

## Article

# Exploring the Impact of the Digital Economy on Rural Mexico

Diosey Ramón Lugo-Morin <sup>1</sup> 

<sup>1</sup> Independent Researcher, Puebla 72760, Mexico; [dioseylugo@gmail.com](mailto:dioseylugo@gmail.com)

**Abstract:** This study explores the potential of the digital economy to strengthen rural resilience and promote territorial permanence in Mexico. Traditionally perceived as incompatible, the digital and rural spheres are increasingly converging, creating hybrid spaces that challenge simplistic dichotomies between modernization and tradition. By adopting a qualitative, exploratory, and descriptive design, the research analyzes the experiences of Oaxaca and Chiapas, two emblematic rural regions with high cultural diversity and socioeconomic marginalization. The findings reveal that digital technologies—including e-commerce, blockchain, and telemedicine—have enabled new economic opportunities, enhanced access to essential services, and fostered cultural preservation. Nevertheless, the results also underscore persistent challenges such as digital infrastructure gaps, new forms of dependency on external platforms, and tensions between innovation and cultural identity. The emerging role of women in leading digital adoption highlights promising paths for greater inclusivity. Overall, the study concludes that digital transformation in rural Mexico is not merely a matter of technological adoption but a complex process of social, economic, and cultural reconfiguration. For digitalization to truly support rural development and territorial permanence, it must be approached through holistic, community-driven, and culturally sensitive strategies that empower local actors and respect diverse knowledge systems.

**Keywords:** rurality; emerging technologies; Mexico; digital; rural sociology

## 1. Introduction

The global transition to the digital age is reshaping economic, social, and cultural dynamics, challenging traditional notions of development and progress (Leviäkangas et al., 2025). In academic and policy debates, rural areas are often viewed as technologically backward or passive recipients of modernization (de Grammont, 2004; Bocean, 2025). This artificial dichotomy between “digital” and “rural” has reinforced extractive development models, overlooking the potential of rural communities to actively shape and adapt technology (Jamanbalayeva et al., 2025; Zhang et al., 2023).

In Mexico, this tension is particularly significant. It is a multiethnic country with rich knowledge systems and strong communal traditions, while experiencing rapid digital transformation in both urban and rural regions (Valdez-Juárez et al., 2024). During the COVID-19 pandemic, rural communities creatively adapted digital tools for education and cultural transmission, revealing a hybrid and dynamic relationship with technology (Barrios Vázquez, 2021; MacKenzie, 2023). However, digital infrastructure expansion often prioritizes external extractive connections rather than strengthening local networks, deepening inequalities and encouraging youth migration (Lynn et al., 2022; Iveson & Melo Zurita, 2025).

These dynamics reflect a broader global trend: despite the digital economy’s rapid growth rural regions in Latin America remain severely underserved, with only 23% of households connected versus 77% in urban areas (Ziegler et al., 2019). In Mexico, nearly half the rural population lives in multidimensional poverty and faces persistent educational and infrastructural barriers (Consejo Nacional de Evaluación de la Política de Desarrollo Social [CONEVAL], 2025). Nevertheless, there are signs of agency and innovation, such as rural women increasingly leading mobile phone adoption and communities experimenting with digital tools to strengthen local economies (Martínez Domínguez, 2024).

This research seeks to answer the following question: How is the digital economy transforming the socioeconomic dynamics of rural Mexican communities, and to what extent does it contribute to reducing structural inequalities while fostering local sustainability and cultural resilience? Addressing this question aims to understand not only the economic dimension of digital integration but also its social, cultural, and territorial implications. Consequently, the main objective of this study is to examine the impact of the digital economy on rural Mexican communities, assessing its



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capacity to close historical development gaps, strengthen local economic resilience, and preserve cultural identity within a framework of sustainable and inclusive growth. By reviewing current research and highlighting both promising practices and ongoing controversies, it underscores the need for approaches that move beyond simple connectivity to embrace community agency and technological co-creation.

## 2. Background

The tension between digital transformation and the preservation of rural ways of life remains one of the most persistent dilemmas in contemporary debates on development, technology, and society. Traditionally, the “digital” has been portrayed as synonymous with progress, innovation, and speed (Bocean, 2025), while the “rural” has been associated with tradition, slowness, and backwardness (de Grammont, 2004). This dichotomy, deeply rooted in technocratic and extractive frameworks, has often depicted the countryside as a blank canvas onto which modernity should be imposed (Jamanbalayeva et al., 2025). However, recent research challenges this binary vision, proposing instead a dynamic conjunction between the digital and the rural—a space of dialogue and mutual transformation that resists homogenizing narratives (Zhang et al., 2023).

In Mexico, this tension acquires particular relevance due to its rich biocultural diversity and the presence of 68 indigenous peoples who maintain millennia-old knowledge systems and communal structures (International Work Group for Indigenous Affairs, 2025). According to a recent report by ECLAC/IFAD, the rural population of Mexico exceeds 50 million people and covers 40% of the national territory (Gaudin & Padilla, 2023). Simultaneously, the country is experiencing rapid digitalization that is reshaping social and economic dynamics in both urban and rural areas (Valdez-Juárez et al., 2024). During the COVID-19 pandemic, for instance, rural students climbed hills to access internet signals for their studies, while elders shared traditional knowledge through digital platforms, revealing a hybrid reality that transcends conventional dichotomies (Barrios Vázquez, 2021; MacKenzie, 2023). There are successful experiences demonstrating the capacity for adaptation and technological appropriation in rural areas. In Chiapas, coffee cooperatives use mobile applications to improve bean quality and connect directly with international markets, bypassing exploitative intermediaries (Simple Blockchain Applications [SIMBA], 2025). In Oaxaca, Zapotec weavers document and market ancestral techniques via social media, strengthening cultural preservation and economic resilience (O’Connell, 2021; Nava Morales, 2023). However, digital infrastructure in rural Mexico often prioritises connections to urban and global markets over strengthening local communications, reproducing extractive logics and deepening historical inequalities (Lynn et al., 2022; Iveson & Melo Zurita, 2025). This contributes to youth displacement, turning technology into a factor that incentivizes migration rather than supporting territorial permanence (Martínez Domínguez, 2024; CONEVAL, 2025).

Far from being spaces resistant to innovation, rural Mexican communities possess a long history of technological transformation, from the domestication of maize (MacNeish, 1967) to the contemporary use of mobile phones for coordinating collective work (Manjarrez, 2023). Numerous community telecommunications initiatives demonstrate that it is possible to design digital infrastructures grounded in collective principles, prioritizing accessibility, cultural relevance, and self-governance (Ajani et al., 2024; Nava Morales, 2023). This perspective demands public policies that move beyond mono-technological visions and embrace diverse knowledge systems and local governance models (Trejo-Quintana, 2020; Valencia et al., 2025). Nevertheless, significant structural challenges persist. The accelerated pace of technological innovation may conflict with the time required for community decision-making, and digital platforms can introduce new forms of surveillance that threaten local autonomies (Gutierrez de Jesus, 2021; Shim et al., 2024).

Globally, the digital economy is projected to become a central transformative driver, valued at USD 16.5 trillion by 2028, equivalent to 17% of global GDP (Chakravorti et al., 2025). However, stark disparities remain: only 23% of rural households in Latin America have internet access compared to 77% in urban areas, perpetuating historical inequalities (Ziegler et al., 2019). In Mexico, over 48% of the rural population lives in multidimensional poverty, facing educational, health, and infrastructural deficiencies that hinder digital inclusion (CONEVAL, 2025; Martínez Domínguez, 2024).

Despite these limitations, there are encouraging signs of emerging digital agency, particularly among rural women, who are increasingly leading mobile phone adoption and reshaping local social and economic networks (SIMBA, 2025; Martínez Domínguez, 2024). The integration of technologies such as blockchain, artificial intelligence, and IoT within communal and ejido structures suggests potential for building decentralised, culturally rooted digital ecosystems (Obasun, 2025; Valdez-Juárez et al., 2024).

From a forward-looking perspective, Mexico stands at a historic crossroads to rethink its role in the global digital ecosystem and become a reference point for inclusive and sustainable technological transitions (Rosa, 2022). The convergence between the rural and the digital is not merely a

challenge but a vital necessity for shaping future socioeconomic models that reconcile technological advancement with ecological and cultural continuity (Contreras-Medina et al., 2020; Sandoval Cabrera, 2019; Stern, 1973).

### 3. Materials and Methods

In order to address the research question and objective, the study adopted a qualitative, exploratory, and descriptive methodological design, seeking to gain a comprehensive and contextualised understanding of the impact of the digital economy on rural Mexican communities. This methodological approach was chosen in response to the complex and multidimensional nature of the phenomenon under study, which requires an in-depth understanding of sociocultural dynamics, technological adaptation processes, and transformations in traditional productive structures (Lim, 2025). This qualitative approach enables the interpretation of meanings, perceptions, and experiences of those involved, facilitating an understanding of how digital transformation interacts with indigenous worldviews, ancestral practices, and community organizational systems (Makateng & Mokala, 2025). This approach prioritises descriptive richness and analytical depth over statistical generalisation, recognising that rural digitisation processes manifest in different ways in specific geographical, cultural, and socioeconomic contexts.

#### 3.1. Research Design

The qualitative component of the research was structured through a systematic literature review covering specialized sources on the rural digital economy (Lim et al., 2022). A bibliographic search strategy was implemented using internationally recognized academic databases, including MDPI, SpringerLink, SAGE, Elsevier, and Redalyc. Search terms in Spanish and English, such as “rural digital economy,” “digital economy rural communities,” “digital transformation agriculture,” and “digital divide rural Mexico”, were used, combined with boolean operators “AND” and “OR” to optimize the retrieval of relevant information. Inclusion criteria prioritized scientific articles published in indexed journals and chapters from academic books specializing in rural development and technology. Official reports from public and private organizations were also included, dating from 1967 to 2025. Document selection emphasized empirical studies, systematic reviews, and theoretical frameworks that contributed to understanding technology adoption processes, the socioeconomic impacts of rural digitalization, and experiences of implementing public policies for digital inclusion. Official reports were analyzed using thematic content analysis techniques to identify recurring patterns in policy objectives, implementation strategies, performance indicators, and reported obstacles (Braun & Clarke, 2022). This approach enabled institutional perspectives to be contrasted with the empirical evidence collected, identifying convergences and divergences between political intentions and implementation realities in the territory. It also allowed the coherence between official discourse and documented experiences in rural communities to be evaluated.

In addition, two case studies were analyzed: the states of Oaxaca and Chiapas, which were selected for representing paradigmatic contexts of rural Mexico, characterized by their socioeconomic, cultural, and technological features. Case studies are a qualitative research method that has been widely used to gain an in-depth understanding of social phenomena (Yin, 1989). Oaxaca is a notable case study due to its ethnic diversity, socioeconomic marginalization, and advances in community e-commerce, such as the “Producto Oaxaca” store on Mercado Libre, as well as its telemedicine and satellite connectivity projects via CFETEit. In contrast, Chiapas stands out as a coffee producer with traceability initiatives using blockchain technology and direct trade platforms, such as “Café Orgánico,” which connect producers with global markets.

#### 3.2. Data Processing and Analysis

The data analysis strategy was carried out systematically. Qualitative information derived from a literature review, document analysis, and case studies was processed using thematic coding techniques with the help of NVivo 12 software. Open, axial, and selective coding were employed to identify emerging patterns, conceptual categories, and theoretical relationships (Mortelmans, 2025). Thematic analysis was complemented by content analysis techniques for government documents and case studies. This analytical process culminated in the construction of a convergence/divergence matrix that systematised concordances and discrepancies between different types of qualitative evidence, thus facilitating the formulation of conclusions. Different versions of the NVivo software, including version 12, can be downloaded free of charge via the following link: [https://techcenter.qsrinternational.com/Content/nv12/nv12\\_standard\\_installation.htm](https://techcenter.qsrinternational.com/Content/nv12/nv12_standard_installation.htm)

The methodological strategy was supported by NVivo 12 software, which analyzed the data through thematic coding. This tool facilitated the management, organization, and analysis of a diverse and complex body of work consisting of three main sources: a systematic literature review; an analysis of official reports; and case studies. Triangulating these sources enabled different scales

of evidence—macro, meso, and micro—to be integrated, providing a comprehensive view of the socioeconomic dynamics associated with implementing the digital economy in rural contexts. The analysis began with the creation of a project in NVivo 12, into which PDF and Word files were imported, including institutional reports and specialized academic publications. The documents were then classified into thematic folders to allow efficient traceability of the analyzed material. The analytical strategy was structured around an iterative coding process based on the Grounded Theory principles proposed by Strauss and Corbin (1998) and adapted for use in a digitally assisted qualitative analysis environment. This process was carried out in three complementary stages: i) Open coding, which aimed to identify emerging concepts; ii) Axial coding, which focused on grouping and relating categories; and iii) Selective coding, which aimed to integrate the central categories that underpinned the overall interpretation of the findings.

### 3.3. Process of Constructing the Analysis Assisted with NVivo 12

The first phase of the analysis involved open coding to identify emerging concepts directly from the text. Key fragments were given initial labels such as “structural digital divide,” “symbolic connectivity,” and “absent infrastructure.” These codes did not respond to a prior hypothesis; rather, they emerged from patterns or discursive emphases detected in the documents' content. This coding enabled the predominant approaches of official digital policy and the tensions highlighted by the literature to be thematically approximated. In the second phase, axial coding was used to group the open codes into broader, more analytically coherent categories. For instance, codes relating to service costs, signal quality, and limited access were integrated into the category “Material barriers to digital inclusion.” Similarly, references to the role of the state, private investment, and regulatory frameworks were grouped under “Institutional architecture of digitalization.” Subsequently, selective coding was applied to identify the central categories that summarize the observed phenomenon. This stage highlighted integrative concepts, such as “asymmetry in technological appropriation,” which articulated the material, cultural, and political aspects of unequal access to the digital environment.

To systematize the points of convergence and contradiction between the different sources, a comparative matrix was constructed in NVivo. This matrix covered categories such as “connectivity,” “effective access,” “productive use,” and “community values,” relating them to the type of source analyzed (academic literature, an official report, or a case study). Cross-referencing revealed that, for example, whilst official documentation emphasizes the extent of connected communities, case studies show that this connectivity is often intermittent or unequal. Similarly, critical literature highlights how the discourse of digital modernization often renders the dynamics of exclusion or cultural resistance to the intensive use of digital platforms invisible (Table A1).

## 4. Case Studies: Oaxaca and Chiapas

### 4.1. Oaxaca

Oaxaca is emblematic of rural Mexico. According to the 2022 Agricultural Census, the state comprises 9.2 million hectares of rural land, 1.9 million of which are used for productive activities such as agriculture and livestock farming (Martínez Domínguez, 2025). The state is characterized by its high indigenous diversity, high levels of marginalization, and low urban density. However, it has recently shown growing interest in the digital economy (Jiménez García, & Pérez Soto, 2020). In 2024, only 69.2% of Oaxacan households had internet access, which was one of the lowest percentages in the country (National Institute of Statistics and Geography, 2024). In order to reduce this disparity, the local government has introduced various initiatives. A notable example is the collaboration with Mercado Libre to establish the official “Producto Oaxaca” shop on the e-commerce platform. Under this agreement, the state provides training in e-commerce to Oaxaca's rural entrepreneurs and artisans and gives them access to an online marketplace, thus increasing their potential clientele (see <https://www.oaxaca.gob.mx/comunicacion/gobierno-de-oaxaca-y-mercado-libre-suman-esfuerzos-para-impulsar-la-digitalizacion-de-las-pequenas-y-medianas-empresas/>).

In addition, a telemedicine programme has been implemented in remote regions of Oaxaca. The programme aims to create a state telemedicine network and provide marginalized populations with quality services using satellite technology. This will avoid unnecessary travel costs and provide free short-term specialized care, as well as training for medical staff. Recent reports indicate that remote medical consultation systems have enabled people in rural areas to consult specialists and receive diagnoses without travelling long distances (Martínez López, 2019). Supported by improvements in school and community connectivity, these digital health initiatives illustrate how digital infrastructure can enhance quality of life in remote locations (Llinás-Delgado et al., 2023).

As part of its digital inclusion policies, the federal government has implemented comprehensive strategies to reduce the technological divide in rural Oaxaca, making systematic efforts to provide satellite internet connectivity to historically disconnected areas of the state. The CFETEIt project, also known as “Internet for All,” was developed through a strategic public-private partnership between the Mexican government and the US company Viasat. This flagship initiative has succeeded in establishing reliable, high-speed connectivity in 1,169 rural communities across 16 Mexican states (<https://es.paperblog.com/viasat-en-el-marco-del-proyecto-de-cfeteit-impulsa-el-desarrollo-de-1169-comunidades-rurales-en-mexico-8028953>), and Oaxaca is one of the main beneficiaries of this digital transformation. This technological implementation involved the strategic installation of high-speed access points in key community infrastructure, such as primary and secondary schools, rural health clinics, and public squares. These spaces traditionally lacked any telecommunications services, but now function as central connectivity nodes for their respective communities. The convergence of these concrete examples, which include community e-commerce development, rural telemedicine service implementation, and state-of-the-art satellite infrastructure deployment, demonstrates a growing and sustained trend towards the adoption of digital technologies in this rural Mexican region. This aligns with the findings of Chen et al. (2023). They argue that wireless networks play a key role in reducing the smart infrastructure gap in rural communities, where inequalities in ICT infrastructure, access to software, and individual capabilities pose significant barriers to smart society development. The structural causes of this digital transformation lie in the consolidation of effective public-private strategic alliances and the development of comprehensive, well-articulated government initiatives that prioritize and promote digital inclusion as a tool for socioeconomic development and reducing territorial inequalities. This contributes to closing the “smart divide,” as defined by Chen et al. (2023), through the implementation of ICT infrastructures that allow equitable access to modern information and communication technologies

#### 4.2. Chiapas

Chiapas is the poorest state in Mexico, but this is offset by its important coffee production, which is significant both nationally and internationally (Calvillo-Arriola & Sotelo-Navarro, 2024). For decades, coffee-growing communities in Chiapas have faced structural challenges, including price volatility, exploitative intermediaries, and limited access to international markets (Rice, 1997). However, the digital economy has recently emerged as a catalyst for change, redefining the region’s productive and commercial dynamics (Contreras-Medina et al., 2020). A significant advance has been the adoption of digital platforms that connect producers directly with global consumers. Initiatives such as Café Orgánico (see [www.rutamayacoffee.com](http://www.rutamayacoffee.com)) and Equipoise Coffee (see [www.equipoisecoffee.com/mexico-chiapas-coffee/](http://www.equipoisecoffee.com/mexico-chiapas-coffee/)) have demonstrated the potential of e-commerce by enabling the sale of certified organic coffee in premium markets in Europe, Asia, Oceania, and the United States. This has increased local income by up to 40% by eliminating intermediaries (Folch & Planas, 2019). At the same time, emerging technologies have improved the production process and supply chain by adding value through certification of product quality and ethical origin (Contreras-Medina et al., 2020). Furthermore, blockchain technology has the potential to improve transparency, fairness, and sustainability in the supply chain, which could benefit small coffee farmers (Samoggia et al., 2025). Blockchain initiatives are being implemented in Mexico. One such initiative is Toks, which is improving the lives of small-scale producers by using SIMBA Chain technology (see <https://simbachain.com/>). Toks is a Mexican chain of casual fast food restaurants owned by Grupo Gigante. It opened its first restaurant in Mexico City in 1971, near the Basilica of Our Lady of Guadalupe. It currently operates more than 200 locations nationwide and plans to expand further. In response to the growing popularity of sustainable brands among consumers, some companies have resorted to ‘greenwashing’, such as mixing low-quality coffee beans with organic beans and marketing them as high-quality organic coffee. This practice can occur at different stages of the supply chain. Recognizing this issue, Toks has implemented a transparent system to verify the authenticity of its coffee beans, tracing them from farm to restaurant. This level of transparency validates the product segmentation and eliminates the possibility of greenwashing or mixing beans of different qualities (Feghali et al., 2025). These measures have enabled Toks to reduce the number of intermediaries in its supply chain and increase the average farmer’s income by 700% (SIMBA, 2025). SIMBA Chain’s cloud platform allows academic, industrial, and government institutions to swiftly and effectively develop and deploy distributed Web 3.0 applications (dApps) across various blockchain protocols. Established in 2017 with funding from a DARPA grant awarded to the University of Notre Dame and ITAMCO, SIMBA Chain has received TechPoint’s 2019 Mira Award for New Product of the Year and 1st Source Bank’s 2019 Commercialization Award. The platform is compatible with various blockchain protocols, including Avalanche, Ethereum, Consensus Quorum, Binance Smart Chain, Stellar, and Hyperledger (SIMBA, 2025).

However, this transition faces barriers. Lack of connectivity remains a major obstacle: although programmes such as Internet for All have made progress, 46% of rural municipalities in Chiapas and Oaxaca still lack adequate coverage (Centro México Digital [CMD], 2022). This digital divide limits access to essential tools, ranging from sales platforms to agricultural management systems. Added to this is the lack of training in basic digital skills, which hinders full participation in the digital economy (Barbara Mungaray Moctezuma & Guadalupe González López, 2025).

The cultural dimension adds complexity to the process. Some communities view technology as a threat to their traditional practices, which creates resistance to its adoption (Ortiz Ricaurte, 2004). The conflict between innovation and tradition requires a sensitive approach that balances modernization with the preservation of identity, avoiding homogenizing solutions (Castillo-González & Gabarrot Arenas, 2021). To assess the impact of this transformation, contrasting indicators must be considered. Among the advances are increased income, access to global markets, and the promotion of sustainable agriculture. However, challenges remain, including insufficient infrastructure, dependence on new digital intermediaries, and educational barriers. Transparency in the value chain and the loss of traditional practices are ambivalent effects that require contextualization analysis.

Multisectoral initiatives are driving progress. While the Mexico Conectado programme has had a positive impact in rural areas, efforts remain insufficient (Martínez Hernández et al., 2023). Meanwhile, partnerships with private sector actors, such as the Toks restaurant chain, have facilitated investments in digitalization (SIMBA, 2025). The case of Chiapas illustrates the potential of the digital economy to reduce inequalities in marginalized regions, but it also highlights risks that require tailored public policies. The key lies in hybrid models that integrate technology while keeping communities connected to their roots, ensuring digitization is an inclusive tool (Rosa, 2022). The future of Chiapas coffee depends on how these tensions between innovation and tradition are managed.

#### 4.3. Synthesis and Interpretation of Case Studies

An analysis of digitization processes in Oaxaca and Chiapas reveals a paradox that challenges traditional ideas about the digital economy in Mexico. The states experiencing the highest levels of socioeconomic marginalization are undergoing digital transformations that contradict conventional predictions about technology adoption. This apparent contradiction suggests that the digital divide is not simply a matter of economics, but a complex phenomenon involving factors such as political will, strategic public-private partnerships, and the specific needs of each territory. Oaxaca's experience with the CFETEit project and its telemedicine initiatives, as well as Chiapas's e-commerce revolution in the coffee industry, demonstrate that economic marginalization is not necessarily an insurmountable barrier to technological innovation when favorable institutional conditions exist. One of the aspects of this transformation is the reconfiguration of traditional value chains. The Chiapas coffee sector illustrates how digital technologies, particularly blockchain and e-commerce platforms, are dismantling intermediation systems that had remained stable for decades. The Toks chain's 700% increase in producer income demonstrates these technologies' disruptive potential to redistribute value throughout the production chain. However, this apparent economic democratization simultaneously generates new forms of dependence and digital intermediation. Technology platforms, connectivity providers, and e-commerce services are becoming new links in the power chain, which can reproduce traditional asymmetries in different ways. Replacing physical intermediaries with digital ones does not automatically guarantee greater equity; specific regulatory frameworks are required to ensure the fair distribution of value.

Digital infrastructure is emerging as a new territorial factor that is changing the prospects for regional development in rural Mexico. The implementation of satellite connectivity in 1,169 rural communities through the CFETEit project is comparable in historical importance to the construction of roads or rural electrification in past decades. This infrastructure facilitates access to global markets and specialized services, such as telemedicine, while also reconfiguring space-time relationships in historically isolated territories. However, the fact that 46% of rural municipalities in both states still lack adequate coverage reveals that this transformation is creating new exclusionary geographies. The tensions between technological modernization and cultural identity are perhaps the most complex and least resolved aspect of these processes. The community resistance documented in both states should not be viewed as merely irrational obstacles to progress, but rather as a legitimate expression of concern for preserving ancestral cultural practices and traditional forms of social organization. This dichotomy poses a fundamental dilemma for development policies: can technological modernization occur without cultural homogenization? The analyzed experience suggests that successful digitization requires hybrid approaches that integrate technological innovation with respect for local knowledge systems and community organizational forms. The challenge lies in avoiding both technological determinism, which imposes homogeneous solutions, and cultural relativism, which rejects any form of modernization.

The sustainability of these rural digital transformation processes depends critically on three interrelated factors. Firstly, local capacities must be consolidated to reduce external technological dependence and enable community ownership of digital tools. Secondly, economic models must be developed that guarantee the long-term financial viability of digital initiatives, avoiding excessive reliance on government subsidies or short-term private investment. Thirdly, institutional frameworks must be constructed that balance the promotion of innovation with cultural preservation, ensuring that digitalization functions as a tool for social inclusion rather than exclusion. The experiences of Oaxaca and Chiapas demonstrate that rural digital transformation involves more than simply adopting technological tools; it is a complex process of social, economic, and cultural reconfiguration that presents extraordinary opportunities and significant risks for the future of rural development in Mexico.

## 5. Results

The analysis reveals that the digital economy is actively reshaping socioeconomic dynamics in rural Mexican communities, though in uneven and paradoxical ways. Drawing on a rich background of studies and historical perspectives, rural Mexico has long been perceived as technologically static and resistant to innovation. However, recent empirical evidence contradicts this view, showing that rural areas can become dynamic sites of technological appropriation when adequate institutional support and community involvement converge.

The qualitative, exploratory, and descriptive approach adopted in this research, which included systematic literature review, document analysis, and case studies in Oaxaca and Chiapas, allowed for an in-depth exploration of this transformation. In Oaxaca, the combination of community-led e-commerce initiatives (e.g., *Producto Oaxaca* on Mercado Libre), telemedicine programmes, and the deployment of satellite-based connectivity via the CFETEit project illustrates a multidimensional integration of digital technologies. These efforts have not only enhanced market access and healthcare delivery but have also strengthened local economic resilience and contributed to cultural preservation through the promotion of local knowledge. Similarly, in Chiapas, digital platforms such as *Café Orgánico* and the adoption of blockchain technologies in coffee production have reconfigured traditional value chains, enabling producers to bypass intermediaries and achieve income increases of up to 700%. This case underscores how technological tools can disrupt entrenched exploitative structures, allowing for more equitable redistribution of value within rural economies. Nevertheless, the emergence of new digital intermediaries, such as e-commerce platforms and connectivity providers, signals a shift rather than a complete elimination of dependency dynamics, highlighting the need for regulatory frameworks to safeguard fair value distribution.

A major finding is the duality of digitalization as both an enabler and a potential risk. While digital infrastructure, exemplified by satellite connectivity in 1,169 rural communities, has been likened to transformative projects such as rural electrification, the persistence of coverage gaps (46% in some areas) indicates the creation of new spatial inequalities. The study also documents strong community resistance in both states, driven by concerns over the erosion of ancestral practices and local governance systems. Rather than dismissing this resistance as irrational, it should be understood as a legitimate defence of cultural identity.

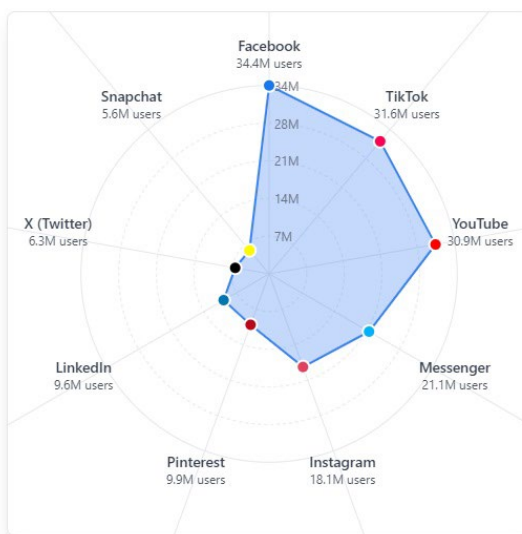
Moreover, the research highlights the critical role of rural women as emerging leaders in technological adoption. Their increased involvement in mobile technology and e-commerce initiatives points to the potential for digital economies to reshape local power dynamics and foster more inclusive socioeconomic structures. However, the lack of training and infrastructural support remains a significant barrier to fully realizing this potential. Overall, these results suggest that rural digital transformation in Mexico is not a monolithic process but rather a complex reconfiguration shaped by historical inequalities, institutional frameworks, and community agency. The interplay between tradition and innovation underscores the importance of hybrid approaches that respect local knowledge systems while fostering technological advancement. In this context, digital economy initiatives must be designed as inclusive tools for development, prioritizing cultural preservation and community empowerment to ensure they contribute meaningfully to reducing structural inequalities and supporting sustainable territorial resilience.

## 6. Discussion

This study set out to explore how the digital economy is transforming rural Mexican communities, asking to what extent digitalization can become a tool for strengthening rural resilience and territorial permanence, rather than exacerbating historical inequalities. The findings confirm that, far from being passive recipients of external technological impositions, rural communities in Mexico are actively negotiating, adapting, and repurposing digital tools to fit local needs and values. This aligns with recent scholarship arguing for a dynamic conjunction rather than a dichotomy between rural and digital realms (Zhang et al., 2023).

The integration of digital platforms and blockchain technology in Chiapas’s coffee sector illustrates a disruptive capacity to dismantle traditional value chains, providing direct access to global markets and significantly increasing producer incomes (SIMBA, 2025; Samoggia et al., 2025). However, these successes simultaneously generate new dependencies on technological intermediaries and global consumer markets, echoing concerns in the literature about the replication of extractive logics within digital infrastructures (Lynn et al., 2022; Iveson & Melo Zurita, 2025). While the elimination of physical intermediaries can democratize economic benefits (Contreras-Medina et al., 2020), it does not automatically ensure equitable power redistribution without robust regulatory frameworks. Similarly, the case of Oaxaca demonstrates that digitalization can transcend mere economic modernization to improve health and cultural outcomes, as seen in telemedicine initiatives and the promotion of local knowledge through e-commerce (Jiménez García, & Pérez Soto, 2020; Martínez López, 2019). Yet, this integration remains uneven: while satellite connectivity projects like CFETEit represent historic milestones comparable to rural electrification (Chen et al., 2023), coverage gaps persist, leaving 46% of rural municipalities without adequate access (CMD, 2022). This reflects broader Latin American trends where only 23% of rural households have internet access compared to 77% in urban areas (Ziegler et al., 2019).

A critical contradiction emerges regarding the perception of rural communities as technologically resistant. Contrary to views depicting rural Mexico as backward or inert (de Grammont, 2004), this research and supporting evidence (MacNeish, 1967; Manjarrez, 2023) show that rural communities have a longstanding history of technological innovation, from maize domestication to contemporary mobile-based collective coordination. This echoes global arguments for community-based, culturally embedded digital infrastructures (Ajani et al., 2024; Nava Morales, 2023). Moreover, the emergence of rural women as digital leaders challenges entrenched gender dynamics, suggesting the digital economy’s potential to foster new social configurations and empowerment pathways (Martínez Domínguez, 2024; SIMBA, 2025; Figure 1). However, as Gutierrez de Jesus (2021) and Shim et al. (2024) warn, digital tools can introduce new surveillance mechanisms and exacerbate local vulnerabilities, highlighting the dual nature of technological integration.



Detailed estimation for rural areas

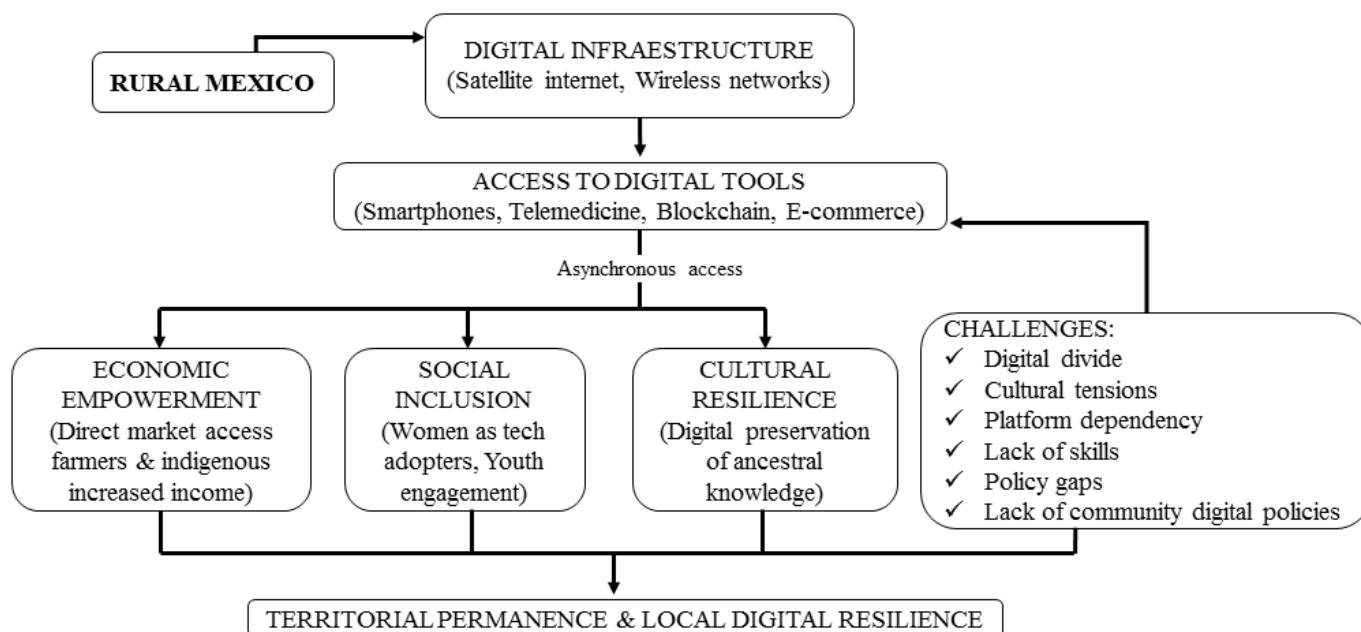
Social Network	National (M)	Rural Estimated (M)	% of Total Rural
Facebook	93	34.4	14%
TikTok	85.4	31.6	13%
YouTube	83.6	30.9	12%
Messenger	57	21.1	8%
Instagram	48.8	18.1	7%
Pinterest	26.7	9.9	4%
LinkedIn	26	9.6	4%
X (Twitter)	16.9	6.3	2%
Snapchat	15.1	5.6	2%

Figure 1. Estimated social media usage in rural Mexico, 2025.

**Source:** Own elaboration with data from Mejia (2025). Methodological note: The estimation applies a 37% adjustment factor considering that rural areas have limited broadband internet access, lower smartphone penetration, and different digital usage patterns. Facebook maintains its leadership due to its lower data consumption and higher adoption in communities with limited connectivity.

The results underscore the necessity of hybrid approaches that respect local knowledge and governance structures while promoting innovation. The tension between cultural preservation and economic modernization remains a central dilemma (Castillo-González & Gabarrot Arenas, 2021; Contreras-Medina et al., 2020). While some communities perceive digital tools as threats to identity, these same tools can also serve as instruments for cultural survival and market diversification, as illustrated by the Zapotec weavers’ social media strategies (O’Connell, 2021; Nava Morales, 2023). Institutional frameworks and public policies thus emerge as decisive factors. Oaxaca’s successful e-commerce and telemedicine programmes, supported by strategic public-private partnerships (e.g., with Mercado Libre and Viasat), contrast with infrastructural deficits that continue to impede full participation in Chiapas (Martínez Hernández et al., 2023; CMD, 2022). This supports the argument that political will, community agency, and tailored policy design can mitigate the structural barriers typically attributed to poverty or remoteness (Trejo-Quintana, 2020; Valencia et al., 2025).

Globally, the digital economy is projected to reach 17% of GDP by 2028 (Chakravorti et al., 2025), yet its uneven integration in Mexico reflects the coexistence of advanced technological experimentation alongside severe multidimensional poverty affecting over 48% of rural residents (CONEVAL, 2025; Martínez Domínguez, 2024). This paradox suggests that digitalization alone cannot resolve structural inequalities without simultaneous investments in education, health, and local governance capacity. While Mexico stands at a critical crossroads, possessing both cultural richness and decentralized demographic structures that could support culturally grounded digital ecosystems (Obasun, 2025; Valdez-Juárez et al., 2024), the risk of reproducing extractive and homogenizing models persists (Jamanbalayeva et al., 2025; Rosa, 2022). Therefore, achieving the research objective—to understand how digitalization can support resilience and territorial permanence—depends on policies that transcend technological determinism, instead fostering inclusive, community-led digital transitions. This study corroborates that rural digital transformation in Mexico is a profoundly socio-cultural process rather than a purely technological one. It presents extraordinary opportunities for economic diversification, empowerment, and cultural revitalization, while simultaneously posing significant risks of exclusion, dependency, and cultural erosion. The challenge, therefore, is not merely to implement digital infrastructures, but to co-create them with rural communities, ensuring they become instruments of collective agency and long-term territorial sustainability (Figure 2).



**Figure 2.** Asynchronous expression of the digital economy in rural Mexico.

**7. Conclusions and Strategic Recommendations**

### 7.1. Conclusions

This study set out to examine how the digital economy can support rural resilience and territorial permanence in Mexico, rather than exacerbate existing inequalities. The analysis demonstrates that rural communities are not merely passive recipients of technological innovations; rather, they actively engage in shaping and appropriating digital tools to fit their collective needs and cultural contexts. The case studies of Oaxaca and Chiapas illustrate that digital technologies -from e-commerce and blockchain traceability systems to telemedicine networks- can generate new economic opportunities, improve access to health services, and contribute to cultural revitalization. These experiences challenge the simplistic notion of a strict opposition between digital progress and rural tradition. However, the findings also highlight important contradictions. While digitalization has enabled the dismantling of exploitative value chains and increased local incomes, it has simultaneously introduced new dependencies on external digital platforms and infrastructures. In many rural areas, significant gaps in connectivity and digital literacy persist, limiting the potential for inclusive development. Cultural resistance towards certain technological changes reflects a legitimate concern for safeguarding local identities and ways of life. This tension underscores the need for hybrid approaches that integrate technological innovation with respect for community values and traditional knowledge systems.

Moreover, the emerging leadership of rural women in adopting and managing digital technologies signals important shifts in local social and economic dynamics, opening up opportunities for greater inclusivity and empowerment. Yet, without comprehensive policy support and sustained investment in local capacities, these advances risk reinforcing existing inequalities instead of alleviating them. Rural digital transformation in Mexico is a complex and multifaceted process of social, economic, and cultural reconfiguration. For digitalization to effectively strengthen rural resilience and foster territorial permanence, future strategies must be holistic, community-led, and culturally sensitive. Rather than viewing technology as a tool for imposing uniform models of progress, it should be understood as a means to support diverse, locally defined pathways towards sustainable and inclusive development.

### 7.2. Strategic Recommendations

It is recommended that future strategies for rural digital transformation in Mexico prioritize the co-creation of technology with local communities, ensuring that innovation strengthens—rather than supplants—territorial knowledge systems. Public policies should promote robust digital infrastructures focused on accessibility and affordability, particularly in the most marginalized areas. Furthermore, it is crucial to develop educational programmes that integrate digital skills with cultural identity, empowering rural youth and women as key agents of transformation. Strengthening transparent regulatory frameworks will also be essential to prevent new forms of digital dependency and guarantee equitable value distribution along local production chains. Finally, fostering multi-sector partnerships among government, academia, the private sector, and community organizations will enable holistic, context-sensitive solutions that embed technological progress within sustainable and culturally respectful rural development models.

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### Abbreviations

The following abbreviations are used in this manuscript:

ECLAC	Economic Commission for Latin America and the Caribbean
IFAD	International Fund for Agricultural Development
ENDUTIH	National Survey on the Availability and Use of Information Technology in Homes

CFETEit The Federal Electricity Commission’s cellular telephone and wireless internet service  
 CMD Centro México Digital  
 CONEVAL National Council for the Evaluation of Social Development Policy

**Appendix A**

**Table A1.** A qualitative analysis process, assisted by NVivo 12.

N°	Stage	Description of the procedure	Results
1	Documentary corpus preparation	The process began with the creation of a project in NVivo. Fifty-seven scientific articles, six institutional reports and two case studies were then imported into the project in compatible formats (PDF and Word).	The corpus was organised by source type and theme to facilitate traceability.
2	Initial thematic classification	The corpus was organised into hierarchically structured folders based on analytical areas, and classified thematically. These folders were labelled: “Public Policies,” “Critical Literature,” and “Sectoral Studies.” This categorisation made it easier to navigate the documents and optimised the identification of patterns according to the level of analysis (macro, meso or micro). Although this phase presented some challenges, such as the possibility of category overlap or the necessity of making early interpretive decisions, implementing it was essential for structuring subsequent analysis.	The initial segmentation of the corpus according to relevant analytical axes.
3	Open coding	Emerging themes were identified directly from the data, without the application of predefined conceptual frameworks. This phase captured the semantic richness of the documents. While this approach resulted in a wide dispersion of categories, it also revealed unanticipated dimensions not identified in the initial theoretical review, thereby broadening the analytical scope of the study.	Generation of initial codes and open nodes.
4	Axial coding	At this stage, an interpretive process was employed to identify the causal conditions, contexts, strategies and consequences associated with each coded phenomenon. Conceptual groupings then emerged, including “structural barriers to digitalisation”, “transformation of rural work through ICT”, and “technologies as a bridge or cultural rupture”. These relationships revealed connections between public policies and the different social effects observed in various regions, among different gender groups, and at different educational levels. This enabled progress towards a relational understanding of the phenomenon.	Consolidation into interrelated thematic categories.
5	Selective coding	This stage involved refining the core categories that explain the phenomenon under study. Based on previous groupings, two main analytical axes were identified: i) digitalisation as a strategy for economic resilience in marginalised communities; and ii) the sociocultural tensions between technological modernity and traditional identities. This synthesis incorporated structural (e.g. connectivity and infrastructure), institutional (e.g., programmes and policies) and symbolic (e.g., local perceptions and values) dimensions, resulting in a theoretical narrative that addressed the research question.	Identification of core categories and construction of the analytical argument.
6	Content and narrative analysis	Alongside thematic analysis, content analysis was applied to official reports, while narrative analysis was applied to case study experiences. This triangulation enabled a comparison to be made between the official and private reports, and the experiences drawn from the case studies. For example, while the reports paint a positive picture of digital coverage, the case studies reveal ongoing issues regarding access, quality and cultural adaptability.	The documentary and experiential evidence was contextualised and interpreted in depth.

Table A1. Cont.

7	<p>Coincidences and discrepancies among the sources (literature, reports and case studies) were organised using a comparative analysis matrix. This integrative systematisation strengthened the interpretative validity of the study and enabled conclusions to be formulated.</p>	<p>The results were cross-validated and integrated conclusions and policy recommendations were formulated</p>
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Source: Authors' elaboration based on NVivo.

Stage 1: The analytical environment in NVivo 12 was created, efficiently centralizing a diverse corpus. However, it was time-consuming and required technical resources to standardize formats and metadata. For future projects, it will be necessary to curate documents digitally and establish protocols for their collection.

Stage 2: Organizing documents by thematic areas facilitated analytical navigation, but also introduced interpretative bias at an early stage.

Stage 3: enabled the capture of a wealth of emerging themes without prior assumptions, opening the field to diverse interpretations. Nevertheless, the proliferation of nodes led to analytical dispersion that was difficult to manage without prioritization criteria. The establishment of theoretical saturation thresholds is needed to reduce excessive fragmentation.

Stage 4: facilitated the grouping of nodes into categories with causal and contextual relationships, thereby improving interpretive depth. However, this stage relies heavily on the researcher's analytical judgement.

Stage 5: Allowed for the refinement of findings. Nevertheless, there is a high risk of oversimplifying the complexity of the phenomenon by creating overly broad categories. Future research would benefit from striking a balance between theoretical synthesis and contextual specificity.

Stage 6: Key relationships were revealed between institutional sources, literature and cases, generating robust evidence. The main limitation was the difficulty of comparing dissimilar formats (narratives versus technical data).

Stage 7: The analytical process culminated in conclusions being drawn. To enhance the scalability of the findings, it would be useful to combine qualitative analysis with geo-referenced quantitative mapping in future agendas.

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