



The Digitalization Technology for Sustainable Rural Entrepreneurship: A Structured Review

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ABSTRACT

Digitalization technology has emerged as a critical tool for promoting and sustaining rural entrepreneurship by providing greater access to information and new business opportunities. It can enhance the competitiveness of rural entrepreneurs by enabling them to leverage e-commerce platforms, social media, and other digital tools to access the global market. However, the uneven distribution of digital infrastructure and the lack of digital literacy in rural areas can create significant barriers to digital adoption and pose challenges to promoting sustainable rural entrepreneurship. Hence, this paper aims to structurally review related studies from 2 databases (Scopus and EconBiz) by utilizing Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). A total of 30 papers were eligible for evaluation. The findings were discussed based on three themes: the role, challenges and opportunities, and impact of digitalization technology on rural entrepreneurship. The adoption of digitalization technology among rural entrepreneurs has the potential to drive economic growth, create employment opportunities, and foster sustainable development in rural areas.

1. Introduction

Digitalization technology is playing a vital role in promoting sustainable rural entrepreneurship. The COVID-19 pandemic has brought about rapid changes in the business environment and has shifted the focus to online platforms. With the development of digital technology, entrepreneurs in rural areas have greater access to information, which can help them identify new business opportunities and innovate [1]. However, there is a growing concern that digital development may generate higher disparities, which may prevent all entrepreneurs from benefitting from digitalization [2]. The capability approach can be used to reflect how different valuations of digital technology in rural entrepreneurs influence their attitude towards recognizing business opportunities and taking

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risks [3]. The use of technology will be a vital supporting agent [4]. Therefore, there is a need to understand the benefits, disadvantages, and barriers to digitalization technology for sustainable rural entrepreneurship, which can help policymakers and stakeholders develop appropriate strategies and policies for driving the adoption of digitalization technology for the internationalization of rural entrepreneurship.

Digital transformation has gained much attention from both academics and practitioners in recent years. Digital technologies have the potential to provide SMEs with the opportunity to initiate digital transformation initiatives in a similar fashion as large-sized organizations [2,5,6]. The innate characteristics of digital technologies favour SMEs in initiating digital transformation initiatives. Digital technologies and infrastructures in rural areas can foster the development of the entrepreneurship sector, as they can provide access to information necessary for the sector's development [6]. However, the rural population needs to acquire the necessary skills to gain confidence in entrepreneurship, which should align with the expected outcomes of the entrepreneurs [7]. A better understanding of the benefits, disadvantages, and barriers to digitalization technology for sustainable rural entrepreneurship is essential to help stakeholders develop appropriate strategies and policies for driving the adoption of technology for the internationalization of regional SMEs. This paper aims to provide a comprehensive review of the literature on digitalization technology for sustainable rural entrepreneurship, exploring the various benefits, disadvantages, and barriers associated with its adoption, and providing insights into the policy implications for promoting sustainable rural entrepreneurship.

1.1 Literature Review

Digitalization technology has the potential to greatly benefit rural entrepreneurship in Malaysia. Hence, the Malaysian government has recognized the importance of supporting digitalization technology for rural entrepreneurship and has implemented several initiatives to address the specific needs of rural areas. MyDigital (Malaysia Digital Economy Blueprint) is a comprehensive initiative aimed at accelerating Malaysia's digital transformation, including in rural areas. It focuses on enhancing digital infrastructure, driving digital adoption, and developing a digital talent pool. MyDigital aims to ensure that every Malaysian, including those in rural areas, has access to digital technologies and can benefit from them [8]. In addition, the government has established Rural Internet Centres to improve internet access in rural areas. These centres provide communities with free or affordable internet connectivity, allowing rural entrepreneurs to access online resources, engage in e-commerce activities, and develop their digital skills [8]. Nonetheless, [9,10] found that there is a digital gap between rural and urban areas, which has led to difficulties for rural communities in accessing telecommunications services, including the Internet and landlines. However, despite the lack of access to these resources, people in rural communities are still interested and open to using technology in their daily activities [9]. The digital divide, which has been dropping in developed nations, remains a significant issue in developing countries like Malaysia, Indonesia, India, and China.

[11] conducted a study to investigate the impact of digitalization on entrepreneurial attitudes in rural areas of Indonesia, using a double case study approach that examined two rural entrepreneurship cases: coffee entrepreneurs in Kintamani and craft producers in Kamasan village. The study revealed that digitalization affects the attitudes of rural entrepreneurs differently, even though the same digital technology opportunities are available in both cases. Factors such as social and environmental aspects play a significant role in motivating rural entrepreneurs to consider using digital technology to improve their businesses. However, entrepreneurs have varying opinions on the

benefits that digital technology can offer, such as increased market opportunities and novel business ideas. Those who value digital technology as a crucial resource for their businesses are more likely to explore its potential benefits. The capability approach provided a new perspective on rural entrepreneurship, highlighting that the success of rural entrepreneurship is not solely dependent on concrete resources but also on the individual perspective on these resources, which may differ among entrepreneurs. Furthermore, sociocultural values and collectivism can impact an individual's assessment of resources that could benefit entrepreneurs, highlighting the potential disparities in the sociocultural context.

Despite the vigorous promotion of digital village projects in China in recent years, the application rate of information and communication technology remains low, and there exists a dearth of understanding regarding the mechanisms through which governmental technology promotion translates into endogenous initiatives, as well as the impact of informal institutions [12]. Strikingly, the study found that the neighbourhoods' effect, rather than institutional incentives, played a decisive role in shaping the adoption patterns of information and communication technology. The perceived well-being benefits emerged as an indispensable internal driver for technology adoption, while government incentives exhibited variations across industries, thereby generating a diverse range of impacts. The findings of this study contribute valuable insights for the effective promotion of technology adoption, advocating for the integration of governmental and community forces and emphasizing the significance of encompassing both cognitive and affective psychological drivers in shaping adoption outcomes [12].

The study conducted by [13] seeks to investigate the factors influencing entrepreneurial intention within the 1,397 rural adult population of India. The analysis reveals a significant association between the demographics of rural adults and their inclination toward entrepreneurship. The findings underscore the need to equip rural residents with the requisite skills and confidence to engage in entrepreneurial activity while aligning their outcome expectations with their entrepreneurial pursuits and digitalization technology support.

The existing findings on digital transformation in SMEs are limited and remain fragmented. Considering the importance of the financial contribution SMEs can offer to nations and economies, it is timely and relevant to conduct a profound analysis of digital transformation in SMEs [13]. In addition, rural entrepreneurship paves the way to solve issues faced by rural populations by spurring economic development in rural areas. However, entrepreneurial ventures within rural areas also face a number of issues in initiating new ventures. The advancement of digital technologies, technological platforms, and digital artifacts may provide a solution for such issues faced by rural entrepreneurs [13]. The understanding of how digital technologies assist rural entrepreneurs in overcoming the problems they face is crucial. The solutions for these issues are then discussed by highlighting the role of digital technology in supporting rural entrepreneurial ventures.

2. Methodology

2.1 Identification

The screening phase involves assessing the collection of potentially relevant research items to identify those that align with the predetermined research questions, focusing on the scope of digitalization technology for sustainable rural entrepreneurship. Content-related criteria, such as relevance to the research topic, are utilized in this phase. The systematic review process consists of three primary phases, and in the initial step, keyword recognition is employed, followed by the exploration of related terms through sources such as thesauri, dictionaries, encyclopaedias, and prior studies [14]. Subsequently, search strings were formulated for Scopus and EconBiz databases (refer

to Table 1). In this initial stage, a total of 523 papers were retrieved from both databases, demonstrating the success of the research in accessing relevant literature.

Table 1

The search strings

| | |
|---------|--|
| Scopus | TITLE-ABS-KEY (digital* AND technology AND sustain* AND rural AND (entrepreneur* OR business*)) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (PUBYEAR , 2023) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j") OR LIMIT-TO (SRCTYPE , "p")) Retrieved on 5th May 2023 |
| EconBiz | (digital* AND technology AND sustain* AND rural AND (entrepreneur* OR business*)) Retrieved on 5th May 2023 |

2.2 Screening

In this screening step, duplicate papers will be removed from the list of searched papers. However, there is no duplicate data found in this process. The first stage of the screening excluded 477 publications, while the second stage examined 46 papers based on different exclusion and inclusion criteria of this study (see Table 2). The article journal and conference proceedings were the first criterion utilized because it is the primary source of practical recommendations. Reviews, meta-synthesis, meta-analyses, books, book series, and chapters were not included in the most recent study. Furthermore, the review was confined to publications in English. It is vital to remember that the publication years only focused on the year of 2014 until 2023. Publications before 2014 were excluded. The data were exported into CSV format [15].

Table 2

The selection criterion is searching

| Criterion | Inclusion | Exclusion |
|-------------------|-------------------------------------|--------------|
| Language | English | Non-English |
| Timeline | 2014 – 2023 | < 2014 |
| Literature type | Journal (Article), Conference Paper | Book, Review |
| Publication Stage | Final | In Press |

2.3 Eligibility

For the third step, known as eligibility, a total of 46 articles have been prepared. All articles' titles and key content were thoroughly reviewed at this stage to ensure that the inclusion requirements were fulfilled and fit into the present study with the current research aims. Therefore, 16 reports were omitted because they were out of the field and the title was not significantly related to the study's purpose based on empirical data. Other than that, the abstracts of those reports were not related to the objective of the study, and there is no full text to be accessed. Finally, 30 articles are available for evaluation (see Figure 1).

2.4 Data Abstraction and Analysis

Integrative analysis was employed as an assessment strategy to comprehensively review and synthesize various research designs, including quantitative, qualitative, and mixed methods

approaches. The primary objective of this rigorous investigation was to identify pertinent topics and subtopics within the field of interest. The data collection phase constituted the initial step in the thematic development process. Figure 1 provides an overview of how the authors meticulously examined a compilation of 30 publications, specifically seeking assertions or content relevant to the current study's topics. Subsequently, the authors critically evaluated the identified significant studies pertaining to digitalization technology for sustainable rural entrepreneurship, thoroughly examining the employed methodologies and research outcomes.

Following the collaboration of the author with co-authors, thematic development was undertaken based on the evidence within the context of this study. Throughout the data analysis process, a log was maintained to document analyses, perspectives, queries, and other relevant thoughts for data interpretation. Subsequently, a comparison of the results was conducted to identify any discrepancies in the thematic design process. In the event of conceptual disagreements, the authors engaged in discussions to resolve them. The generated themes were refined to ensure consistency. To ascertain the validity of the findings, two experts—one from a public university and the other from the industry—were involved in the analysis selection process. The expert review phase was implemented to ensure the clarity, significance, and appropriateness of each subtheme within the research domain.

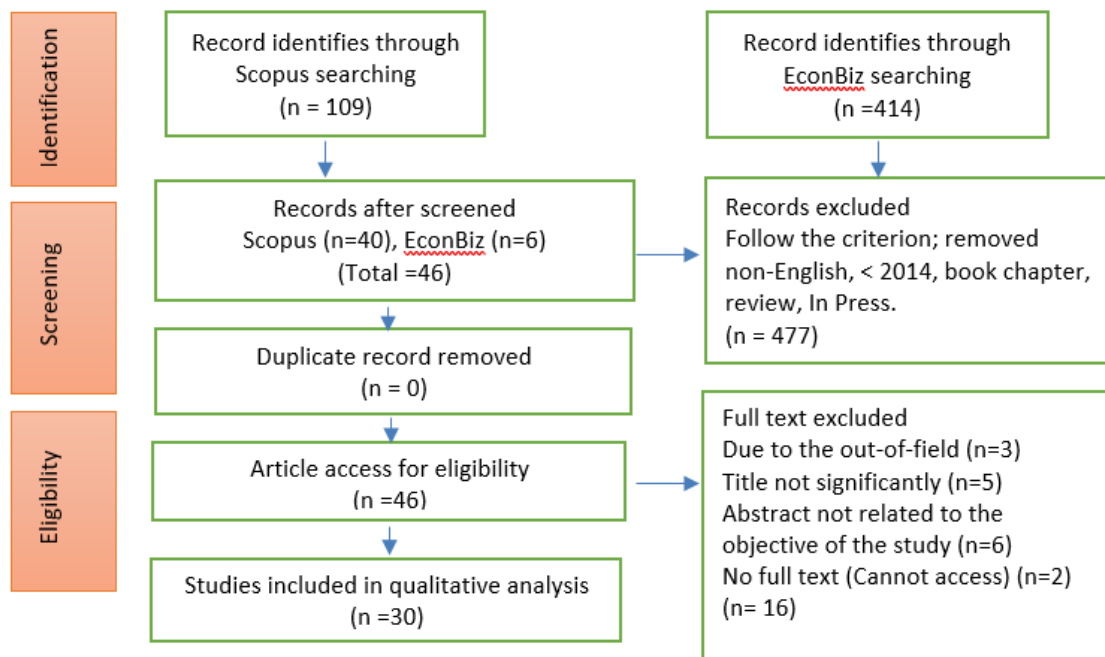


Fig. 1. Flow diagram of the proposed search study

3. Results

Digitalization technology has emerged as a transformative force in various sectors, including entrepreneurship. In recent years, there has been a growing interest in exploring the role of digitalization technology in promoting sustainable rural entrepreneurship. Rural areas, often characterized by limited resources and access to markets, can benefit significantly from the adoption of digital technologies to overcome challenges and seize opportunities. However, the adoption of digitalization technology in rural entrepreneurship comes with its own set of challenges and complexities.

This chapter presents the results and findings of a systematic literature review conducted to investigate three key themes related to digitalization technology in the context of rural entrepreneurship:

- i. the role of digitalization technology in promoting sustainable rural entrepreneurship
- ii. challenges and opportunities of digitalization technology adoption in rural entrepreneurship
- iii. the impact of digitalization technology on rural entrepreneurship sustainability. Through a comprehensive analysis of existing scholarly works, this chapter aims to provide a comprehensive understanding of the current state of knowledge in these areas and offer insights for future research and practical implications.

3.1 The Role of Digitalization Technology in Promoting Sustainable Rural Entrepreneurship

Rural entrepreneurship emerges as a critical driver for local economic empowerment and sustainable development in rural areas. However, rural entrepreneurs often face unique challenges, including limited access to resources, infrastructure, and markets, which can impede their success and hinder the overall development of rural communities. Fortunately, advancements in digitalization technology have opened up new possibilities for promoting sustainable rural entrepreneurship. Digitalization refers to the integration of digital technologies into various aspects of society, including business operations, communication, and information sharing. It encompasses a wide range of technologies, such as the internet, mobile devices, cloud computing, and data analytics, which have the potential to transform rural entrepreneurial ecosystems. Table 3 describes the role of digitalization technology in promoting sustainable rural entrepreneurship.

Table 3

The findings of the role of digitalization technology in promoting sustainable rural entrepreneurship

| Authors (Year) | Title | Source title | Role of digitalization technology |
|----------------|---|---|---|
| [16] (2022) | Scale-Up Collaboration Model of Village-Owned Enterprises for Increasing Village Economy | International Journal of Sustainable Development and Planning | BUMDES, or Village-Owned Enterprises, are vital for achieving economic self-sufficiency at the village level in Indonesia. To enhance their performance, a BUMDES scale-up program is recommended, focusing on institutional development, innovation, digitalization, and sustainability. A collaborative model involving BUMDES, academia, and industry has proven effective in addressing challenges. Academics contribute by assessing potential, providing training, and offering mentorship, while industry partners provide technological advancements and market access. Digitalization and technology integration further strengthen the village economy. |
| [17] (2022) | Rural Digital Innovation Hubs as a Paradigm for Sustainable Business Models in Europe's Rural Areas | Sustainability (Switzerland) | Rural Digital Innovation Hubs (DIHs) offer a promising solution for sustainable rural development. These hubs provide access to innovative technologies, equipment, and skilled personnel, benefiting local businesses and promoting sustainability. Empirical findings show that DIHs enhances business sustainability by optimizing processes, reducing costs, creating jobs, and promoting sustainable practices. They also contribute to environmental sustainability by assessing vineyard conditions and reducing the environmental footprint. |

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| | | | Moreover, DIHs foster social sustainability by promoting equal opportunities and digital inclusion in rural communities. |
| [18] (2022) | Investigating the effect of technology-based village development towards smart economy: An application of variance-based structural equation modelling | International Journal of Data and Network Science | Indonesia prioritizes rural poverty reduction and achieving the Sustainable Development Goals (SDGs). To address this, the country has implemented digital villages within a smart village ecosystem. Since 2018, Indonesia has launched pilot projects to establish smart villages, which rely on the concept of citizen science for effectiveness. This study proposes a novel approach to assess villagers' readiness for building a smart economy within this ecosystem, focusing on community support. Research findings highlight those factors like technology digitalization, ICT literacy, education and research access, motivation for smart villages, and village innovation are influenced by family participation. Collaborative efforts between the private sector, local government, and communities are crucial for driving the smart village's economy. |
| [19] (2021) | Digital entrepreneurship in local government: Case study in Municipality of Fundão, Portugal | Sustainable Cities and Society | Digital entrepreneurship has become an integral component of the technological advancements and digitalization observed in the twenty-first century. Consequently, the involvement and investment of economic and non-economic actors, particularly those with administrative and political influence, are crucial in harnessing the potential of this sector. Like other forms of entrepreneurship, digital entrepreneurship fosters the establishment of local networks and connections, attracting both investments and individuals. Moreover, it serves as a catalyst in combating depopulation in rural areas. The findings highlight the significance of local actors embracing digital entrepreneurship, as it not only contributes to economic development but also serves to mitigate the negative consequences of geographical isolation that have been evident in recent times. |
| [20] (2014) | Achieving sustainable competitive advantage of Romanian rural area by integrating information technologies: An interdisciplinary approach | Studies in Informatics and Control | The digital economy is crucial for the economic revitalization of the European Union (EU) and Romania. Europe is leveraging its technological prowess to harness its full potential. Small and medium-sized enterprises (SMEs) in manufacturing and services benefit from the digital economy. A comprehensive digital agenda, including measures for a unified online market, is necessary for sustainable recovery and social development. National competitive advantages are important for future prosperity. Information technologies promote sustainable development in urban and rural areas worldwide. |

3.2 Challenges and Opportunities of Digitalization Technology Adoption in Rural Entrepreneurship

In recent years, digitalization technology has emerged as a powerful force that has the potential to revolutionize various sectors of the economy, including rural entrepreneurship [21]. While digitalization offers numerous opportunities for growth, it also presents unique challenges

that need to be addressed to ensure successful adoption and implementation. Table 4 portrays the challenges and opportunities of digitalization technology adoption in rural areas.

Table 4

The findings of the challenges and opportunities of digitalization technology adoption in rural entrepreneurship

| Authors (Year) | Title | Source Title | Challenges and opportunities |
|----------------|--|---|--|
| [22] (2021) | Digitalization and the foundational economy: A digital opportunity or a digital divide for less-developed regions? | Local Economy | The growing attention given to the foundational economy in academic and policy discussions is driven, in part, by its potential to address challenges faced by less-developed regions. While supporting foundational sectors can contribute to inclusive and sustainable growth, there are concerns about whether digitalization can effectively enable these goals. The study highlights the disparities in digital capabilities between foundational and non-foundational businesses in urban and rural areas of the region. It demonstrates that while investing in digital infrastructure and technology can support the foundational economy, barriers to digital adoption pose a risk of undermining the advantages gained from the embeddedness of these sectors and exacerbating spatial divides. |
| [23] (2020) | Small rural operators' techno-economic analysis to bring mobile services to isolated communities: The case of Peru Amazon rainforest | Telecommunications Policy | Rural communities in developing nations often lack access to communication services due to urban-centric business models employed by traditional operators. This paper proposes a sustainable strategy to provide mobile communication services to isolated communities with fewer than 1000 residents. The approach combines low-cost technologies and an innovative business model facilitated by regulatory frameworks. The implementation of this model in six isolated communities in Peru demonstrates its viability. Collaboration between universities, NGOs, and cellular operators plays a crucial role. Recent regulatory developments in Peru have created a niche market for Small Rural Operators targeting these isolated communities. |
| [24] (2016) | Common Services Centres (CSCs) as an approach to bridge the digital divide: Reflecting on challenges and obstacles | Transforming Government: People, Process and Policy | In developing countries like India, a significant portion of the population lacks access to basic information and communication technologies, resulting in a digital divide. To address this, India has introduced Common Services Centres (CSCs) to provide electronic public services at the village level. However, the successful implementation and sustainability of CSCs face numerous challenges, including connectivity issues, limited availability of government-to-citizen services, low computer literacy, lack of awareness and training, inadequate infrastructure, lack of support from government officials, remote locations, high investment costs, corruption, staffing issues, power supply problems, language barriers, limited space, and network maintenance challenges. Bridging the digital divide requires addressing these complex issues. |
| [25] (2015) | 'Stuck Out Here': The Critical Role of Broadband for | Scottish Geographical Journal | The availability of broadband Internet is now considered an essential requirement for modern society. Despite this growing recognition, universal access to broadband remains elusive throughout the entirety of the UK, |

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| | Remote Rural Places | | particularly in remote rural areas where access poses significant challenges. The study investigates the utilization of broadband and its applications among small business owners in rural Scotland, exploring how the internet is employed to support business development, sustainability, as well as other aspects such as education, leisure, and social engagement. The research findings shed light on the impact of broadband access and usage on rural business owners, highlighting its potential contribution to the long-term sustainability of life in remote rural areas of Scotland. |
| [26] (2020) | Challenges and Opportunities for Coping with the Smart Divide in Rural America | Annals of the American Association of Geographers | The success of information and communications technologies in urban areas has shaped the understanding of sustainable development in smart societies. However, rural communities face significant barriers to adopting these technologies, including lack of infrastructure, isolation, and social inequalities. The conventional model of smart societies based on urban broadband access may not be suitable for decentralized rural regions. This has led to the emergence of a new challenge known as the smart divide, where rural areas are left behind in technology advancements. |
| [27] (2021) | 5G for Remote Areas: Challenges, Opportunities and Business Modelling for Brazil | IEEE Access | The benefits of new technologies and innovations tend to be concentrated in urban areas due to higher returns on investment. This has resulted in a growing digital divide between urban and rural areas, including in Brazil. Internet penetration is significantly lower in rural areas, particularly in the North and Northeast regions. Bridging this divide requires a scalable and sustainable business model for rural connectivity, which can be achieved through partnerships between Mobile Network Operators (MNOs) and Rural Mobile Infrastructure Operators (RMIOs). RMIOs can operate their networks using a portion of the incumbent operators' network infrastructure. |
| [28] (2021) | An Assessment of Social Media Usage Patterns and Social Capital: Empirical Evidence from the Agricultural Systems of China | Frontiers in Psychology | This study explores the relationship between agricultural policies on entrepreneurship training and social media usage. The findings reveal that social, hedonic, and cognitive use of social media significantly influence both bridging and bonding social capital. Additionally, entrepreneurs who have received training exhibit higher levels of social and cognitive use compared to those who haven't. These results emphasize the importance of sustainable education and learning in digital transformation for agricultural entrepreneurs, as well as utilizing social media for acquiring and accumulating social capital. |

3.3 The Impact of Digitalization Technology on Rural Entrepreneurship Sustainability

Digitalization technology has become a catalyst for transformative change across various sectors, and its impact on rural entrepreneurship sustainability is a topic of significant interest and importance. As rural areas grapple with unique challenges such as limited access to resources, connectivity constraints, and geographic isolation, the adoption and utilization of digitalization technology hold the potential to revolutionize rural entrepreneurial ecosystems. Table 5 exhibits the impact of digitalization technology on rural entrepreneurship sustainability.

Table 5
 The findings of the impact of digitalization technology on rural entrepreneurship sustainability

| Authors (Year) | Title | Source title | Impact of digitalization technology |
|----------------|---|--|---|
| [29] (2023) | Strengthening the role of corporate social responsibility in the dimensions of sustainable village economic development | Heliyon | This research focuses on the challenges faced in implementing sustainable village economic development initiatives that incorporate green growth and digitalization programs. The study examines Bali's villages and highlights the importance of sustainable economic growth in the agricultural and plantation sectors. The integration of green growth and digitalization has a significant impact on various aspects, including economic growth, poverty reduction, social inclusion, environmental sustainability, and resource efficiency. The digital village program plays a vital role in enhancing the knowledge and capabilities of rural communities, enabling them to utilize technology effectively in their businesses and compete with regional and national enterprises. |
| [30] (2023) | Rural entrepreneurs' behaviours towards green innovation: Empirical evidence from Bangladesh | Journal of Open Innovation: Technology, Market, and Complexity | This study aims to explore the impact of different dimensions on the adoption of green innovation technology, with a specific focus on designing a clean energy strategy and fostering eco-friendly SMEs among rural entrepreneurs in Bangladesh. The research findings indicate a positive and significant relationship between environmental concern and the adoption of green innovation, as well as perceived ease of use and the adoption of green innovation. Furthermore, the study reveals that the intention to use green energy technology, particularly solar energy, acts as a mediator between environmental concern and attitude, and the adoption of green innovation. Given the relatively new concept of green innovation, it is essential to consider sustainability factors and eco-innovations technology that can serve as catalysts for encouraging green innovation practices among rural entrepreneurs. |
| [31] (2023) | Finding a Neue Gemeinschaft in rural Indonesia: A discussion of forest community digital transformation | Forest Policy and Economics | This research explores the impact of digital technology on forests and the increasing adoption of digital solutions by entrepreneurs and development groups. To address challenges like the digital divide, the study suggests creating digitally minded forest communities and providing local support through online public services. The introduction of digital technology has transformed forest communities into digitally oriented ones, but sustainable economic activity requires local government support and the implementation of digital roadmaps in villages. The findings highlight the importance of digital transformation policies as social innovations for promoting the sustainability of forest communities. |
| [32] (2023) | Developing Institutions and Inter-Organizational | Land | This research explores the establishment of a community of practice for African youth engaging in agriculture through digitalization. The study highlights the role of the Technical Centre for |

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| | Synergies through Digitalization and Youth Engagement in African Agriculture: The Case of “Africa Goes Digital” | | Agricultural and Rural Cooperation ACP-EU (CTA) in supporting these enterprises with drones and training, leading to the formation of Africa Goes Digital (AFGD). AFGD serves as a platform for communication, knowledge sharing, and partnership development among members through WhatsApp and Twitter. Challenges include the lack of regulations for drone usage and high costs of sensors and drones. Overall, the findings provide insights into the opportunities and obstacles faced by youth enterprises in agriculture as they embrace digitalization in Africa. |
| [33] (2022) | Sustainable Entrepreneurship in Rural E-Commerce: Identifying Entrepreneurs in Practitioners by Using Deep Neural Networks Approach | Frontiers in Environmental Science | This research examines the factors influencing rural residents' capacity and expectations in establishing e-commerce ventures. The digital divide between urban and rural areas has diminished, enabling rural areas to capitalize on e-commerce opportunities. However, challenges exist for rural entrepreneurs and support providers. The study suggests that collaboration between local governments and e-commerce enterprises is necessary to address practical concerns and support rural e-commerce practitioners. Rural residents can leverage information technology opportunities, while local governments should embrace digitization trends to manage rural economic growth effectively. |
| [34] (2022) | Rural Housewives Entrepreneurial Intention: Insight from Socio-Demographic and Psychological Traits in Indonesia | Review of Integrative Business and Economics Research | This study investigates the factors influencing sociopreneurs' intention to adopt digital technology. It highlights the significance of tolerance for ambiguity, especially during the post-COVID-19 transition. Housewives with a high tolerance for ambiguity are more likely to embrace digitalization and pursue entrepreneurship. Understanding these psychological factors is crucial in supporting and encouraging potential entrepreneurs to utilize digital technology for transformative purposes. |
| [35] (2022) | Is innovation inevitable with more experiences: Diversity of private entrepreneurs' career experience, policy perception and firm innovation | Journal of Industrial Engineering and Engineering Management | Digital technology has fostered entrepreneurship and innovation in digital firms. Pre-entrepreneurial experience is crucial for private enterprises, shaping their knowledge and social networks. However, private firms face challenges in gaining legitimacy and adapting to institutional changes compared to state-owned firms. Private entrepreneurs must understand government policies and make strategic decisions accordingly. Policy makers should support entrepreneurial growth, value diverse backgrounds, and optimize policies to address resource limitations in private firms. |
| [36] (2022) | Assessing the Digital Transformation in Two Banks: Case Study in Hungary | Agris On-line Papers in Economics and Informatics | This study analyses the digital transformation practices of two Hungarian banks in the context of Industry 4.0 and globalization. It reveals that incumbent banks in Hungary have a moderate level of digitalization. Strategic planning and human resources are important for successful digital transformation, while stakeholders and government support can influence the process. Improving digital |

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|----------------|---|---|--|
| | | | financial services for agriculture in Hungary requires government policies and support. |
| [37] (2022) | An Inclusive Entrepreneurial Path Model Based on Rural Digital Entrepreneurship Data in Zhejiang Province Using Few-Shot Learning | Computational Intelligence and Neuroscience | Rural revitalization aims to empower farmers and foster their prosperity through high-quality development. The study highlights the growing interest in entrepreneurship among farmers but identifies a negative impact of knowledge resources on their inclusive entrepreneurial behaviour. In contrast, social and industrial networks positively influence migrant workers' access to resources. To promote prosperity, supporting inclusive entrepreneurship and involving industrial and commercial capital in rural areas is crucial. Providing agricultural knowledge, skills, technology, and market guidance is essential for driving employment opportunities and rural development. |
| [38] (2021) | Driving Factors, Effect Analysis and Countermeasures of the Development of China's Live Broadcast Platform | China Finance and Economic Review | The COVID-19 pandemic has had a profound impact on economic and social development, with traditional industries facing setbacks while the platform economy driven by digital technology experiences accelerated growth. Live streaming has emerged as a thriving business during this period, meeting the demand for contactless interactions and integrating online and offline activities. It revitalizes traditional industries, generates economic growth, expands employment opportunities, and contributes to rural revitalization and poverty alleviation. However, government intervention is necessary to guide and support the live streaming platform while ensuring proper supervision and governance for its healthy and sustainable development. |
| [39] (2021) | Digital resilience: How rural communities leapfrogged into sustainable development | Information Systems Journal | Digital social innovation (DSI) is an important factor in achieving sustainable development by utilizing digital technology to address societal challenges. This study explores three instances where grassroots communities successfully adopted e-commerce as a means of leapfrogging development and initiating transformative change. Additionally, the paper identifies three obstacles that emerged during the technology leapfrogging process, posing sustainability challenges for grassroots DSI efforts. To overcome these challenges and foster self-sustaining and resilient communities, three top-down interventions have proven effective in facilitating grassroots leapfrogging development. |
| [40] (2020) | Impact of the eKutir ICT-enabled social enterprise and its distributed micro-entrepreneur strategy on fruit and vegetable consumption: A quasi-experimental | Food Policy | This study explores the impact of eKutir, a social enterprise using ICTs, on household fruit and vegetable consumption in Odisha, India. eKutir employs farming micro-entrepreneurs to provide agricultural knowledge, inputs, and market connections, aiming to address poverty and undernutrition. The findings reveal that farmers exposed to the eKutir ecosystem consume more fruits and vegetables compared to those without exposure. This suggests the potential of achieving |

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| | study in rural and urban communities in Odisha, India | | nutritional impact through increased homegrown consumption supported by digitalization technology. |
| [41] (2019) | Smart Village Development Principles and Driving Forces: The Case of Lithuania | European Countryside | The aim of the research is to identify the preconditions for rural area progress and smart rural villages driving forces in Lithuania. The research object concerns the principles and driving forces of the development of smart villages. The findings revealed that three out of five selected pilot rural areas of Lithuania have an innovative potential with some of the smart village principles adopted. The main constraints identified by the study were related to the lack of technological, digital or energy efficiency innovation and human resources in rural areas. |
| [42] (2019) | WinChannel's digital gambit to revitalize rural China | Emerald Emerging Markets Case Studies | This study analyses the value creation and capture evolution in the FMCG industry using strategic analysis tools. It focuses on Beijing WinChannel Software Technology Co., Ltd. (WinChannel) and its affiliated company, Huixiadan, in the context of digital transformation. Case A examines ways for WinChannel to enhance the reach and efficiency of the traditional trade channel through online/mobile B2B FMCG platforms in China. Case B explores Huixiadan's sustainability and strategies to leverage opportunities and navigate competition in the traditional FMCG industry in China. |
| [43] (2018) | Digital Empowerment Foundation's Chanderiyaan Project: linking the poor producers with the market using ICT | Emerald Emerging Markets Case Studies | The Chanderi Weavers ICT Resource Centre (CWIRC) was established in 2009 by DEF, Media Labs Asia, and MICT to empower weavers in Chanderi, Madhya Pradesh using information and communication technology. The project showed significant growth over three years, positively impacting the handloom industry and sectors like education, health, and tourism. However, DEF founder Osama Manzar has concerns about the sustainability of the ecosystem created and the ability of the local weaver community to sustain it in the long term. |
| [44] (2015) | Bridging the service divide through digitally enabled service innovations: Evidence from Indian healthcare service providers | MIS Quarterly: Management Information Systems | This study examines the service aspect of the digital divide in developing countries, emphasizing the unequal access to basic services like healthcare and education. It proposes that leveraging information and communication technologies (ICTs) can bridge this divide and improve capabilities for disadvantaged populations. The study highlights the importance of innovative combinations of ICT and non-ICT resources and identifies three stages of service innovation evolution. It also identifies four key enablers for successful implementation: customer empathy, belief in the power of ICT, continuous learning, and effective network coordination. |
| [45] (2022) | Innovation in Basilicata agriculture: From tradition to digital | Economia Agro-Alimentare | The implementation of 4.0 technologies is transforming agricultural processes and supply chains in the Basilicata region of southern Italy, crucial for the competitiveness of the "Made in Italy" brand. The |

region has invested in modernizing and restructuring agricultural, agri-food, and forestry farms through sustainable rural development policies. Local agricultural entrepreneurs in Basilicata have collaborated with scientific institutions, advisors, training organizations, and small to medium-sized agro-industrial enterprises, forming clusters and European Partnerships for Innovation. This paper examines eleven Operational Groups within these partnerships, which serve as incubators for the digitalization of agri-food 4.0. The analysis reveals that Precision Farming is the most prominent aspect of digitization in Basilicata, with a dedicated operational group called AgrotechBasilicata. However, other operational groups in the region also focus on digitalization through information collection systems, software and data analysis, as well as robotics and automation.

4. Conclusions

Digitalization technology plays a crucial role in promoting sustainable rural entrepreneurship. It enables access to innovative solutions, enhances business sustainability, fosters economic development, combats depopulation, and contributes to environmental and social sustainability. Embracing digital entrepreneurship and implementing comprehensive digital agendas are key factors in achieving sustainable rural development and empowering rural communities. Digital entrepreneurship plays a vital role in leveraging technological advancements and addressing the challenges faced by rural areas. Embracing digital entrepreneurship not only contributes to economic development but also mitigates the negative consequences of geographical isolation.

The adoption of digitalization technology in rural entrepreneurship presents both challenges and opportunities. While the foundational economy in less-developed regions and rural communities in developing nations can benefit from digital investments, there are existing barriers such as limited access to communication services, lack of infrastructure, connectivity issues, low computer literacy, and inadequate support. Bridging the digital divide requires addressing these complex challenges. Collaborative efforts, innovative business models, regulatory frameworks, and addressing specific rural needs and contexts are key factors in promoting digitalization technology adoption and realizing the potential for sustainable development in rural entrepreneurship.

The impact of digitalization technology on rural entrepreneurship sustainability is significant, transformative, and multifaceted. Digitalization technology, including ICTs and innovative digital solutions, has the potential to transform rural economies and empower entrepreneurs in various ways. Furthermore, digitalization technology plays a crucial role in driving rural entrepreneurship sustainability by fostering prosperity, facilitating innovation, and addressing geographical isolation. By leveraging digital tools and solutions, rural businesses can thrive, adapt to changing market dynamics, and contribute to the sustainable development of rural economies.

5. Conflicts of Interest

The authors declare that they have no conflicts of interest to report regarding the present study.

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