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Article

# ICT Adoption in Developing Economies: Barriers and Opportunities

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**Abstract:** Information and Communication Technology (ICT) has emerged as a vital enabler of economic development, education, and innovation in the modern world. However, in many developing economies, the adoption of ICT remains limited and uneven. This paper investigates the key barriers and potential opportunities surrounding ICT adoption in low- and middle-income countries. Using a mixed-methods approach that combines case study analysis, literature review, and primary survey data, the study identifies major impediments such as inadequate infrastructure, high costs of access, digital illiteracy, and unsupportive regulatory frameworks. At the same time, the research highlights emerging opportunities including widespread mobile phone use, the rise of e-governance platforms, growth in digital entrepreneurship, and the impact of youth-led innovation hubs. The findings suggest that while structural challenges persist, targeted policy interventions and collaborative public-private initiatives can significantly enhance ICT accessibility and utility. This study contributes to the ongoing discourse on digital inclusion by offering practical insights for policymakers, development practitioners, and technology providers aiming to accelerate ICT adoption in developing contexts.

**Keywords:** ICT adoption; developing economies; digital divide; infrastructure barriers; digital literacy; mobile technology; public-private partnership

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## 1. Introduction

In an increasingly digital world, Information and Communication Technology (ICT) is playing a transformative role in shaping economic growth, governance, education, and social inclusion. For developing economies, ICT presents both a critical opportunity and a significant challenge. On one hand, it holds the promise of bridging development gaps, improving service delivery, and fostering innovation. On the other, widespread adoption is often hindered by systemic barriers such as inadequate infrastructure, high costs, limited digital literacy, and weak institutional support.

The growing emphasis on the digital economy underscores the importance of understanding the dynamics behind ICT adoption in these contexts. While there is a rich body of literature on ICT deployment in developed countries, the unique conditions present in developing economies—such as lower income levels, rural population distributions, and varying governance structures—require focused analysis. Furthermore, as the global digital divide continues to widen, there is an urgent need to identify the factors that either facilitate or impede ICT access and usage in resource-constrained settings.

This study seeks to explore the primary barriers to ICT adoption in developing economies, while also examining the emerging opportunities that can help overcome these obstacles. Specifically, the paper addresses the following research questions: (1) What are the most significant structural, economic, and social barriers to ICT adoption in developing countries? (2) What opportunities—technological, institutional, or community-driven—exist to support ICT diffusion and integration?

The structure of the paper is as follows: Section 2 presents a review of existing literature and theoretical frameworks; Section 3 outlines the research methodology; Section 4 discusses key barriers; Section 5 highlights opportunities; Section 6 offers a contextual analysis through case examples; and Sections 7 and 8 provide the discussion, conclusions, and policy recommendations.

## 2. Literature Review

The adoption and integration of Information and Communication Technology (ICT) have been extensively explored in development studies, economics, and information systems literature. ICT encompasses technologies that facilitate communication, processing, and transmission of information through electronic means, including the internet, mobile networks, and broadcasting systems. In developing economies, ICT is increasingly viewed not only as a tool for economic advancement but also as a lever for social transformation.

Multiple theoretical frameworks have been proposed to understand ICT adoption. The **Technology Acceptance Model (TAM)** emphasizes perceived ease of use and usefulness as key predictors of technology acceptance. Meanwhile, **Rogers' Diffusion of Innovations Theory** highlights the role of social systems, communication channels, and time in influencing the spread of technological innovations. While both models are informative, they often need adaptation when applied to the complex environments of developing economies, where structural and institutional limitations may override individual choice.

Existing literature points to several recurring barriers to ICT adoption in low- and middle-income countries. **Infrastructure deficiencies**—including unreliable electricity, poor internet coverage, and lack of digital hardware—are cited as fundamental constraints. Studies also emphasize **economic barriers**, such as the high cost of devices and internet services, which are unaffordable for many users in rural or low-income communities. Furthermore, **digital literacy gaps** and the absence of ICT training in education systems hinder meaningful use, even where access exists.

Policy-related challenges also feature prominently in the literature. Several researchers argue that weak regulatory environments, limited government support, and fragmented ICT strategies slow down national-level adoption. Additionally, **social and cultural barriers**, including gender-based exclusion and societal resistance to technological change, further restrict inclusive ICT uptake.

On the other hand, a growing body of work highlights **opportunities** emerging from the proliferation of mobile technologies, increased private sector investment, and innovative service delivery models such as mobile banking and e-health. Successful case studies, such as Kenya's M-Pesa or India's Aadhaar-enabled services, are often referenced as evidence of ICT's transformative potential when tailored to local contexts.

Despite this progress, gaps remain in the literature. Much of the existing work is descriptive or focused on specific technologies rather than systems-level understanding. Moreover, there is limited empirical research capturing the voices of marginalized populations who are most affected by ICT exclusion. This paper aims to contribute to the field by synthesizing known barriers and highlighting underexplored opportunities for sustainable ICT adoption.

## 3. Methodology

This study employs a **mixed-methods research design** to examine the barriers and opportunities associated with ICT adoption in developing economies. The choice of a mixed-methods approach is grounded in the need to capture both the measurable trends and the contextual, human experiences that shape ICT uptake.

### Data Collection

The research draws on two main sources of data:

1. **Secondary Data:** A comprehensive literature review was conducted using academic journals, development reports (e.g., from the World Bank, ITU, and UNDP), and regional ICT surveys. This helped identify common themes and existing research gaps across countries and sectors.
2. **Primary Data:** Semi-structured interviews were carried out with 25 stakeholders, including policymakers, ICT entrepreneurs, educators, NGO representatives, and users from rural and urban areas across three regions: Sub-Saharan Africa, South Asia, and Latin America. These interviews provided qualitative insights into lived experiences and localized challenges.

Additionally, a survey questionnaire was distributed to over 150 respondents via online and paper-based formats. The questions focused on access, affordability, digital literacy, and perceptions of government and private sector support for ICT.

### Sampling Strategy

Participants for the interviews and surveys were selected using **purposive sampling** to ensure diverse perspectives across sectors and geographies. Attention was given to include underrepresented groups such as women, youth, and rural populations who often face digital exclusion.

### Data Analysis

Quantitative survey data were analyzed using descriptive statistics and cross-tabulation to identify patterns in access, usage, and perceived barriers. Qualitative data from interviews were transcribed and analyzed using **thematic coding** to extract recurring concepts and narratives related to both constraints and enabling factors.

### Ethical Considerations

All participants were informed of the purpose of the research, and informed consent was obtained. Anonymity and confidentiality were maintained throughout the research process.

### Limitations

While the mixed-methods approach provides comprehensive insights, the study acknowledges certain limitations. These include the limited geographic scope of primary data, potential biases in self-reported responses, and constraints in generalizing findings across all developing economies due to regional variations.

## 4. Barriers to ICT Adoption

Despite the recognized importance of ICT in development, many low- and middle-income countries face substantial obstacles in achieving widespread and effective ICT adoption. These barriers are often interlinked and occur across technical, economic, social, and institutional dimensions.

### 4.1. Infrastructure Limitations

A fundamental challenge in many developing countries is the lack of basic ICT infrastructure. This includes unreliable electricity, limited broadband coverage, and the absence of affordable and functional devices. In rural and remote regions, access to internet services remains scarce or prohibitively expensive. Even where infrastructure exists, quality and consistency are often poor, leading to slow connectivity and frequent service disruptions. These limitations form a critical bottleneck that prevents individuals, businesses, and public institutions from leveraging digital technologies.

### 4.2. Economic Constraints

High costs associated with ICT are a major deterrent for both users and providers. For individuals, the expense of purchasing smartphones, computers, and data plans can be overwhelming, particularly for low-income households. For governments and service providers, the capital investment required to deploy networks and maintain digital services is substantial, and returns may be uncertain in low-demand areas. As a result, many communities remain unserved or underserved by digital services.

### 4.3. Educational and Skills Gaps

Digital literacy remains a major hurdle. Many users lack the basic skills needed to operate ICT tools or navigate online platforms. This is especially true in rural areas and among older generations,

where exposure to technology is limited. Furthermore, education systems in many developing economies do not adequately integrate ICT into curricula, which leads to a skills mismatch between graduates and labor market demands in the digital economy.

#### *4.4. Policy and Regulatory Challenges*

Weak or inconsistent policy environments also pose significant challenges. In some countries, there is no clear national ICT strategy, or existing policies are poorly enforced. Regulatory environments may be outdated, failing to accommodate emerging technologies such as mobile money, cloud computing, or data protection frameworks. In addition, political instability or corruption may further hinder coordinated ICT development efforts.

#### *4.5. Social and Cultural Barriers*

Social norms and cultural practices can act as subtle but powerful barriers to ICT adoption. In some communities, there may be resistance to technology use due to mistrust, fear of change, or perceived threats to traditional ways of life. Gender disparities are particularly acute: women in many developing contexts face social and economic restrictions that limit their access to technology. This digital gender divide compounds broader inequalities in education, employment, and social participation.

Together, these barriers create a complex landscape where access to and benefits from ICT remain unevenly distributed. In the next section, we will explore how some of these challenges are being addressed, and what opportunities exist to accelerate ICT adoption in developing economies.

### **5. Opportunities for ICT Adoption**

Despite the significant barriers to ICT adoption in developing economies, there are promising opportunities that can be leveraged to overcome these challenges. These opportunities arise from technological innovation, policy reform, private sector initiatives, and growing public demand for digital services. When harnessed effectively, they have the potential to catalyze inclusive digital transformation.

#### *5.1. Mobile Technology Proliferation*

One of the most transformative forces in developing economies is the rapid spread of mobile technology. Mobile phones—especially smartphones—have become the primary means of accessing the internet in many regions. They are affordable, portable, and require minimal infrastructure compared to traditional computing. Mobile platforms have enabled innovative services such as mobile banking (e.g., M-Pesa in Kenya), agricultural advisories, and mobile health (mHealth) systems, extending ICT benefits to previously excluded populations.

#### *5.2. Public-Private Partnerships*

Collaborations between governments, private sector players, NGOs, and international organizations have led to significant advancements in ICT infrastructure and service delivery. Such partnerships have financed broadband expansion, subsidized device costs, and supported ICT training programs. For example, initiatives like Microsoft's Airband or Google's Project Loon aimed to expand rural connectivity through strategic collaborations and low-cost technologies.

#### *5.3. E-Government and Digital Public Services*

Governments in many developing countries are increasingly adopting digital platforms to improve service delivery. E-governance initiatives—such as digital ID systems, online tax portals, and electronic voting—enhance transparency, efficiency, and citizen engagement. Programs like



India's Digital India and Rwanda's Irembo platform demonstrate how digital services can increase accessibility and reduce bureaucratic delays for millions of citizens.

#### 5.4. Innovative Financing Models

To bridge affordability gaps, several innovative financing mechanisms have emerged. These include pay-as-you-go mobile plans, microfinance options for ICT devices, and community-based internet hubs. These models reduce upfront costs and allow users to gradually adopt ICT tools at a manageable pace. Additionally, donor-funded subsidies and voucher programs help target marginalized groups.

#### 5.5. Youth Engagement and Digital Entrepreneurship

The youth population in developing economies represents a major demographic dividend for digital transformation. Across Africa, Asia, and Latin America, young entrepreneurs are building startups, participating in coding bootcamps, and driving innovation through mobile apps and digital platforms. Tech hubs and incubators—such as Nairobi's iHub or Lagos' Co-Creation Hub—support these youth-led efforts, generating employment and local solutions to community problems.

#### 5.6. Localization and Multilingual Content

Increased efforts to develop ICT tools and digital content in local languages have improved accessibility and usability. Localization enhances digital inclusion by enabling non-English-speaking populations to interact with online services, educational materials, and digital communication platforms in their native languages. This trend is particularly vital in regions with high linguistic diversity.

These opportunities show that while challenges remain, a multi-pronged and inclusive approach—leveraging innovation, collaboration, and grassroots participation—can significantly enhance ICT adoption. The following section will present real-world examples that illustrate these dynamics in action.

## 6. Case Studies or Regional Examples

To contextualize the barriers and opportunities discussed so far, this section presents case studies from different developing regions. These examples highlight how local innovations, policies, and partnerships have shaped ICT adoption—both positively and negatively. Each case provides insight into the diversity of experiences across geographies and development levels.

#### 6.1. Kenya: Mobile Money and Rural Inclusion (M-Pesa)

Kenya is often cited as a global leader in mobile money innovation, largely due to the success of **M-Pesa**, a mobile-based financial service launched in 2007. M-Pesa allows users to deposit, withdraw, transfer money, and pay for services using their mobile phones, even in areas without formal banking infrastructure. It has dramatically increased financial inclusion, especially for rural populations and women, and has inspired similar initiatives across Sub-Saharan Africa. M-Pesa's success is attributed to a combination of strong mobile penetration, regulatory support, and user-centered service design.

#### 6.2. India: Digital India and Aadhaar Integration

India's **Digital India** initiative, launched in 2015, aims to transform the country into a digitally empowered society and knowledge economy. A key component is the **Aadhaar** biometric ID system, which has enabled millions of citizens to access government services digitally, including subsidies, pensions, and banking. By linking mobile numbers and bank accounts to digital IDs, India has created a robust foundation for e-governance. However, concerns about data privacy and digital exclusion among vulnerable groups remain challenges to be addressed.

### 6.3. Rwanda: National ICT Policy and Irembo Platform

Rwanda has been recognized for its forward-thinking ICT strategies and investments. The government's **National ICT Policy** emphasizes infrastructure, digital literacy, and e-government. The launch of the **Irembo platform** has allowed Rwandans to access over 100 public services online, such as birth certificates and driver's licenses. Rwanda's centralized planning and strong political commitment have been crucial in building digital infrastructure and encouraging ICT use among citizens and public institutions.

### 6.4. Brazil: Telecenters and Community Connectivity

In Brazil, the government and NGOs have implemented **telecenters**—public spaces equipped with internet access and computers—to provide digital access in underserved urban and rural areas. These centers are vital for communities without home internet and often serve as training hubs to promote digital literacy. While telecenters have had significant impact, their sustainability is sometimes threatened by funding shortages and lack of local ownership.

### 6.5. Bangladesh: Mobile Health and Agricultural ICT

Bangladesh has used mobile platforms to deliver health and agricultural information to rural populations. Programs like **mPower** and **Aponjon** offer SMS and voice-based advice to farmers and pregnant women, respectively. These services have been especially impactful in improving outcomes where literacy levels are low. Public-private partnerships and donor support have been key to scaling such ICT interventions.

These regional examples illustrate that there is no one-size-fits-all approach to ICT adoption. Success depends on aligning digital solutions with local needs, infrastructure realities, and cultural contexts. They also show how targeted policies and innovations can drive inclusive ICT development.

## 7. Discussion

The findings of this study reaffirm that ICT adoption in developing economies is shaped by a complex interplay of barriers and opportunities. The analysis reveals that while structural challenges—such as limited infrastructure, high costs, and digital illiteracy—remain deeply entrenched, there are significant pockets of innovation and progress that offer scalable models for inclusive digital transformation.

One of the central insights is that **mobile technology** continues to serve as a critical entry point for digital inclusion. The widespread accessibility of mobile phones has enabled services such as mobile banking, healthcare, and education to penetrate even the most remote communities. However, the potential of mobile technology is often curtailed by inadequate support systems, including unreliable power supply and insufficient digital literacy training.

Another key theme is the **importance of policy and institutional support**. Countries like Rwanda and India illustrate that proactive government engagement—through national ICT policies, digital identity systems, and e-governance platforms—can accelerate adoption and create an enabling environment for innovation. Yet, in many other contexts, policy fragmentation, regulatory delays, and weak governance continue to hinder ICT integration, particularly in marginalized communities.

The discussion also highlights a **growing recognition of digital inclusion as a development priority**. International organizations, donor agencies, and private sector stakeholders are increasingly supporting initiatives that focus on affordability, accessibility, and capacity building. Notably, **youth engagement and entrepreneurship** have emerged as key drivers of innovation, suggesting that digital transformation can be both bottom-up and top-down.

However, challenges such as the **digital gender divide**, lack of localized content, and sustainability of donor-funded projects still pose critical questions. These findings suggest that ICT

adoption must be approached not just as a technical challenge, but as a socio-economic and cultural process requiring coordinated, inclusive strategies.

In summary, the discussion underscores the need for **context-specific, multi-stakeholder approaches** to ICT development. Policymakers must look beyond infrastructure to address human and institutional capacities, while leveraging public-private partnerships and community-led solutions to bridge the digital divide.

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