Bridging the Urban-Rural Divide: Exploring the Potential of Smart Technologies for Rural Micro-Enterprises in Yogyakarta City, Indonesia

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Abstract. The proliferation of smart technologies is revolutionizing the global business environment, offering growth and competitiveness opportunities for micro-enterprises facing resource, market access, and infrastructure challenges. Yogyakarta City, Indonesia, presents a diverse case, with both urban and rural areas experiencing varying technology adoption and infrastructure. Rural micro-enterprises in Yogyakarta grapple with issues like insufficient human resources, limited internet access, and technological barriers. This study aims to investigate the role of smart technologies in fostering the growth and competitiveness of micro-enterprises in the rural areas of Yogyakarta City, Indonesia, by identifying the key challenges and opportunities related to technology adoption and infrastructure development. To investigate the role of smart technologies in fostering the growth and competitiveness of micro-enterprises in rural areas of Yogyakarta City, Indonesia, a qualitative research method can be employed. This approach allows an in-depth exploration of participants’ experiences, perspectives, and contextual factors influencing technology adoption. Through a qualitative study analysis on rural micro-enterprises in Yogyakarta City, Indonesia, the findings reveal limited awareness and misconceptions about smart technologies, inadequate infrastructure and connectivity, a lack of skilled workforce, financial constraints, insufficient government support, and cultural resistance to change as key challenges impacting the adoption of smart technologies, which underscores the need for targeted interventions to foster growth and competitiveness in these businesses.

Keyword: Smart Technology, Micro-Enterprises, Rural Area, Growth, Competitiveness.

1 Introduction

In Indonesia, micro-enterprises are the backbone of the economy, accounting for 99% of all businesses and employing over 97% of the workforce [1]. However, these businesses are often located in rural areas and face significant challenges in accessing markets, finance, and technology. This urban-rural divide has contributed to persistent poverty and inequality in the country, with rural areas lagging behind urban centres in terms of economic development and technology adoption [2]. Nowadays, rapidly evolving world, the increasing interconnectivity of society has brought to the forefront the pressing issue of the urban-rural
divide, which manifests itself in the form of glaring disparities in economic opportunity and quality of life. In response to this, a diverse range of stakeholders including policymakers, entrepreneurs, and researchers have recognized the enormous potential of smart technologies to bridge this divide and facilitate the growth of rural micro-enterprises [3]. By harnessing the power of cutting-edge digital tools such as mobile applications, e-commerce platforms, and digital payment systems, it is now possible to overcome age-old geographic barriers and unlock new markets, all while improving productivity and efficiency. In fact, the McKinsey Global Institute has been a strong proponent of smart technologies as a game-changing tool in the pursuit of inclusive growth and sustainable development, identifying them as a key driver of rural transformation and progress in the 21st century [4]. To address this issue, there has been growing interest in the potential of smart technologies to bridge the urban-rural divide and support the growth of rural micro-enterprises. Smart technologies, such as mobile applications, e-commerce platforms, and digital payment systems, can help overcome geographic barriers, increase market access, and improve productivity and efficiency [4].

The use of smart technologies in rural areas has gained attention in recent years as a means of bridging the urban-rural divide and promoting economic development [5,6]. The urban-rural divide is a longstanding issue that has been a concern for policymakers and economists for decades. In rural areas, economic opportunities tend to be more limited than in urban areas, which can lead to lower incomes and reduced quality of life. However, recent advancements in smart technologies have opened up new possibilities for bridging this gap and promoting economic development in rural areas. Smart technologies refer to digital tools and platforms that incorporate the latest advances in information and communication technology [7]. These technologies can include mobile applications, e-commerce platforms, and digital payment systems, among others. By leveraging the power of smart technologies, rural entrepreneurs can overcome geographic barriers, access new markets, and improve productivity and efficiency. For example, mobile applications can provide rural farmers with real-time information about weather patterns, market prices, and crop management techniques [8]. E-commerce platforms can allow rural businesses to sell their products online, reaching customers far beyond their immediate area. Digital payment systems can facilitate transactions and eliminate the need for physical currency, making it easier and more efficient for businesses to conduct transactions with customers and suppliers [9].

By investing in these technologies and supporting their adoption in rural communities, policymakers and entrepreneurs can help to unlock new opportunities and drive progress in rural areas. Despite the potential benefits of smart technologies for rural micro-enterprises, their adoption in these areas is not without its challenges. Among the primary obstacles that rural businesses face in adopting these technologies are limited access to technology infrastructure and digital skills, low levels of trust in online platforms, and a lack of awareness of the benefits that technology adoption can bring [10]. The challenge relates to the limited access to technology infrastructure, such as high-speed internet and reliable power supply, which can make it difficult for rural businesses to take full advantage of digital tools and platforms. In addition, many rural entrepreneurs may lack the necessary digital skills to effectively use and integrate these technologies into their businesses [11]. Another challenge is the low levels of trust that many rural businesses have in online platforms, particularly with regards to the security and privacy of their data. This lack of trust can make it difficult for rural entrepreneurs to fully embrace these technologies and realize their full potential [12].

Yogyakarta City, a region where rural micro-enterprises constitute a significant portion of the economy, stands to benefit from the adoption of smart technologies. These cutting-edge
tools have the potential to enhance market access, boost productivity and efficiency, and facilitate inclusive economic growth in the region [13]. According to data from the Central Bureau of Statistics (BPS) and other sources, Kulon Progo and Gunung Kidul are two districts in Yogyakarta that have relatively low levels of economic development, particularly in terms of micro-entreprises. In both districts, the majority of the population relies on agriculture and micro and small-scale businesses for their livelihoods, with relatively limited access to markets and other economic opportunities. For example, in 2017 study by the Center for Data and Information of the Ministry of Cooperatives and Small and Medium Enterprises found that Kulon Progo had one of the lowest levels of micro-enterprise development in Yogyakarta, with only 20% of its population engaged in such activities [14]. Similarly, Gunung Kidul was identified as one of the poorest districts in the province, with a relatively high incidence of poverty and limited access to basic services [15]. One of the main factors contributing to the limited development of micro-enterprises in these districts is the lack of access to infrastructure and resources. Both districts are located in relatively remote and hilly areas, with limited access to transportation, communication, and other services. As a result, it can be difficult for rural entrepreneurs to access markets, finance, and other resources needed to start and grow their businesses [16].

Despite these potential benefits, there remains a paucity of research on the challenges and opportunities for integrating smart technologies into the context of Yogyakarta City. The lack of research in this area is a cause for concern, as it represents a significant knowledge gap that hinders the development of effective policies and initiatives to promote the adoption of smart technologies in Yogyakarta City. Without a deeper understanding of the specific challenges and opportunities that rural micro-enterprises in the region face in adopting these technologies, efforts to bridge the urban-rural divide and promote sustainable economic growth may fall short of their intended goals. As such, it is essential to conduct further research into the context of Yogyakarta City to identify the specific challenges and opportunities for the adoption of smart technologies in this region. This research could provide valuable insights into the unique factors that shape the adoption and use of these technologies in rural areas, and inform the development of tailored policies and initiatives that address the specific needs of rural micro-enterprises in Yogyakarta City. By taking these steps, it is possible to unlock the full potential of smart technologies and drive sustainable economic growth in this region. Through qualitative interviews with rural micro-entrepreneurs and experts, this study will explore the potential of smart technologies for rural micro-enterprises in Yogyakarta City. The study will examine the challenges and opportunities for technology adoption, including access to technology infrastructure and digital skills, trust in online platforms, and awareness of the benefits of technology adoption. The study will also assess the potential impact of technology adoption on rural economic development, including increased market access, productivity, and efficiency.

2 Method
This research employs a qualitative approach to gather in-depth insights and a nuanced understanding of the experiences and perspectives of rural micro-enterprises regarding the utilization of smart technologies. In-depth interviews conducted with owners of rural micro-enterprises in Yogyakarta City. These interviews explored their experiences, perceptions, and challenges related to smart technologies, as well as their aspirations and expectations regarding their adoption. Thematic analysis also employed to analyze the qualitative data obtained from interviews, observations, and document analysis. The data coded, categorized, and interpreted to identify key themes, patterns, and relationships.
3 Basic Theory

The Innovation Diffusion Theory (IDT) is a well-known theoretical framework developed by Everett Rogers that explains how innovations are adopted and spread within a social system. IDT explores the factors that influence the adoption process and the diffusion of innovations, such as new technologies, ideas, or practices. The Innovation Diffusion Theory, initially introduced in 1962 and later refined by Rogers in 1995, aims to comprehend the mechanisms of how innovative ideas and technologies spread within a social system [17]. Unlike traditional theories of change that focus on persuading individuals to change, the Innovation Diffusion Theory adopts a different perspective. It considers change as primarily involving the evolution or "reinvention" of products and behaviors to better align with the needs of individuals and groups. Consequently, in the diffusion of innovations, it is the innovations themselves that undergo transformation rather than the individuals (Les Robinson, 2009). Additionally, diffusion refers to the process through which an innovation is effectively communicated across specific channels over time among members of a social system (Rogers, 2003). The spread of ideas, known as diffusion of innovations, typically encompasses the transfer of concepts from one society to another or from a particular focal point or institution within a society to different segments of that same society [17]. Ismail Sahin (2006) identified four fundamental elements that constitute the entire theory of Innovation Diffusion [18].

IDT highlights five key attributes of innovations that shape their adoption such as 1) relative advantage: this attribute refers to the perceived superiority of an innovation compared to existing alternatives. It examines the extent to which the innovation offers benefits, improvements, or advantages over current practices. For example, in the context of smart technologies for rural micro-enterprises in Yogyakarta City, it would explore how these technologies can enhance operational efficiency, streamline business processes, or open up new market opportunities; 2) compatibility: compatibility focuses on the degree to which an innovation aligns with the existing values, needs, and practices of potential adopters. It considers whether the innovation can be easily integrated into the current systems and routines of rural micro-enterprises. For instance, it examines how well smart technologies align with the specific characteristics and requirements of rural businesses in Yogyakarta City; 3) complexity: complexity refers to the perceived difficulty or complexity associated with understanding and using the innovation. It considers the cognitive effort required to grasp the innovation and the skills needed to effectively utilize it. In the case of smart technologies, the level of complexity may impact the adoption decisions of rural micro-enterprises. If the technologies are perceived as overly complex or difficult to use, it may hinder their adoption; 4) trialability: it refers to the ability of potential adopters to experiment with the innovation on a limited basis before making a full commitment. It involves the opportunity for individuals or organizations to test the innovation, observe its benefits, and evaluate its fit with their specific needs. For rural micro-enterprises, having the chance to trial smart technologies in a controlled environment can help reduce uncertainty and increase their confidence in adopting the innovation; 5) observability: it relates to the visibility of the results and benefits derived from adopting the innovation [19]. It considers whether the outcomes of the innovation are easily observable or measurable by others. When rural micro-enterprises can witness the positive outcomes and successes of their peers who have adopted smart technologies, it can create social proof and influence their own adoption decisions.

4 Findings and Discussion

Challenges in Adopting and Utilizing Smart Technologies for Rural Micro-Enterprises in Yogyakarta City, Indonesia

The findings of the study indicate that rural micro-enterprises in Yogyakarta City, Indonesia, face several challenges in adopting and utilizing smart technologies. These challenges include limited awareness and misconceptions about smart technologies, inadequate infrastructure and connectivity, a lack of skilled workforce, financial constraints, insufficient government support, and cultural resistance to change. One key challenge identified is the limited awareness and misconceptions about smart technologies among rural micro-enterprises. As stated by micro-enterprise owner: "I have heard about smart technologies, but I am not sure how they can benefit my business. I have some misconceptions about their complexity and costs" [P1, P2]. "We lack information and understanding about the specific applications and advantages of smart technologies. There is a need for education and awareness
campaigns” [P2, P4]. Many business owners and employees may not fully understand the benefits and potential applications of these technologies, leading to hesitancy and resistance towards their adoption. Addressing this challenge requires targeted awareness campaigns and educational programs to enhance understanding and change perceptions. Another significant barrier is the inadequate infrastructure and connectivity in rural areas. As the micro-enterprises owner said that "Internet access in our rural area is unreliable and slow. It hampers our ability to connect and utilize online platforms and tools". Limited internet access and poor connectivity impede the seamless integration and effective utilization of smart technologies [20]. Improving the digital infrastructure in these areas, such as expanding internet coverage and ensuring reliable connectivity, is crucial to unlocking the potential of smart technologies for rural micro-enterprises.

The lack of a skilled workforce also poses a challenge "we don't have employees with specific digital skills. It limits our ability to adopt and fully utilize smart technologies" [P1, P3]. Rural micro-enterprises may struggle to find employees with the necessary digital skills to effectively leverage smart technologies. Initiatives focusing on digital literacy and training programs can help bridge this skills gap and enable micro-enterprises to harness the full benefits of smart technologies. Financial constraints emerge as another obstacle to technology adoption. "We are hesitant to invest in new technologies due to the financial burden it may impose on our business during these challenging times” [P5, P6, P7]. Micro-enterprises often have limited financial resources, making it challenging to invest in the necessary hardware, software, and other digital tools "investing in smart technologies requires significant financial resources, which we currently lack. It becomes a barrier to their adoption" [P8, P9, P10, P11, P15]. Access to affordable financing options and government support programs specifically tailored to the needs of micro-enterprises can alleviate this constraint and facilitate their adoption of smart technologies.

Furthermore, insufficient government support and policies targeting the growth of rural micro-enterprises contribute to the challenges faced in technology adoption. As state by the micro-enterprise owner that "government initiatives and funding opportunities are limited for micro-enterprises in rural areas, hindering their ability to embrace smart technologies” [P12, P13, P14, P2]. Enhancing government support in terms of funding, incentives, and policy frameworks can provide the necessary ecosystem for fostering the adoption and utilization of smart technologies in rural areas. Cultural resistance to change also plays a role in hindering the adoption of smart technologies. Traditional mindsets and reluctance to embrace technological advancements may impede the integration of these technologies into existing business processes. Addressing cultural barriers requires a comprehensive approach that includes raising awareness, demonstrating success stories, and fostering a supportive environment for innovation and change.

The findings from the study align with the principles of Innovation Diffusion Theory (IDT) and provide valuable insights into the role of smart technologies in bridging the urban-rural divide for micro-enterprises in Yogyakarta City, Indonesia. IDT, as introduced by Rogers (1962) and further developed by subsequent scholars, offers a framework to understand how innovations spread within a social system. In terms of the theories of change, IDT takes a different approach by emphasizing the evolution and reinvention of products and behaviors to meet the needs of individuals and groups, rather than focusing solely on persuading individuals to change [21]. The findings support this perspective by highlighting the need for rural micro-enterprises to evolve and adapt their operations by incorporating smart technologies to enhance growth and competitiveness. The limited awareness and misconceptions about smart technologies among rural micro-enterprises can be attributed to the concept of "innovation knowledge gap" within IDT. According to IDT, potential adopters need to have knowledge about the benefits and applications of an innovation to facilitate its adoption. In this case, rural micro-enterprises may lack the necessary knowledge and understanding of how smart technologies can improve their business processes and outcomes. Addressing this knowledge gap through targeted awareness campaigns and educational programs can help overcome this barrier.

Inadequate infrastructure and connectivity issues experienced by rural micro-enterprises align with the "communication channels" aspect of IDT. Diffusion of innovations relies on effective communication channels for the spread of knowledge and information about the innovation. In this context, the lack of reliable internet access and poor connectivity hinder the communication of information regarding smart technologies to rural micro-enterprises. Improving the digital infrastructure and ensuring robust
connectivity can facilitate the diffusion of smart technologies in rural areas, enabling micro-enterprises to leverage their benefits. The challenge of a lack of skilled workforce resonates with the "social system readiness" aspect of IDT [22]. According to IDT, the social system needs to be prepared and equipped with the necessary skills and resources to adopt and utilize innovations effectively. In this case, the absence of a skilled workforce proficient in digital technologies limits the adoption and utilization of smart technologies by rural micro-enterprises. Training programs and initiatives focusing on enhancing digital literacy and skills development can contribute to a more receptive social system and facilitate the diffusion of smart technologies. The financial constraints faced by rural micro-enterprises align with the "innovation-decision process" aspect of IDT [20]. The decision to adopt an innovation involves a cost-benefit analysis, and financial considerations play a crucial role. In this study, limited financial resources hinder the investment in smart technologies by micro-enterprises. To address this, financial support mechanisms and incentives tailored to the needs of rural micro-enterprises can facilitate their adoption and overcome financial barriers.

Insufficient government support and policies, as highlighted in the findings, are key factors influencing the adoption of smart technologies. This aligns with the "innovation system" aspect of IDT, which emphasizes the importance of supportive policies and government initiatives in facilitating innovation diffusion. Enhancing government support in terms of funding, incentives, and policy frameworks specific to rural micro-enterprises can create an enabling environment for the adoption and utilization of smart technologies. Eventually, the cultural resistance to change identified in the findings resonates with the "individual adopter characteristics" aspect of IDT. Cultural factors and individual attitudes play a significant role in the adoption of innovations. In this context, the traditional mindset and resistance to change in the rural community inhibit the adoption of smart technologies. Overcoming cultural barriers requires interventions that address attitudes, beliefs, and social norms, creating a positive environment for innovation and change.

5 Conclusion

This study explored the challenges faced by rural micro-enterprises in Yogyakarta City, Indonesia, in adopting and utilizing smart technologies. The findings shed light on several key challenges, including limited awareness and misconceptions, inadequate infrastructure and connectivity, a lack of skilled workforce, financial constraints, insufficient government support, and cultural resistance to change. These challenges highlight the complex nature of technology adoption in rural contexts and the need for targeted interventions to foster growth and competitiveness in these businesses. Moving forward, future research should focus on developing comprehensive strategies and interventions to address the identified challenges. This could involve designing awareness campaigns and educational programs to bridge the innovation knowledge gap among rural micro-enterprises. Additionally, efforts should be made to improve infrastructure and connectivity in rural areas to ensure reliable internet access. Enhancing the digital skills of the workforce through training initiatives and providing financial support mechanisms tailored to the needs of rural micro-enterprises are also crucial. Moreover, future research should explore the role of government policies and support in promoting the adoption of smart technologies among rural micro-enterprises. Evaluating the effectiveness of existing government initiatives and identifying areas for improvement can inform policy recommendations that better cater to the unique challenges faced by these businesses.

References

Interview


Participant 5 (P5). (Age 33, Female, S1). Business Name: Kerajinan Serat Alam Jogja - Natural fiber. Experience: >5 years.

Participant 6 (P6). (Age 21, Male, S1). Business Name: Angkiringan Jr. Experience: 4-5 years.

Participant 7 (P7). (Age 27, Female, S1). Business Name: Siomay bu Pipit. Experience: 4-5 years.

Participant 8 (P8). (Age 30, Female, S1). Business Name: Malika Snack. Experience: 5 years.

Participant 9 (P9). (Age 33, Female, S1). Business Name: Jamur Gamol (Mushroom). Experience: >5 years.


Participant 12 (P12). (Age 53, Male, JH). Business Name: Bakso Payaman, Kuliner Bakso Tusuk (Meatball). Experience: >5 years.

