatives improved confidence in using digital technologies, facilitated access to information and financial services, and reduced transaction costs, particularly for members in remote areas. However, limited digital literacy among older members, inadequate access to smartphones and reliable internet, weak rural digital infrastructure, and cybersecurity concerns remain important challenges. Overall, the qualitative evidence indicates that while SACCOS play a significant role in promoting digital financial inclusion and digital empowerment,

continued investment in digital literacy, infrastructure, and secure digital financial services is essential for achieving inclusive digital transformation in Nepal.

4.6. Discussion

The findings indicate that participation in Saving and Credit Cooperative Societies (SACCOS) is associated with higher levels of digital empowerment, reflected in members' use of digital technologies for financial services, communication, learning, information access, and online economic activities. The positive associations of training participation, higher education, and non-agricultural occupation suggest that both institutional support and human capital are important for developing digital capabilities. In contrast, the lower level of digital empowerment associated with older age and general membership status indicates that digital capabilities and engagement are not equally distributed among members. The qualitative evidence complements these findings by indicating that digital literacy programmes, training, and access to digital financial services can improve members' confidence and participation in digital activities. At the same time, inadequate digital infrastructure, limited internet connectivity, lower digital literacy among older members, and concerns about cybersecurity continue to constrain wider digital engagement.

The findings are consistent with the Capability Approach, Empowerment Theory, and Cooperative Theory. From the Capability Approach, SACCOS participation can expand members' opportunities and capabilities to access and use digital technologies (Gigler, 2015; Nussbaum, 2000; Sen, 1999). Empowerment Theory highlights the importance of knowledge, skills, confidence, participation, and agency in strengthening individuals' ability to use available resources effectively (Narayan, 2002; Zimmerman, 1995). Cooperative Theory further explains how member-owned organizations such as SACCOS can provide institutional opportunities through financial services, training, participation, and collective support (Birchall, 2003; International Cooperative Alliance & Euricse, 2024). Thus, the findings suggest that SACCOS may contribute to digital empowerment not simply by providing access to digital financial services, but also by creating an institutional environment in which members can develop and apply digital capabilities.

The results also broadly support previous evidence linking digital financial inclusion, digital capabilities, education, and training with improved use of digital technologies and socioeconomic opportunities (Demirgüç-Kunt et al., 2022; Funlayo et al., 2024; Lyons & Kass-Hanna, 2021; Ozili, 2022). The positive association between training and digital empowerment is particularly consistent with the view that digital skills and institutional support are important for effective engagement with digital services. The observed educational gradient also corresponds with evidence that socioeconomic and educational differences contribute to unequal digital access and use in Nepal (Chand et al., 2024). Furthermore, the gender differences identified in the study indicate that digital empowerment is not uniform across SACCOS members, highlighting the need for gender-responsive digital training and support.

By covering SACCOS members across all seven provinces and incorporating province fixed effects in the regression analysis, the study extends previous evidence that has often focused on specific locations or dimensions of cooperative and digital-finance outcomes. However, the findings should be interpreted as associations rather than causal effects, given the cross-sectional survey design and retrospective measurement of digital empowerment before SACCOS participation. Overall, the evidence suggests that SACCOS can serve as an important institutional platform for strengthening digital capabilities, while further efforts in training, infrastructure, cybersecurity awareness, and inclusive digital support are needed to reduce disparities in digital empowerment.

5. SUMMARY AND CONCLUSION

This study examined the contribution of Saving and Credit Cooperative Societies (SACCOS) to digital empowerment in Nepal using a national mixed-methods approach based on 638 cooperative members from 20 SACCOS across all seven provinces. The findings addressed the three research objectives. First, digital empowerment improved significantly after joining SACCOS across all eight digital empowerment indicators. Second, both female and male members experienced substantial improvements in digital empowerment, although male members recorded relatively larger gains than female members. Third, training participation, higher education, and non-agricultural

occupation were identified as significant positive determinants of digital empowerment, whereas female gender, older age, and general membership status were negatively associated with digital empowerment. Overall, the findings demonstrate that SACCOS play an important role in advancing digital financial inclusion and digital empowerment in Nepal.

The findings suggest that SACCOS should strengthen digital literacy and financial education programmes, particularly for older and digitally disadvantaged members. Policymakers should promote collaboration among cooperatives, financial institutions, and digital service providers while investing in digital infrastructure, affordable internet access, and cybersecurity awareness to support inclusive digital transformation.

This study is limited by its cross-sectional design and respondents' retrospective assessment of digital empowerment before joining SACCOS. In addition, the sample was restricted to selected NEFSCUN-affiliated SACCOS, which may limit the generalizability of the findings.

Future research should employ longitudinal data to examine the long-term effects of cooperative participation on digital empowerment. It should also investigate how different types of cooperatives and other financial institutions contribute to digital transformation in Nepal. In addition, future studies could explore the long-term impacts of cooperative participation on other dimensions of empowerment, including economic, socio-cultural, political, and psychological empowerment, to provide a more comprehensive understanding of the role of cooperatives in promoting inclusive and sustainable development.

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INSTITUTIONAL REVIEW BOARD STATEMENT

The study involved minimal risk and followed ethical guidelines for social science fieldwork. Formal approval from an Institutional Review Board was not required under the policies of Institute for Research Ethics Committee of the Tribhuvan University, Jhapa, Nepal. Informed verbal consent was obtained from all participants, and all data were anonymized to protect participant confidentiality.

TRANSPARENCY

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

COMPETING INTERESTS

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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