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Literature Review : The Role of Digital Technology in Enhancing Entrepreneurship in the Era of Industry 4.0

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Abstract *This study examines the role of digital technology in enhancing entrepreneurship in the Era of industry 4.0 through a systematic literature analysis of various sources from 2013 to 2023. By adopting this methodological approach, the research elucidates the benefits, challenges, and solutions associated with the adoption of digital technology for business practitioners, particularly in the micro, small and medium enterprises (MSMEs). The analysis demonstrates that digital technology significantly enhances operational efficiency, productivity, and market reach, while also fostering innovation in business models. However, challenges such as resource limitations, a lack of digital literacy, and the digital divide persist as significant obstacles. Furthermore, the study identifies strategic solutions to mitigate these challenges, including digital literacy training, technology subsidies, and improvements to digital infrastructure. The limitations of this research include a constrained data range from 2013 to 2023 and insufficient exploration of practical dimensions and ethical issues pertaining to the adoption of digital technology. Future research is encouraged to investigate these topics in greater depth, particularly within localized contexts and their implications for business sustainability. These findings underscore the critical role of digital technology as a fundamental enabler for developing competitive and sustainable entrepreneurship in Era 4.0.*

Keywords: *Digital Technology, Entrepreneurship, the Era of Industry 4.0*

1. INTRODUCTION

The role of entrepreneurship in driving a country's economic growth has become a focal point in various economic and social studies. Entrepreneurship is considered one of the driving forces behind innovation, job creation, and enhancing global competitiveness. In the modern context, entrepreneurship is no longer limited to conventional businesses; it also includes digital transformation, which brings significant changes to the way businesses operate. The Fourth Industrial Revolution, characterized by the integration of digital technology, the Internet of Things (IoT), artificial intelligence (AI), and big data, has created both opportunities and new challenges for the entrepreneurial landscape.

Digital transformation not only impacts operational efficiency but also opens opportunities for creating new business models. For example, the emergence of e-commerce platforms, fintech, and technology-based applications has changed how consumers interact with products and services. Additionally, digital technology enables business owners to reach a wider market, including global markets, at a relatively low cost. However, adopting this technology requires a deep understanding and readiness in terms of human resources, infrastructure, and supportive regulations.

Although the positive impact of digital technology on entrepreneurship is widely acknowledged, challenges in its implementation cannot be ignored. One of the main obstacles is the digital literacy gap among entrepreneurs, especially in the micro, small, and medium

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enterprises (MSMEs) sector. Additionally, the high initial investment costs for implementing advanced technology often serve as a barrier for small business owners. Furthermore, the rapid pace of technological change presents challenges in terms of adaptation and the sustainability of business models.

The Revolution of Industry 4.0 requires businesses not only to adopt digital technologies but also to reshape the entrepreneurial ecosystem as a whole. Key factors such as government policy, collaboration between the public and private sectors, and the presence of supportive institutions like business incubators and startup accelerators play a crucial role in facilitating successful digital transformation in entrepreneurship. Thus, a comprehensive study is necessary to understand how digital technology can enhance entrepreneurial performance while identifying the factors that support or inhibit this process.

Previous research has extensively explored the role of digital technology in business transformation. For instance, a study by Bharadwaj et al. (2013) found that adopting digital technology can enhance product and service innovation, while research by Hanelt et al. (2021) emphasizes the importance of digital strategy in creating a competitive advantage. Additionally, Beliaeva et al. (2019) demonstrated that digital entrepreneurship holds significant potential for driving economic inclusion, particularly in developing countries. However, much of this research focuses primarily on large corporations or high-tech startups, leaving the impact on micro, small, and medium enterprises (MSMEs) underexplored.

Despite the valuable insights offered by existing literature on the benefits of digital technology, there is a significant research gap regarding its implementation in the MSME sector, especially in regions with limited digital infrastructure. Furthermore, studies examining the relationship between digital technology and business sustainability are scarce. Many highlight technology adoption without addressing long-term sustainability factors, such as social and environmental impacts.

In this context, there are two main questions that need to be addressed: How does digital technology influence entrepreneurship, particularly in the MSME sector, and what factors support or hinder the adoption of technology in business? These questions are relevant for bridging the gap between theory and practice while also providing direction for future research.

This literature review aims to identify trends in the field of digital entrepreneurship, specifically regarding the adoption of technology in Era 4.0. Additionally, this study seeks to identify gaps in research that can serve as a foundation for further studies. Thus, the results of this literature review are expected to contribute both theoretically and practically to the development of entrepreneurship in the digital age.

2. LITERATURE REVIEW

Digital Technology

Digital technology has become the backbone of modern world development, enabling rapid progress across various sectors of life. In general, digital technology can be defined as the use of electronic devices to process, store, and transmit information in digital form (Brynjolfsson & McAfee, 2014). This technology plays a crucial role in creating an efficient ecosystem that supports human activities, whether in personal, business, or governmental contexts.

The definition of digital technology encompasses several key aspects that explain its functionality. First, digital technology relies on electronic devices such as computers, smartphones, and servers to perform various functions. These devices operate using the binary system—a combination of 0s and 1s—which forms the foundation of digital data processing. Additionally, digital technology possesses the capability to store and transmit information electronically, enabling fast and efficient data access anytime and anywhere.

Beyond the fundamental definition, digital technology exhibits several distinctive characteristics that set it apart from traditional technology. One of its most significant features is its reliance on the binary system for data processing. This system allows for highly precise information processing by utilizing combinations of the two basic numbers, 0 and 1 (Turban et al., 2017). Furthermore, the digitalization process is another critical element, facilitating the conversion of analog data into digital formats to simplify data storage and processing (Laudon & Laudon, 2019). Another prominent characteristic is its electronic nature, where devices like computers and networks are employed to perform essential technological functions (Kumar et al., 2018). Lastly, digital technology supports interconnectivity—the ability to link various devices and networks—creating a seamless and collaborative flow of information (Gartner, 2020).

Digital technology not only presents theoretical concepts but also plays a significant role through various key functions. The first function is **data processing**, where raw data is transformed into useful information for decision-making or analysis (Brynjolfsson & McAfee, 2014). The second function is **storage**, which refers to the ability to keep information electronically in various formats, such as databases, cloud storage, or other device storage (Turban et al., 2017). The third function is **communication**, which enables information to be delivered through networks, including the Internet, to reach recipients in a matter of seconds (Kumar et al., 2018). The final function is **applications**, where digital technology provides

online services and applications that facilitate human activities, such as e-commerce, digital banking, and social media (Gartner, 2020).

In general, digital technology serves as an important foundation of modern life, designed to enhance efficiency and productivity. In the business world, this technology allows companies to operate more effectively, reach a broader market, and create new business models. Meanwhile, in everyday life, digital technology simplifies communication, accelerates access to information, and improves the quality of life. Therefore, having a solid understanding of digital technology is crucial for maximizing its potential in this era of globalization.

Entrepreneurship

The concept of entrepreneurship dates back to the 17th century, when French economist Jean-Baptiste Say (1767-1832) used the term "entrepreneur" to describe individuals who assumed risk and managed businesses. In general, entrepreneurship is the ability of an individual to identify opportunities, take risks, and create new value through the management of existing resources (Zimmerer, Scarborough, & Wilson, 2008). Peter Drucker (1985) defines entrepreneurship as a process of innovation and opportunity exploitation to create something new or add value to products or services. Thus, entrepreneurship can be understood as a discipline that integrates creativity, innovation, and courage to generate economic and social value. Understanding the definition, concept, and characteristics of entrepreneurship is essential to fostering growth and sustainability in the business world.

The framework of entrepreneurship encompasses various elements that serve as the foundation for entrepreneurial practices. These elements are interconnected and form a robust basis for the successful development of entrepreneurial ventures. The key elements of entrepreneurship include:

1. **Innovation**: Entrepreneurship is often associated with the ability to create or introduce something new, whether in the form of products, processes, or business models (Schumpeter, 1934).
2. **Risk-Taking**: Entrepreneurs must have the courage to take risks, both financial and non-financial, to achieve their goals (Hisrich, Peters, & Shepherd, 2017).
3. **Opportunity Identification**: Entrepreneurship involves the ability to identify and evaluate opportunities in the environment that have not yet been utilized (Baron, 2006).
4. **Creativity**: Creativity is at the core of entrepreneurship, enabling individuals to develop unique and effective solutions (Amabile, 1996).
5. **Resource Management**: Entrepreneurs must effectively manage resources such as capital, labor, and time to maximize output (Timmons & Spinelli, 2007).

An entrepreneur possesses distinct characteristics that differentiate them from others. These traits enable entrepreneurs to identify opportunities, develop successful businesses, and make a positive impact on society. The primary characteristics of an entrepreneur include:

1. **Action-Oriented**: Entrepreneurs are implementation-focused individuals who prioritize real actions to achieve their goals (McClelland, 1961).
2. **Self-Confidence**: Confidence in one's abilities is a critical asset for overcoming challenges in business (Rotter, 1966).
3. **Long-Term Vision**: Entrepreneurs have the capability to think ahead and develop long-term strategic plans (Bird, 1988).
4. **Adaptability**: Entrepreneurs must be flexible and able to adapt quickly to changes in the market and environment (Stevenson & Jarillo, 1990).
5. **Perseverance and Discipline**: Success in entrepreneurship requires hard work, consistency, and discipline in managing business operations (Covin & Slevin, 1989).

Industrial Revolution 4.0

The Industrial Revolution 4.0 represents a significant transformation in the industrial world, characterized by the integration of digital technology into production and service processes (Schwab, 2016). This concept was first introduced in Germany in 2011 as a strategic initiative to enhance the competitiveness of the manufacturing sector through digitalization (Hermann, Pentek, & Otto, 2016). This digital revolution encompasses advanced automation, device communication through the Internet of Things (IoT), and the use of big data for decision-making (Kagermann, Wahlster, & Helbig, 2013).

Various sophisticated and interconnected technologies form the core of the Industrial Revolution 4.0. This era is marked by significant changes in how industries operate, merging digital technology to create more efficient, innovative, and connected systems. Some key technologies driving the Industrial Revolution 4.0 include:

1. **Internet of Things (IoT)**: IoT enables devices to communicate and exchange data in real-time, enhancing efficiency and transparency in production processes (Atzori, Iera, & Morabito, 2017).
2. **Artificial Intelligence (AI)**: AI is employed to analyze big data and provide insights that enhance productivity and foster innovation (Russell & Norvig, 2021).
3. **Big Data and Analytics**: Big data is used to identify patterns and trends, aiding in more accurate decision-making (Chen, Mao, & Liu, 2014).
4. **Cloud Computing**: This technology enables access to data and applications from various locations, supporting operational flexibility (Marinescu, 2017).

5. **Smart Manufacturing**: Advanced robotics and other technologies are utilized to create more efficient and adaptive production lines (Brettel et al., 2014).
6. **Blockchain**: This technology ensures security and transparency in digital transactions, particularly in supply chains (Casino, Kanakaris, & Patsakis, 2019).

The Industrial Revolution 4.0 has far-reaching impacts on various sectors, including economic, social, and environmental domains. In the economic sector, productivity and efficiency have improved, creating new business opportunities and driving global economic growth (Manyika et al., 2017). In the workforce sector, although technology can replace certain jobs, the Industrial Revolution 4.0 also creates new job types that require digital and technological skills (World Economic Forum, 2020). Meanwhile, in the environmental sector, advanced technologies help reduce waste and energy consumption through more detailed and efficient production processes (Geissdoerfer et al., 2017).

3. METHODOLOGY

Research Approach

The approach employed in this study is a systematic literature review. This approach was selected to ensure that the collection and analysis of literature were conducted in a structured and transparent manner. This method enables the identification, evaluation, and synthesis of relevant literature to provide a comprehensive understanding of the role of digital technology in entrepreneurship. The reviewed literature includes empirical studies, theoretical frameworks, and best practice reports published in scientific journals, academic books, and conference proceedings.

Criteria for Literature Selection

The criteria for selecting literature encompassed three main aspects: source, publication timeframe, and topic relevance. The sources of literature included reputable scientific journals, academic books, and reports from international conferences. The publication timeframe was restricted to the period between 2013 and 2023 to ensure that the data analyzed was current and relevant. Additionally, the relevance of the literature to the topics of digital entrepreneurship and technology in the Industry 4.0 era was a primary condition for selection. Particular attention was given to studies that explored the adoption of digital technology, its impact on business innovation, and the factors influencing its successful implementation.

Data Collection Techniques

Data collection was conducted through searches in academic databases such as Scopus, Google Scholar, IEEE Xplore, and ScienceDirect. The keywords used in the searches included

"digital entrepreneurship," "technology 4.0," "digital start-up," "digital entrepreneurship," and "digital transformation in business." Each piece of literature identified was then filtered based on its abstract, methodology, and study results to ensure its relevance to the study's objectives. Data analysis was carried out by grouping the literature based on key themes, such as the benefits of digital technology, challenges in adoption, supporting solutions, and its implications for entrepreneurship in the Industry 4.0 era.

4. RESULTS AND DISCUSSION

A systematic literature analysis on the role of digital technology in enhancing entrepreneurship in the Industry 4.0 era revealed several significant findings. This research examined various empirical and theoretical literature published in scientific journals, academic books, and conference proceedings from 2013 to 2023. Based on Scopus, Google Scholar, IEEE Xplore, and ScienceDirect, 13 articles met the researchers' criteria out of a total of 624 articles published during this period. The analysis conducted using the selected literature sources yielded the following results:

Benefits of Digital Technology in Entrepreneurship

The systematic literature analysis identified numerous benefits of digital technology in entrepreneurship, as outlined in the following table:

Table 1. Benefits of Digital Technology Based on Empirical Studies

Type of Technology	Key Benefits	Reference
ERP	Operational efficiency, cost reduction	Tajudeen et al. (2018)
Big Data Analytics	In-depth insights, strategic decision-making	Lee et al. (2020)
AI	Personalized services, improved customer loyalty	Chang et al. (2021)
IoT	More energy-efficient management	Zhang et al. (2020)

Source: Processed data

The analysis results indicate that digital technology provides numerous significant benefits for entrepreneurship in the Industry 4.0 era. One of the primary advantages is operational efficiency achieved through business process automation and cost reduction (Tajudeen et al., 2018). Technologies such as ERP (Enterprise Resource Planning) systems and robotics enable companies to integrate various business functions onto a single platform, thereby reducing the time and effort required for daily operations.

Digital technology also supports more accurate decision-making through tools such as cloud computing and big data analytics. These tools enable the processing of large volumes of

data in real-time, providing deep insights into consumer behavior, market trends, and business performance (Lee et al., 2020). With well-structured data and sophisticated analytics, entrepreneurs can make more strategic and informed decisions, thereby reducing the risk of failure in business planning.

Moreover, digital technology facilitates broader market access through digital marketing platforms such as social media, e-commerce, and internet-based advertising. These platforms enable businesses to reach a global audience at significantly lower costs compared to traditional marketing methods (Dwivedi et al., 2021). With effective digital marketing strategies, even small businesses can compete in the global market, enhancing their revenue potential and business growth.

In the field of innovation, digital technology creates opportunities for developing new products and services tailored to consumer needs. For instance, start-up companies like Gojek and Tokopedia leverage mobile application technology to offer innovative solutions such as app-based transportation services and e-commerce platforms that empower local SMEs (Purwanegara et al., 2019). These innovations not only address specific market needs but also create a digital ecosystem that fosters collaboration among business actors.

Digital technology also plays a critical role in service personalization. By using artificial intelligence (AI) and machine learning algorithms, companies can offer customized products and services based on individual customer preferences. For example, platforms like Netflix and Spotify utilize these technologies to recommend relevant content to their users, creating a more satisfying customer experience and improving consumer loyalty.

Furthermore, the adoption of digital technology enables businesses to manage risks more effectively. Advanced cybersecurity systems, such as data encryption and two-factor authentication, help protect sensitive company and customer data from digital threats (Chang et al., 2021). This is crucial for building customer trust, which is a key factor in business success in the digital age.

Digital technology also provides new opportunities for business financing through crowdfunding and fintech platforms. Platforms such as Kickstarter, Indiegogo, and GoFundMe allow entrepreneurs to raise funds from a global community without relying on traditional banking processes. Additionally, blockchain technology underlying many modern fintech platforms offers transparency and efficiency in financial transactions, helping small businesses access financial services that were previously difficult to obtain.

In the context of sustainability, digital technology supports businesses in adopting more environmentally friendly practices. For example, the use of Internet of Things (IoT) technology

in energy management enables companies to reduce energy consumption and carbon emissions (Zhang et al., 2020). Thus, digital technology not only enhances business efficiency but also addresses environmental concerns that are increasingly important to consumers.

The benefits of digital technology are also evident in improved collaboration and communication within teams. Collaboration tools such as Slack, Microsoft Teams, and Zoom enable geographically distributed teams to work together efficiently. This is especially relevant in the post-pandemic era, where hybrid and remote work models have become the norm. Enhanced collaboration fosters faster innovation and more responsive adaptation to market changes.

Overall, digital technology is not merely a tool for supporting business operations but serves as a key driver of business transformation and sustainability. Businesses that effectively leverage digital technology will gain a significant competitive advantage, both locally and globally.

Challenges in Adopting Digital Technology

While digital technology offers numerous benefits, its adoption also faces several significant challenges. These challenges encompass various factors that can impede the digital transformation process, particularly for small and medium enterprises (SMEs) that often encounter limitations in capacity and access. The following table highlights the levels of difficulty (on a scale of 1-5) faced by SMEs in adopting digital technology, based on empirical and theoretical literature from various sources:

Table 2. Difficulty Levels in Adopting Digital Technology

Challenge	Difficulty Level (1-5)	Source
Limitations in Resources	5	Tajudeen et al. (2018); World Bank (2020)
Lack of Digital Literacy	4	Chang et al. (2021); Dwivedi et al. (2021)
Resistance to Change	3	Schwab (2016); Lee et al. (2020)
Digital Divide	4	World Bank (2020); Zhang et al. (2020)
High Implementation Costs	5	Tajudeen et al. (2018); Lee et al. (2020)
Security and Privacy Concerns	4	Chang et al. (2021); Dwivedi et al. (2021)
Lack of Policy Support	4	World Bank (2020)
Complexity of Technology	3	Lee et al. (2020)
Lack of Partnerships and Collaboration	3	Zhang et al. (2020)
Dependence on Technology	3	Dwivedi et al. (2021)

Source: Processed data

Limitations of Resources

Many small businesses face significant challenges in allocating funds for technological investments, including hardware, software, and human resource training (Tajudeen et al., 2018). Digital technology often necessitates costly infrastructure, such as servers, specialized software, and stable internet connectivity. Additionally, training costs to enhance workforce competencies in utilizing such technologies can impose an extra financial burden (World Bank, 2020). These factors make the adoption of digital technology a substantial challenge for small businesses, especially in developing countries.

Lack of Digital Literacy

Digital literacy is a critical element for successful digital transformation. Business actors lacking adequate understanding of digital technology often struggle to integrate it into their business models (Chang et al., 2021). Studies indicate that low digital literacy is a primary barrier for SMEs in fully leveraging digital technology (Dwivedi et al., 2021). This limitation can lead to over-reliance on third parties for technology management, further increasing operational costs.

Resistance to Change

Many business owners are reluctant to shift from traditional operational methods, which hampers digital transformation efforts (Schwab, 2016). Such resistance is often rooted in uncertainty about the long-term benefits of technological investments and fears of losing control over business processes. According to Lee et al. (2020), psychological factors, such as comfort with established workflows, pose significant barriers to adopting new technologies.

Digital Divide

The digital divide between urban and rural areas presents another major challenge in adopting digital technology (World Bank, 2020). In many developing countries, digital infrastructure, such as reliable internet access and electricity, is often limited to urban regions. This creates a significant gap in access to digital opportunities. A study by Zhang et al. (2020) emphasizes that the digital divide inhibits innovation in remote areas, making it difficult for small businesses to compete with larger players in urban centers.

High Implementation Costs

Implementing digital technology involves not only substantial initial investments but also ongoing maintenance costs (Tajudeen et al., 2018). Expenses related to upgrading technology, purchasing software licenses, and maintaining cybersecurity systems add to the financial burden for many businesses. These high costs are often deemed prohibitive for SMEs with limited budgets.

Data Security and Privacy

Data security is a critical concern in adopting digital technology. Increased reliance on technology amplifies the risks of cyberattacks and privacy breaches (Chang et al., 2021). Many businesses worry about the potential financial and reputational losses stemming from data security violations. According to Dwivedi et al. (2021), a lack of trust in data security is a major reason many businesses hesitate to fully adopt digital technology.

Lack of Policy Support

In some countries, government policies supporting digital technology adoption are inadequate. Measures such as subsidies for technology training, tax incentives for technology investments, and the development of digital infrastructure in remote areas are crucial for driving digital transformation (World Bank, 2020).

Complexity of Technology Implementation

Adopting digital technologies often involves complex processes, from selecting the right technology to integrating it with existing systems (Lee et al., 2020). Many business owners feel overwhelmed by this complexity, especially if they lack a competent technology team.

Lack of Partnership and Collaboration

Small businesses often face difficulties in establishing partnerships with technology providers or larger companies to support their digital transformation. Zhang et al. (2020) highlight the importance of collaboration between small businesses, government bodies, and technology companies to overcome barriers to technology adoption.

Dependence on External Technology Providers

Many businesses rely heavily on external technology providers without having a deep understanding of how these technologies work. This excessive dependence on third parties poses risks if the technology provider encounters operational issues or exits the market (Dwivedi et al., 2021).

Support to Overcome Challenges

The following table summarizes solution strategies to address the challenges of digital transformation, based on empirical and theoretical studies from various sources:

Table 3. Solutions to Overcome Challenges in Digital Transformation

Challenge	Solution	Source
Limitations of Resources	Government funding programs for SMEs; subsidies for technology training.	World Bank (2020)
Lack of Digital Literacy	Free training programs for business practitioners; partnerships with universities or training institutions.	Chang et al. (2021); Dwivedi et al. (2021)
Resistance to Change	Workshops and seminars highlighting the benefits of digital transformation; case studies showcasing successful transformations in similar sectors.	Schwab (2016); Lee et al. (2020)
Digital Divide	Development of digital infrastructure in rural areas; collaboration with internet service providers.	World Bank (2020); Zhang et al. (2020)
High Implementation Costs	Soft loan schemes for purchasing technology; tax incentives for technology investments.	Tajudeen et al. (2018); Lee et al. (2020)
Security and Privacy Issues	Education on the importance of data security; introduction of affordable data security software for SMEs.	Chang et al. (2021); Dwivedi et al. (2021)
Lack of Policy Support	Regulatory frameworks to promote innovation; establishment of digital transformation centers for SMEs in local regions.	World Bank (2020)
Complexity of Technology Implementation	Simplified procedures for adopting technology; free consultations with technology experts.	Lee et al. (2020)
Lack of Partnership and Collaboration	Public-private partnership enhancement programs; collaborations with large companies for technological mentorship.	Zhang et al. (2020)
Dependence on External Technology	Internal training on technology usage; capacity-building initiatives for human resource management of technology.	Dwivedi et al. (2021)

Source: Processed data

The findings above reveal that digital transformation has become a global phenomenon, presenting significant opportunities for innovation and growth across various sectors. A systematic literature analysis highlights that comprehensive and multifaceted support is essential to address these challenges effectively. For digital transformation to serve as a true catalyst for positive change, coordinated efforts are required at individual, organizational, and

community levels. These efforts must be aligned and tailored to ensure the benefits of digital transformation are accessible and sustainable for all stakeholders.

Implications for Entrepreneurship in the 4.0 Era

The adoption of digital technology has long-term implications for entrepreneurship, encompassing changes in business models, enhanced competitiveness, and improved business sustainability. With the rapid development of technology in the 4.0 era, businesses face both challenges and opportunities to adapt to an ever-evolving business environment.

Business Model Transformation

Digital technology has encouraged businesses to innovate their business models. One notable transformation is the shift from traditional sales methods to digital platforms, such as e-commerce (Tajudeen et al., 2018). Platforms like Tokopedia and Shopee enable businesses to reach a broader, geographically unrestricted market (Chang et al., 2021). Additionally, technologies such as artificial intelligence (AI) facilitate product and service personalization, thereby enhancing customer satisfaction (Lee et al., 2020).

Enhanced Competitiveness

In an increasingly competitive global market, leveraging digital technology provides significant competitive advantages. For instance, big data analytics supports data-driven decision-making, enabling businesses to respond to market changes more effectively and promptly (Dwivedi et al., 2021). Moreover, social media serves as a powerful marketing tool, allowing businesses to directly engage with customers at a relatively low cost. This not only increases brand exposure but also builds customer loyalty (Kapoor et al., 2021).

Business Sustainability

Digital technology supports environmentally friendly practices, such as using the Internet of Things (IoT) for energy management, which helps businesses meet the growing consumer demand for sustainability (Zhang et al., 2020). Additionally, digital tools enable more efficient supply chain management, reducing waste and advancing sustainability initiatives (OECD, 2020). For example, blockchain technology can enhance transparency and accountability in supply chains (Zhang et al., 2020).

Innovation in Products and Services

Digital technology creates opportunities for businesses to develop more innovative products and services. For instance, augmented reality (AR) is used in the retail sector to offer interactive shopping experiences (Tajudeen et al., 2018). Furthermore, AI-based applications, such as chatbots, allow companies to deliver fast and efficient customer service, significantly enhancing the overall customer experience (Dwivedi et al., 2021).

Gap Study

Based on the empirical and theoretical findings from the literature review above, it can be concluded that the role of digital technology in supporting entrepreneurship has become a central focus of various studies. However, several research gaps remain, requiring further exploration to better understand the relationship between digital technology and entrepreneurship, particularly within the context of the Fourth Industrial Revolution (Industry 4.0). These research gaps are outlined as follows:

Gaps in Technology Adoption within the MSME Sector

Existing literature predominantly focuses on large corporations or high-tech start-ups. Studies such as those by Bharadwaj et al. (2013) and Hanelt et al. (2021) emphasize digital strategies aimed at achieving competitive advantage. However, research on the implementation of digital technology in the MSME (Micro, Small, and Medium Enterprise) sector remains limited. This is particularly concerning, as MSMEs serve as the backbone of the economy in many countries, especially in developing nations. Comprehensive research is required to understand how MSMEs can address challenges such as limited financial resources, inadequate digital literacy, and insufficient access to technological infrastructure.

Impact of Digital Technology on Business Sustainability

Research on the impact of digital technology often emphasizes its economic benefits, but aspects of sustainability—both social and environmental—are frequently overlooked. For instance, Laudon & Laudon (2019) discuss the digitization of data to enhance efficiency, but they do not explore how such advancements influence long-term business sustainability. Studies that link digital technology adoption with business sustainability, including its effects on social inclusion and ecological impact, represent an important area for further investigation.

The Role of Policies and Support Ecosystems

Government policies and supportive ecosystems, such as business incubators, accelerators, and funding institutions, play critical roles in facilitating digital transformation in entrepreneurship. However, there is limited research examining the synergy between public policies and private-sector initiatives (Kumar et al., 2018). Further investigation is needed to determine how policies can be effectively designed to promote the adoption of digital technology among entrepreneurs, particularly in developing countries with inadequate infrastructure.

Ethical and Security Challenges in Digital Technology

Ethical challenges, such as data privacy and cybersecurity, have become increasingly significant as reliance on digital technology grows. While Gartner (2020) highlights the

importance of interconnectivity between devices, there has been insufficient in-depth research on the ethical and security risks associated with digital entrepreneurship. More detailed studies are necessary to explore how entrepreneurs can mitigate these risks without compromising innovation, addressing the urgent need for balanced approaches to ethical and technological challenges.

5. CONCLUSION AND SUGGESTIONS

Conclusion

This study reveals that digital technology plays a significant role in enhancing entrepreneurship in the Era 4.0. Through a systematic literature analysis covering various sources from the period 2013–2023, it was found that digital technology contributes to improving operational efficiency, productivity, and market reach. Furthermore, the adoption of digital technology facilitates the development of innovative business models, improves service quality, and provides access to global markets.

However, several challenges hinder the adoption of digital technology, particularly for small and medium enterprises (SMEs). These challenges include resource limitations, low digital literacy, the digital divide, and high implementation costs. Strategic solutions such as training programs, subsidies, and infrastructure development have been identified as essential steps to address these obstacles.

Study Limitations

This study has several limitations that should be noted:

1. **Data Sources**: The analysis relies on literature published between 2013–2023, meaning recent developments in digital technology may not be fully covered.
2. **Regional Context**: Most of the analyzed studies focus on global trends and do not adequately address the specific conditions of certain countries, particularly developing nations.
3. **Practical Aspects**: This study primarily examines theoretical and empirical literature, offering limited analysis of practical experiences from entrepreneurs in the field.
4. **Ethical and Social Dimensions**: The study does not sufficiently explore the ethical, privacy, and social implications of adopting digital technology in entrepreneurship.

Suggestions

Based on the findings of this study, the following recommendations are proposed for various stakeholders:

For Researchers

1. **Explore Local Contexts**: Future studies should investigate the implementation of digital technology in regional contexts, particularly in developing countries.
2. **Focus on Sustainability**: It is important to delve deeper into issues related to ethics, privacy, and the sustainability impacts of digital technology in entrepreneurship.
3. **Adopt Multidisciplinary Approaches**: Future research should integrate perspectives from technology, business, and policy to provide more comprehensive analyses.

For Business Practitioners

1. **Enhance Digital Literacy**: Entrepreneurs, especially SMEs, should prioritize digital literacy through training and capacity-building programs.
2. **Forge Strategic Partnerships**: Collaborations with technology providers and educational institutions can support digital transformation efforts.
3. **Gradual Adoption**: SMEs should adopt digital technology incrementally to minimize risks and manage implementation costs effectively.

For Governments and Policy Stakeholders

1. **Support Infrastructure Development**: Accelerate the development of digital infrastructure, particularly in rural and underserved areas.
2. **Provide Incentives and Subsidies**: Offer tax incentives or subsidies to encourage SMEs to adopt digital technology.
3. **Establish Data Protection Policies**: Develop and enforce regulations that ensure data security and privacy for businesses adopting digital technologies.

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