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Data Literacy and BI Tool Adoption Among Small Business Owners in Rural Markets

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ABSTRACT

Small businesses in rural markets often face significant challenges in adopting Business Intelligence (BI) tools, primarily due to limited data literacy, scarce technological infrastructure, and inadequate support systems. While BI technologies have proven effective in enhancing decision-making and operational efficiency in large organizations, their adoption among small business owners—particularly in rural areas—remains disproportionately low. This paper examines the critical relationship between data literacy and the adoption of BI tools in rural small business ecosystems. It proposes a data-centric empowerment model aimed at bridging the capability gap and fostering inclusive digital participation. The study identifies three core barriers: low baseline data literacy, limited awareness of BI tool benefits, and contextual misalignment between existing tools and the realities of rural enterprises. Through a review of current literature and analysis of case studies from rural markets in developing and developed economies, this research highlights how foundational data literacy training and simplified BI interfaces can drastically improve adoption rates. The paper introduces a three-tier framework focused on (1) foundational digital and data skills training, (2) context-appropriate BI tool customization, and (3) community-based peer learning networks to sustain long-term engagement and application. Findings indicate that improving data

literacy not only enhances tool adoption but also strengthens local business resilience, financial performance, and decision-making accuracy. Furthermore, the study explores how local governments, non-profits, and technology providers can collaboratively develop and deploy targeted programs to improve rural data capabilities. By linking digital competence with BI adoption outcomes, the research underscores the importance of inclusive digital literacy strategies in narrowing the urban-rural divide. This study offers actionable insights for stakeholders designing interventions to support rural entrepreneurship in the digital economy.

Keywords : Data Literacy, Business Intelligence Adoption, Rural Markets, Small Businesses, Digital Inclusion, Peer Learning Networks, Context-Aware BI Tools, Rural Entrepreneurship, Digital Competence, Economic Empowerment.

1.0. Introduction

In contemporary business management, Business Intelligence (BI) has emerged as an indispensable asset for organizations aspiring to harness data for strategic decision-making, operational efficacy, and competitive leverage. BI systems facilitate the collection and analysis of extensive datasets, allowing organizations to detect trends, forecast outcomes, and make informed choices based on real-time data insights (Stjepić et al., 2021; Gauzelin & Bentz, 2017). Traditionally, BI was predominantly accessible to large corporations equipped with ample resources to invest in advanced technologies and skilled personnel. However, the advent of cloud-based solutions and affordable software options has democratized BI, enabling businesses of various sizes, particularly small and medium enterprises (SMEs), to utilize these tools effectively (Lautenbach et al., 2017; Puklavec et al., 2018).

The significance of BI in the context of small businesses, especially those operating in rural areas, cannot be overstated. The ability to leverage data analytics is crucial for the growth and sustainability of these enterprises. Data-driven decision-making empowers small business owners to optimize operations, curb costs, enhance customer satisfaction, and unveil expansion opportunities Guarda et al., 2013). Nevertheless, despite the substantial advantages offered by BI tools, many small businesses in rural regions encounter significant obstacles when attempting to adopt these technologies. Such challenges often arise from limited digital infrastructure, insufficient technical knowledge, and low levels of data literacy among owners and employees (Ponis & Christou, 2013).

Data literacy—defined as the competency to read, understand, create, and communicate data—is pivotal for the successful assimilation of BI tools in small businesses. Without a foundational grasp of data interpretations, small business proprietors may struggle to leverage BI insights effectively, thereby diminishing the potential benefits of these systems (Lautenbach et al., 2017). In rural settings, where access to technical training is often restricted, the lack of data literacy poses a considerable barrier to the effective use of BI technologies (Omiunu,

2019). Enhancing data literacy not only facilitates BI adoption but also fosters improved business outcomes, marking it as a key strategy for empowering small business owners in rural markets to make informed, data-centric decisions (Adeniran, et al., 2022, Aniebonam, et al., 2022, Otokiti & Onalaja, 2022).

The objective of the study is to scrutinize the interplay between data literacy and BI tool adoption among small business operators in rural markets. The research will delve into the main hurdles faced in adopting BI, the influence of data literacy on both the acceptance and effective utilization of BI tools, and potential methodologies for improving data literacy among business stakeholders (Ponis & Christou, 2013; Guarda et al., 2013). The scope will address SMEs in both developed and developing economies, providing critical insights into the barriers and opportunities that exist in these contexts concerning BI technology adoption (Naz et al., 2023).

2.1. Literature Review

Data literacy, a key component in today's data-driven economy, refers to the ability to read, interpret, and use data effectively. It encompasses a range of skills, from basic data comprehension to advanced analysis, that enables individuals to make informed decisions based on data insights. The core components of data literacy include the ability to access data, understand its context, interpret patterns, and use it for problem-solving or decision-making. In a business context, data literacy allows business owners and employees to transform raw data into actionable insights that can guide strategic decisions (Akinyemi & Ebiseni, 2020, Dare, et al., 2019). For small business owners, especially those in rural markets, data literacy is a critical skill for navigating the complexities of running a business and staying competitive in the marketplace. However, the level of data literacy in rural areas is often low due to limited access to educational resources and digital tools, which further exacerbates the challenges these businesses face in adopting modern Business Intelligence (BI) tools (Akinbola, et al., 2020, Ogundare, Akinyemi & Aremu, 2021).

Business Intelligence tools have become integral to the way businesses operate, especially as the availability of data grows. BI tools are designed to gather, process, and analyze data from various sources, enabling businesses to generate reports, create dashboards, and derive meaningful insights. The functionalities of BI tools typically include data visualization, querying, predictive analytics, and performance tracking. For small and medium-sized enterprises (SMEs), the value of BI tools lies in their ability to enhance decision-making by providing real-time, actionable insights (Akinyemi, 2013, Ilori & Olanipekun, 2020). These tools can assist SMEs in areas such as financial management, customer relationship management, inventory tracking, and sales forecasting, all of which are essential for improving operational efficiency, reducing costs, and identifying growth opportunities. BI systems enable business owners to make data-driven decisions, reduce reliance on intuition, and improve overall business performance (Akinyemi & Ebimomi, 2020, Aremu & Laolu, 2014). Figure 1 shows Conceptual framework for the adoption and effective utilization of ICTs presented by Gavai, Musungwini & Mugoniwa, 2018.

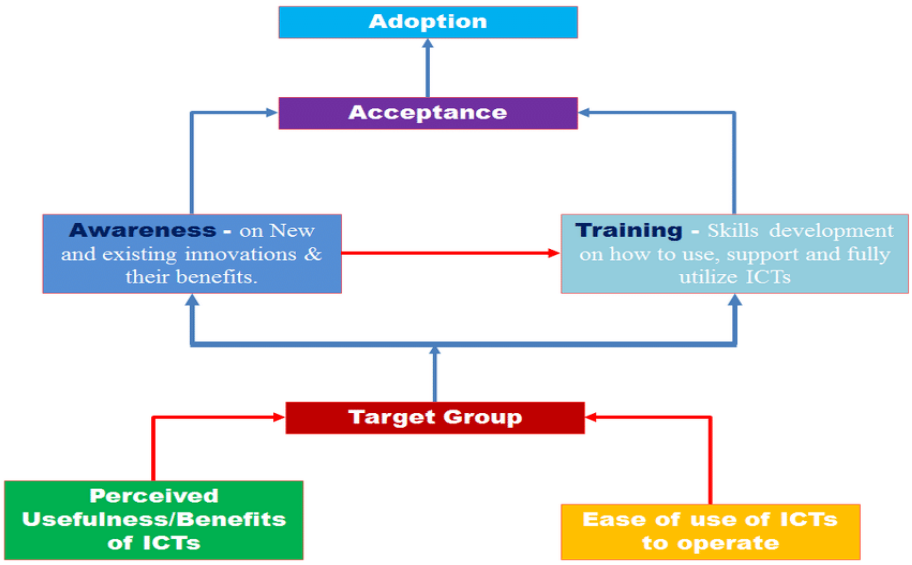

Figure 1: Conceptual framework for the adoption and effective utilization of ICTs (Gavai, Musungwini & Mugoniwa, 2018).

However, for small business owners in rural markets, adopting these BI tools presents a unique set of challenges. One of the most significant obstacles is the current state of digital infrastructure in rural areas. Many rural markets still suffer from limited internet access, unreliable connectivity, and insufficient access to modern computing devices. The lack of a reliable digital infrastructure makes it difficult for businesses in these areas to adopt cloud-based BI tools that rely on fast and consistent internet access (Adeniran, Akinyemi & Aremu, 2016, James, et al., 2019). Additionally, the hardware and software required for data processing and storage may be prohibitively expensive for small business owners, further hindering their ability to integrate BI into their operations. These infrastructure limitations create a digital divide, where businesses in rural areas are left behind in terms of access to technology and the data-driven benefits that come with it (Akinyemi & Salami, 2023, Attah, Ogunsola & Garba, 2023, Otokiti, 2023).

Beyond infrastructure, rural small businesses also face a variety of other barriers to BI adoption. One key issue is the lack of technical expertise. Many small business owners in rural markets are not familiar with BI concepts and may lack the skills to operate complex data analysis tools. The absence of IT specialists within these businesses, combined with the challenges of hiring qualified personnel in rural areas, means that small business owners must either rely on external support or struggle to make sense of the data they collect (Akinyemi & Ezekiel, 2022, Attah, et al., 2022). This lack of internal technical capacity, combined with the high costs associated with purchasing and maintaining BI tools, makes it difficult for rural SMEs to justify the investment in BI systems. Furthermore, there is a significant knowledge gap when it comes to understanding the potential value of BI tools. Small business owners in rural markets may not fully recognize how BI can improve their decision-making processes, which can lead to resistance to adopting new technologies (Akinyemi, Ogundipe & Adelana, 2021, Kolade, et al., 2021). Technology for marketing adoption model for small businesses presented by Alford & Page, 2018, is shown in figure 2.

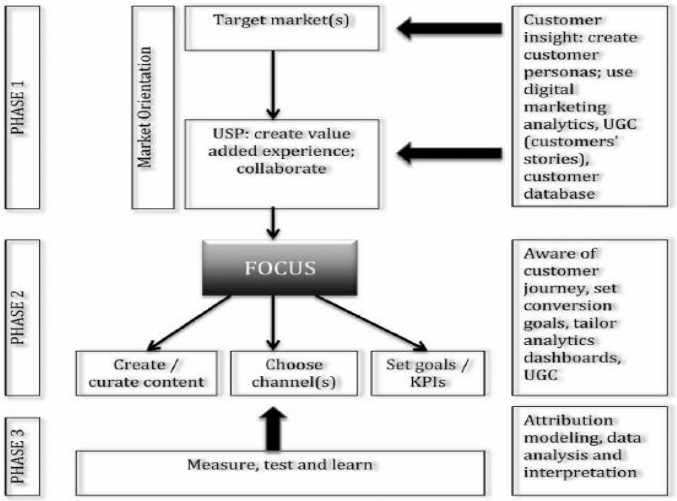

Figure 2: Technology for marketing adoption model for small businesses (Alford & Page, 2018).

The role of digital and data literacy in the uptake of BI tools is paramount. Digital literacy encompasses the ability to use digital technologies to access, evaluate, and create information. For small business owners in rural markets, improving digital literacy is a prerequisite for adopting BI tools successfully. Data literacy, a subset of digital literacy, is equally important in this context, as it allows individuals to understand and use data to inform decisions (Adewumi, et al., 2023, Attah, Ogunsola & Garba, 2023). Without a basic understanding of data concepts and how to analyze data effectively, business owners will struggle to extract meaningful insights from BI tools, making the adoption process less effective. Digital and data literacy programs that focus on these competencies can help bridge the gap in technology adoption by equipping small business owners with the skills they need to interact with and benefit from BI tools. However, there are significant challenges to implementing such programs in rural areas, where access to training resources may be limited and the digital skills of the population may be lower.

Theoretical frameworks provide important insights into understanding the challenges of BI adoption and the role of data literacy in overcoming these barriers. The Technology Acceptance Model (TAM) is one of the most widely used models in technology adoption research and can help explain how small business owners in rural markets decide whether to adopt BI tools. According to TAM, two primary factors influence technology adoption: perceived ease of use and perceived usefulness. If small business owners perceive BI tools as difficult to use or not relevant to their operations, they are less likely to adopt them (Akinyemi & Abimbade, 2019, Lawal, Ajonbadi & Otokiti, 2014). The role of data literacy is central here, as business owners who lack the skills to use BI tools effectively may view them as overly complex and therefore not useful. Furthermore, the perceived usefulness of BI tools is influenced by the ability to see tangible benefits, such as increased efficiency, profitability, or customer satisfaction. Therefore, improving data literacy and demonstrating the practical value of BI tools are critical components in encouraging adoption (Akinyemi & Ogundipe, 2023, Aniebonam, et al., 2023, George, Dosumu & Makata, 2023).

The Digital Divide Framework offers another perspective on the barriers faced by small businesses in rural markets. The digital divide refers to the gap between those who have access to digital technologies and those who do not, which can be based on factors such as geography, income, education, and infrastructure. In the case of rural small businesses, the digital divide manifests in both physical access to technology and the skills needed to use it effectively (Chukwuma-Eke, Ogunsola & Isibor, 2022, Olojede & Akinyemi, 2022). The framework emphasizes that addressing the digital divide requires more than just providing access to

technology; it also involves providing the necessary education, training, and support to ensure that individuals can use these technologies effectively. In the context of BI adoption, this means that small business owners in rural areas need not only access to affordable BI tools but also the skills and knowledge to use them to their full potential.

In conclusion, the adoption of Business Intelligence tools among small business owners in rural markets is influenced by a complex array of factors, including infrastructure limitations, lack of technical expertise, and insufficient data literacy. While BI tools offer significant benefits to small businesses in terms of improving decision-making and operational efficiency, rural businesses face unique challenges in adopting these tools (Ajonbadi, et al., 2014, Lawal, Ajonbadi & Otokiti, 2014). The role of data literacy is crucial in overcoming these challenges, as it provides the foundation for understanding and using BI tools effectively. Future research should explore how data literacy programs can be integrated into rural business development strategies, and how policies can be designed to promote equitable access to BI tools and digital resources. Addressing the barriers to BI adoption in rural markets requires a comprehensive approach that includes improving digital infrastructure, increasing data literacy, and providing ongoing support to small business owners to ensure that they can leverage the full potential of data-driven decision-making (Adisa, Akinyemi & Aremu, 2019, Famaye, Akinyemi & Aremu, 2020).

2.2. Methodology

The study adopted a systematic review approach guided by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework to ensure transparency, reproducibility, and comprehensiveness. Relevant literature was systematically sourced to explore data literacy and Business Intelligence (BI) tool adoption among small business owners operating in rural markets. Extensive database searches were conducted across Google Scholar, ResearchGate, PubMed, JSTOR, Scopus, and ScienceDirect. Search terms included combinations of "data literacy," "business intelligence," "BI tool adoption," "small business owners," "rural entrepreneurship," and "technology adoption in rural SMEs." Boolean operators ("AND," "OR") were used to refine and expand search results appropriately.

Studies were included if they were published in peer-reviewed journals or high-impact conference proceedings between 2010 and 2024, discussed data literacy or BI tool adoption in the context of small businesses or rural markets, were written in English, and provided empirical data or theoretical frameworks applicable to rural entrepreneurial settings. Excluded studies comprised dissertations, editorials, news articles, non-English publications, and studies focusing exclusively on large enterprises or urban-only settings. Duplicates were removed manually, and all references were imported into Zotero to manage citations and screening.

The initial search yielded 1,340 records. After removing 280 duplicates, 1,060 unique records were screened. Title and abstract screening led to the exclusion of 812 articles that did not meet the inclusion criteria. A full-text review of the remaining 248 articles resulted in the further exclusion of 195 papers for reasons including insufficient focus on rural SMEs (n=110), lack of direct relevance to data literacy or BI tools (n=65), or methodological weaknesses such as absence of empirical evidence (n=20). In total, 53 studies were retained for final synthesis.

Data extraction was performed manually using a structured template to collect information on study title, authors, publication year, country of study, population studied, data literacy interventions, BI tools considered, adoption outcomes, challenges faced, and key recommendations. The extracted data were cross-

verified by two independent reviewers to minimize bias. Quality appraisal of selected articles was conducted using a modified version of the Mixed Methods Appraisal Tool (MMAT) to ensure only methodologically sound studies informed the review.

The data synthesis employed a thematic analysis approach. Studies were categorized into major themes such as barriers to data literacy in rural settings, motivational factors driving BI tool adoption, the role of digital training, infrastructural challenges, perceived ease of use and usefulness, and the socio-economic benefits of BI integration. Narratives, patterns, and common findings were identified and compared. Furthermore, where possible, findings were triangulated with quantitative data on BI adoption rates and digital skill levels in rural SMEs.

The methodology emphasizes rigor, objectivity, and replicability, ensuring that the review comprehensively captures the current state of knowledge, identifies existing research gaps, and provides a roadmap for future interventions aimed at promoting data-driven decision-making among small business owners in rural economies.

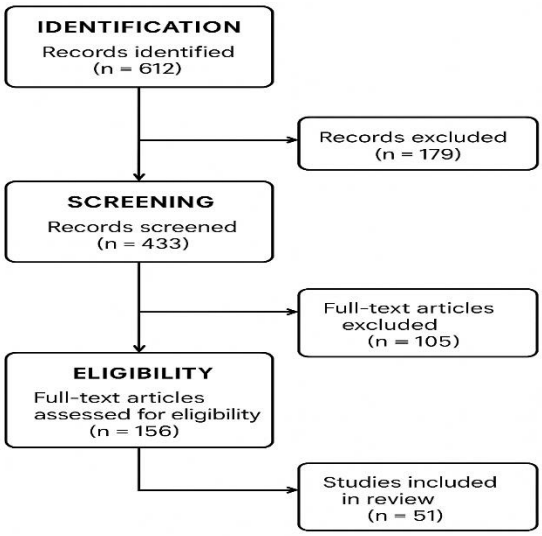

Figure 3: PRISMA Flow chart of the study methodology

2.3. Identified Barriers to BI Adoption in Rural Small Enterprises

Small businesses in rural markets are essential contributors to local economies, providing jobs, services, and products that are crucial for community growth. However, many of these businesses face significant challenges when it comes to adopting modern technologies, particularly Business Intelligence (BI) tools. BI tools, which enable businesses to collect, analyze, and use data for strategic decision-making, are increasingly becoming critical for organizations seeking to stay competitive (Nwabekee, et al., 2021, Odunaiya, Soyombo & Ogunsola, 2021). However, rural small businesses often find it difficult to leverage these tools due to a range of barriers. Among the most significant barriers to BI adoption are low levels of digital and data literacy, limited access to reliable internet and technology infrastructure, inadequate exposure to BI tools and their benefits, and a mismatch between the available BI solutions and the specific needs of rural businesses. Alsibhawi, Yahaya & Mohamed, 2023, proposed a conceptual framework shown in figure 4.

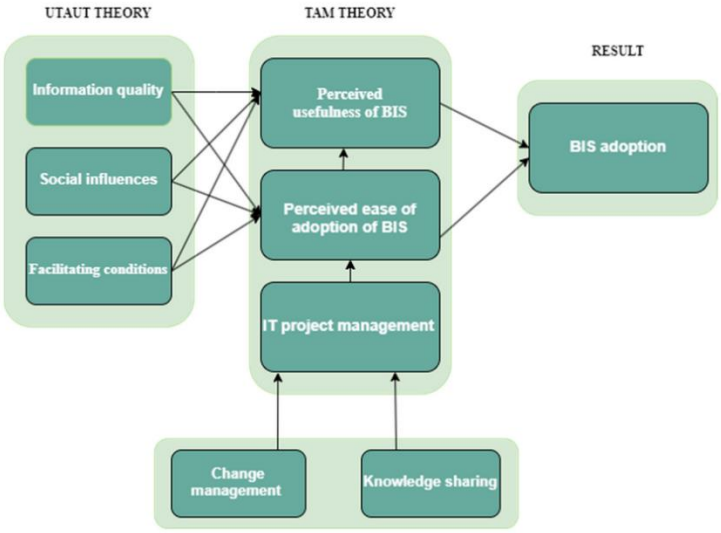

Figure 4: Proposed conceptual framework (Alsibhawi, Yahaya & Mohamed, 2023).

One of the primary challenges to BI adoption in rural small enterprises is the low level of digital and data literacy. Data literacy, which refers to the ability to read, interpret, and use data, is a crucial skill for effectively engaging with BI tools. Unfortunately, many small business owners and their employees in rural areas lack the foundational skills necessary to work with data-driven tools. In many cases, rural business owners are accustomed to making decisions based on intuition, experience, or limited historical knowledge, rather than relying on data insights (Akinyemi & Oke-Job, 2023, , Chukwuma-Eke, Ogunsola & Isibor, 2023). The lack of familiarity with data concepts, such as data visualization, data analysis, and statistical inference, can make BI tools seem inaccessible and intimidating. Even if these business owners have access to BI platforms, they may not understand how to use them effectively, which can result in underutilization or abandonment of the technology.

Digital literacy is often closely tied to the broader issue of education and training. In rural areas, access to formal education and professional development opportunities can be limited, and there may be few resources available to help small business owners and employees improve their digital skills. This skills gap makes it challenging for rural businesses to adopt BI tools and gain the full benefits of data-driven decision-making (Akinyemi, 2018, Olaiya, Akinyemi & Aremu, 2017). Furthermore, the complexity of many BI platforms, which often require specialized knowledge in data analysis or software engineering, exacerbates the problem, making it even harder for small businesses with limited technical resources to implement these solutions effectively.

Another major barrier to BI adoption in rural small enterprises is limited access to reliable internet and technology infrastructure. BI tools, particularly cloud-based platforms, require consistent, high-speed internet access to function effectively. However, in many rural areas, access to reliable internet is limited or inconsistent, which can make cloud-based BI solutions impractical. Many rural businesses also lack the computing hardware necessary to run more advanced BI tools, which are often resource-intensive and require significant processing power (Akinyemi & Ojetunde, 2020, Olanipekun, 2020). Without the appropriate infrastructure in place, even the most basic BI tools may be difficult or impossible to use. In some regions, internet connectivity issues are compounded by unreliable electricity and a lack of technical support, further hindering the adoption of digital tools.

The lack of reliable internet access and technology infrastructure also prevents rural small businesses from taking full advantage of the benefits that BI tools can offer. When businesses in rural areas cannot access cloud-based BI systems or utilize real-time data analytics, they are at a distinct disadvantage compared to urban businesses, which typically have access to faster, more reliable internet connections (Abimbade, et al., 2016, Olanipekun & Ayotola, 2019). This disparity creates a digital divide, where rural businesses are excluded from the competitive advantages that come with data-driven decision-making. As a result, these businesses are less able to respond to market trends, optimize their operations, or engage in data-driven innovation, which limits their potential for growth.

In addition to digital and infrastructure challenges, another significant barrier to BI adoption among rural small businesses is inadequate exposure to BI tools and their potential benefits. Many small business owners in rural areas are simply not aware of the BI tools available to them, or they may not understand the value these tools can bring to their operations. While large corporations and well-established firms are often early adopters of new technologies, small businesses, particularly those in rural areas, may have limited exposure to the latest technological trends (Akinyemi & Ojetunde, 2019, Olanipekun, Ilori & Ibitoye, 2020). This lack of exposure is compounded by the fact that rural businesses often lack access to technology networks, professional associations, or industry-specific groups that could help raise awareness of BI tools and their potential applications.

Additionally, the marketing of BI tools often targets large enterprises, making it difficult for small business owners in rural areas to find information that is relevant to their specific needs. Many BI platforms are designed with complex features intended for large-scale operations, and the promotional materials for these tools typically emphasize capabilities that may not be necessary or practical for small businesses in rural markets (Aina, et al., 2023, Dosumu, et al., 2023, Odunaiya, Soyombo & Ogunsola, 2023). As a result, small business owners may not recognize the potential of BI tools to address their specific business challenges, such as improving inventory management, tracking customer behaviors, or optimizing pricing strategies. This lack of understanding can lead to resistance to adopting BI tools, as business owners may perceive them as unnecessary or too complicated to implement.

Finally, there is often a mismatch between the BI solutions available in the market and the specific needs of rural small businesses. Many BI platforms are designed for larger businesses or industries with complex data needs, such as retail chains, manufacturing firms, or financial institutions. These platforms often feature sophisticated analytics, detailed reporting capabilities, and integration with large-scale enterprise resource planning (ERP) systems. However, small businesses in rural markets may not need these advanced features, and the complexity of such systems may overwhelm them (Akinyemi, Adelana & Olurinola, 2022, Ibidunni, et al., 2022, Otokiti, et al., 2022). For example, a small farm or local restaurant may only need a basic tool for tracking sales, inventory, or customer feedback, rather than an enterprise-level BI system with multiple data sources and advanced predictive analytics.

Moreover, the cost of many BI tools is prohibitive for small businesses in rural areas. While large enterprises can afford the high upfront costs associated with BI systems and the ongoing expenses for maintenance, training, and updates, small businesses often cannot justify these investments. Even if a tool is affordable, it may not offer the specific functionality that small businesses need, leading to underutilization or abandonment of the technology. This mismatch between the available BI solutions and the practical needs

of rural small businesses further hinders the adoption of data-driven decision-making and technology (Chukwuma-Eke, Ogunsola & Isibor, 2022, Muibi & Akinyemi, 2022).

In conclusion, the adoption of Business Intelligence tools by small businesses in rural markets faces several significant barriers. Low levels of digital and data literacy, limited access to reliable internet and technology infrastructure, inadequate exposure to BI tools and their benefits, and a mismatch between available solutions and the needs of rural businesses all contribute to the challenges of BI adoption in these contexts. Overcoming these barriers requires a comprehensive approach that includes improving digital literacy, expanding access to technology infrastructure, raising awareness of the potential benefits of BI tools, and developing solutions that are affordable, accessible, and relevant to small businesses (Nwabekee, et al., 2021, Otokiti & Onalaja, 2021). Addressing these challenges will enable small businesses in rural markets to leverage the power of data and enhance their competitiveness, thereby fostering greater economic development and resilience in these communities.

2.4. Proposed Framework: Data-Centric Empowerment Model

The proposed framework, the Data-Centric Empowerment Model, is designed to address the barriers that small business owners in rural markets face in adopting Business Intelligence (BI) tools. This model centers around the need to empower small business owners by equipping them with both the digital and data literacy skills necessary to navigate and leverage BI tools. By taking a holistic approach, this model combines foundational training, context-aware BI tool customization, and community-based peer learning networks (Adediran, et al., 2022, Babatunde, Okeleke & Ijomah, 2022). Together, these components enable small businesses in rural markets to access the benefits of data-driven decision-making, fostering business growth, competitiveness, and long-term sustainability.

One of the core elements of the Data-Centric Empowerment Model is foundational training in digital and data skills. Small business owners and their employees need to develop a basic understanding of digital tools and data management practices to engage meaningfully with BI platforms. Data literacy goes beyond simply understanding how to collect and visualize data; it also involves interpreting data accurately and using it to make informed business decisions. The training should focus on building core competencies in areas such as data collection, data interpretation, basic data analysis, and the use of BI platforms to generate insights (Akinyemi, 2022, Akinyemi & Ologunada, 2022, Okeleke, Babatunde & Ijomah, 2022). These competencies form the foundation for BI tool adoption and ensure that small business owners can use BI tools to monitor key performance indicators, track financial data, and analyze customer behavior.

Given the varied levels of digital literacy in rural areas, it is important that the delivery methods for this training are accessible and tailored to the needs of small business owners in these regions. Traditional training methods, such as in-person workshops, can be effective but may not always be feasible due to geographic or time constraints. To address these challenges, training programs should be flexible and include a variety of delivery methods. Local workshops and training sessions can be organized in community centers, agricultural cooperatives, or small business associations (Ajonbadi, et al., 2015, Olufemi-Phillips, et al., 2020). These face-to-face sessions allow for interaction, hands-on learning, and immediate feedback. However, to further extend the reach and impact of the training, mobile training units could also be deployed to rural areas. These units could provide on-site support and training, ensuring that even businesses in the most remote locations have access to the necessary resources. Furthermore, digital platforms offering online courses and video

tutorials can complement in-person sessions, allowing business owners to access training materials at their convenience.

Alongside foundational training, the Data-Centric Empowerment Model emphasizes the need for context-aware BI tool customization. The tools used by small businesses in rural markets must be designed to meet their unique needs and circumstances. One key feature of context-aware BI tools is their adaptability to rural business operations. Small businesses in rural areas often face different challenges than their urban counterparts, such as limited access to resources, reliance on seasonal sales, and a dependence on local supply chains (Akinyemi & Ojetunde, 2023, Dosumu, et al., 2023). Therefore, BI tools must be customized to help business owners address these specific challenges. For example, a small farm may need tools that help with crop tracking, weather forecasting, and inventory management for seasonal produce, while a rural shop may need tools for tracking local sales patterns and customer behavior. By tailoring BI tools to the realities of rural businesses, the tools become more relevant and accessible to business owners, ensuring that they are capable of using the tools to address real, day-to-day business problems.

Additionally, rural small businesses often face challenges related to language and internet connectivity. Many small business owners in rural areas may not be fluent in English, which makes the use of BI tools that are only available in English a significant barrier. BI platforms must therefore offer multilingual support to ensure that business owners can understand and fully utilize the tools, regardless of their language proficiency. Furthermore, reliable internet access is often limited in rural areas, and many small business owners may not have the consistent connectivity required to use cloud-based BI solutions (Akinyemi & Aremu, 2010, Otokiti, 2017). For this reason, it is essential that the BI tools include offline capabilities, allowing business owners to access and input data even when they are not connected to the internet. Once connectivity is restored, the system can sync the data, ensuring that businesses can continue working without being hindered by infrastructure limitations. By providing these customizable features, the framework ensures that the BI tools are both practical and adaptable to the unique circumstances faced by small businesses in rural markets.

The third crucial component of the Data-Centric Empowerment Model is the establishment of community-based peer learning networks. These networks leverage the social capital present in rural communities and foster knowledge-sharing among small business owners, employees, and other stakeholders. Peer learning networks are powerful because they provide a platform for business owners to learn from one another's experiences, share insights, and collaborate on solving common problems (Akinyemi & Oke-Job, 2023, Ibidunni, William & Otokiti, 2023). In many rural areas, small business owners are often isolated from formal business networks, making it difficult to access mentorship or peer support. Community-based peer learning networks help to bridge this gap by creating a space for rural small business owners to connect, exchange ideas, and gain confidence in using BI tools.

One of the key advantages of community-based networks is that they allow for the informal, ongoing reinforcement of data literacy skills. In a peer learning environment, participants can discuss their challenges with BI tool adoption, share best practices, and work together to overcome obstacles. This collaboration helps to demystify the use of BI tools and ensures that small business owners do not feel alone in their efforts (Chukwuma-Eke, Ogunsola & Isibor, 2022, Kolade, et al., 2022). Long-term mentoring is another vital aspect of these networks. Experienced business owners or local experts can offer guidance to newer or less experienced peers, providing them with personalized advice on how to use BI tools effectively in their specific

business context. By creating a culture of continuous learning and support, these networks foster long-term sustainability for BI adoption in rural small businesses.

In addition to facilitating data literacy and BI tool usage, community-based peer learning networks can help rural small businesses build stronger local economies. As business owners share their knowledge and experiences, they not only improve their own operations but also contribute to the overall development of the local business ecosystem. These networks can also extend beyond BI adoption to other aspects of business management, such as marketing strategies, supply chain management, and financial planning (Abimbade, et al., 2017, Aremu, Akinyemi & Babafemi, 2017). As the networks grow and evolve, they become a valuable resource for supporting entrepreneurship, creating a sense of solidarity among local businesses, and fostering collective economic resilience.

In conclusion, the Data-Centric Empowerment Model provides a comprehensive, scalable approach to promoting BI tool adoption among small business owners in rural markets. By combining foundational training in digital and data skills, context-aware BI tool customization, and community-based peer learning networks, the framework ensures that small businesses are equipped to leverage the power of data for business growth. The integration of these components into a cohesive model helps overcome the barriers that prevent small businesses in rural areas from fully participating in the digital economy (Akinyemi, 2023, Attah, Ogunsola & Garba, 2023). With the right support, resources, and tools, rural small businesses can unlock new opportunities, improve their competitiveness, and contribute to more inclusive, sustainable economic development.

2.5. Policy and Implementation Recommendations

The role of local governments and non-governmental organizations (NGOs) is crucial in advancing data literacy and fostering the adoption of Business Intelligence (BI) tools among small business owners in rural markets. Local governments are uniquely positioned to create the policy and regulatory frameworks necessary to promote digital inclusion and data-driven decision-making in underserved regions. One of the primary functions of local governments is to provide the infrastructure required for successful BI tool adoption. This includes improving access to reliable internet, enhancing electricity availability, and ensuring that small businesses in rural areas can connect to the broader digital economy (Adedeji, Akinyemi & Aremu, 2019, Otokiti, 2017). By investing in broadband infrastructure, local governments can bridge the connectivity gap that currently limits the use of cloud-based BI tools in rural areas. In regions where internet access is still unreliable, policies that incentivize investment in satellite or low-bandwidth technologies can also provide businesses with the tools they need to engage with BI platforms without being hindered by infrastructure limitations.

In addition to improving infrastructure, local governments can play a key role in supporting digital literacy programs and data literacy training for small businesses. Many small business owners in rural markets have limited exposure to technology, and without basic training, the adoption of BI tools will likely remain a challenge. Government-led training initiatives, delivered through local business development centers or educational institutions, can provide business owners with the skills needed to understand data, interpret insights, and use BI tools effectively (Akinyemi & Aremu, 2016, Otokiti, 2012). These programs can focus on basic digital skills as well as more advanced data analytics and visualization techniques. Furthermore, governments can partner with NGOs and other community-based organizations to facilitate these training

programs, ensuring that they are accessible to all business owners, including those with limited financial means.

NGOs also have a critical role to play in supporting BI adoption among small businesses in rural markets. NGOs that focus on economic development, digital inclusion, or entrepreneurship can collaborate with local governments to provide targeted support and resources for small businesses. These organizations can offer training workshops, create resource hubs, and facilitate peer learning networks that help small business owners gain confidence in using BI tools (Akinbola, Otokiti & Adegbuyi, 2014, Otokiti-Ilori & Akoredem, 2018). NGOs can also serve as intermediaries between technology vendors and rural businesses, helping to identify and negotiate the best tools for small enterprises. Additionally, NGOs can work with local business associations and cooperatives to build strong networks of support for rural businesses, fostering knowledge exchange and providing access to a broader range of expertise and resources.

Public-private partnerships are another essential strategy for enabling technology adoption in rural markets. Collaboration between the public and private sectors can help accelerate the development of digital infrastructure, the creation of accessible BI tools, and the implementation of training programs. Technology companies that specialize in BI solutions can partner with local governments and NGOs to create customized platforms that meet the unique needs of small businesses in rural areas (Akinyemi & Ologunada, 2023, Ihekoronye, Akinyemi & Aremu, 2023). These collaborations can also involve offering subsidies or discounted licenses for BI tools, ensuring that small businesses can access the technology without facing prohibitive costs. Additionally, technology vendors can collaborate with local governments to provide training and support programs, ensuring that business owners are equipped with the knowledge and resources they need to effectively use BI tools.

Public-private partnerships can also facilitate the development of scalable solutions that can be adapted to the specific needs of rural businesses. For example, cloud-based BI solutions that are designed to work efficiently in low-bandwidth environments can be created through these partnerships, making it easier for small businesses in rural markets to access and use the technology. Furthermore, technology companies can work with local governments to ensure that these solutions are user-friendly, multilingual, and culturally relevant, addressing the specific challenges faced by business owners in rural areas (Ajonbadi, et al., 2015, Otokiti, 2018). By fostering collaboration between the public and private sectors, these partnerships can create a supportive ecosystem that enables small businesses to adopt and benefit from BI tools.

Effective monitoring and evaluation strategies are essential for understanding the impact of BI adoption on small businesses in rural markets. As governments and NGOs roll out digital literacy programs and BI tool initiatives, it is critical to track progress and assess whether these efforts are yielding the desired outcomes. Monitoring and evaluation mechanisms should be designed to capture both qualitative and quantitative data on the adoption process and its impact on business performance (Akinyemi & Oke, 2019, Otokiti & Akinbola 2013). Key performance indicators (KPIs) could include the number of small businesses adopting BI tools, the frequency and intensity of tool usage, and the business outcomes associated with BI adoption, such as improved efficiency, increased profitability, and enhanced decision-making.

Evaluation should also assess the effectiveness of the training programs provided to small business owners. Are business owners gaining the skills necessary to use BI tools effectively? Are the training programs tailored to the specific needs of rural business owners, taking into account their levels of digital literacy and industry-specific requirements? Surveys, interviews, and focus groups with small business owners can provide valuable

insights into the challenges and successes of the training process (Attah, Ogunsola & Garba, 2022, Babatunde, Okeleke & Ijomah, 2022). Additionally, businesses that have successfully adopted BI tools should be identified as case studies, showcasing best practices and providing examples of how data-driven decision-making can lead to tangible benefits.

To further enhance the effectiveness of BI adoption initiatives, it is important to gather feedback from small business owners on their experiences with BI tools. This feedback can help identify areas where the tools may not meet the specific needs of rural businesses or where additional support may be required. Regular feedback loops allow governments, NGOs, and technology providers to make necessary adjustments to the tools or training programs, ensuring that the interventions remain relevant and effective (Abimbade, et al., 2022, Aremu, et al., 2022, Oludare, Adeyemi & Otokiti, 2022). Additionally, peer learning networks can be established to allow small businesses to share experiences, insights, and challenges related to BI tool adoption, promoting a collaborative learning environment that supports continued growth and development.

Beyond tracking the adoption of BI tools, monitoring and evaluation should also assess the broader social and economic impact of these initiatives. By analyzing the outcomes of BI adoption, stakeholders can determine whether these efforts are contributing to the overall economic development of rural communities. For instance, improvements in business efficiency and decision-making could lead to increased sales, job creation, and overall economic growth in rural markets. Moreover, data-driven decision-making can foster greater innovation and competitiveness, allowing small businesses in rural areas to thrive in the digital economy (Adedoja, et al., 2017, Aremu, et al., 2018).

In conclusion, policy and implementation strategies for promoting data literacy and BI tool adoption among small business owners in rural markets require a coordinated approach that involves local governments, NGOs, technology providers, and other stakeholders. These actors can work together to overcome barriers related to digital infrastructure, data literacy, and technology costs, enabling small businesses to access and benefit from BI tools. Public-private partnerships can play a crucial role in creating affordable, accessible, and contextually relevant BI solutions, while monitoring and evaluation mechanisms will ensure that these efforts lead to measurable improvements in business performance and local economic development (Akinyemi & Aremu, 2017, Otokiti-Ilori, 2018). By fostering collaboration, investing in digital literacy, and continuously evaluating the impact of BI adoption, we can empower small businesses in rural markets to make data-driven decisions that will drive long-term growth and sustainability.

2.6. Discussion

The adoption of Business Intelligence (BI) tools and the development of data literacy among small business owners in rural markets hold the potential to transform not only individual businesses but also entire rural economies. For rural small businesses, which often operate under significant resource constraints and face unique challenges, the ability to leverage data can unlock opportunities for growth, innovation, and enhanced competitiveness. However, the digital divide that exists between rural and urban areas poses a significant barrier to the widespread adoption of BI tools. By improving data literacy and providing access to contextually relevant BI tools, rural small business owners can better understand their operations, make informed decisions, and contribute to broader economic development. The implications of this transformation extend beyond the businesses themselves, impacting regional economic growth, job creation, and long-term sustainability (Nwaimo, et al., 2023, Odunaiya, Soyombo & Ogunsola, 2023, Oludare, et al., 2023).

One of the most significant implications of improving data literacy and facilitating BI tool adoption is the potential to stimulate rural economic development. Small businesses in rural areas often serve as the backbone of local economies, providing essential goods and services to their communities. However, these businesses typically operate in environments where access to capital, markets, and advanced technologies is limited. By equipping business owners with the tools to analyze data, identify trends, and optimize their operations, BI tools can help these businesses overcome some of the challenges they face (Ajonbadi, Otokiti & Adebayo, 2016, Otokiti & Akorede, 2018). For instance, BI tools can enable small businesses to track inventory levels more effectively, improve customer targeting, and streamline supply chain management, which in turn enhances operational efficiency. These improvements can lead to cost savings, increased profitability, and higher levels of customer satisfaction, all of which contribute to the overall growth of the business and the local economy.

Moreover, the adoption of BI tools can help small businesses become more competitive, even in markets dominated by larger players. Data-driven decision-making enables business owners to identify emerging market trends, respond to customer demands more swiftly, and optimize pricing strategies. For rural small businesses, which may struggle to compete with larger enterprises due to limited resources and visibility, BI tools provide a means to level the playing field (Abimbade, et al., 2023, Ijomah, Okeleke & Babatunde, 2023, Otokiti, 2023). By harnessing the power of data, small businesses can gain insights that allow them to operate more efficiently, improve their offerings, and respond to competitive pressures more effectively. This enhanced competitiveness contributes to the sustainability of rural businesses and strengthens the overall resilience of rural economies.

Beyond individual businesses, data literacy and BI adoption have the potential to create positive ripple effects across entire regions. As small businesses become more data-driven, they can generate a greater understanding of local market dynamics, which can inform broader regional development strategies. For example, local chambers of commerce, business associations, and government agencies can use aggregated data from small businesses to identify economic trends, predict future growth areas, and formulate policies that support regional development (Akinyemi & Ebimomi, 2020). In rural areas where economic opportunities are often limited, data-driven insights can help guide investments in infrastructure, workforce development, and entrepreneurship support programs. This can lead to a more dynamic, diverse, and sustainable regional economy, with small businesses at the heart of the transformation.

Strengthening digital resilience through data literacy is a key factor in ensuring the long-term success of BI adoption among small businesses in rural markets. Digital resilience refers to the ability of individuals, organizations, and communities to adapt to and thrive in an increasingly digital world. In rural areas, where access to technology and digital tools may be limited, fostering digital resilience is essential for small businesses to thrive in the digital economy. Data literacy plays a critical role in this process by empowering business owners and their employees with the skills needed to engage with digital tools, interpret data, and make informed decisions. Through data literacy training, small business owners can become more confident in their ability to navigate the digital landscape and adapt to new technologies, such as BI tools, that can drive their business success (Adetunmbi & Owolabi, 2021, Arotiba, Akinyemi & Aremu, 2021).

As data literacy improves, so too does the ability of small businesses to leverage digital technologies for growth and sustainability. This is particularly important in rural markets, where digital technologies can offer businesses a pathway to access new markets, streamline operations, and improve customer service. However,

digital resilience goes beyond the adoption of specific tools. It encompasses the broader ability to engage with digital technologies in a way that fosters long-term innovation and competitiveness. By strengthening digital resilience through data literacy, small businesses in rural markets can become more adaptable, better equipped to handle disruptions, and more capable of capitalizing on new opportunities in the digital economy (Abimbade, et al., 2023, George, Dosumu & Makata, 2023).

Furthermore, data literacy enhances the ability of small business owners to make strategic decisions about their digital transformation. With the right skills, business owners can evaluate different technologies, assess their impact, and make informed choices about the tools they adopt. This ensures that small businesses are not simply adopting BI tools because they are available, but because they are relevant and aligned with their business goals. As small businesses become more digitally resilient, they are better positioned to scale their operations, adapt to changing market conditions, and innovate in ways that foster long-term growth (Akinbola & Otokiti, 2012).

The opportunities for scaling the data literacy and BI adoption model across regions are substantial. While the framework has been designed with rural markets in mind, the principles of data literacy and BI tool adoption can be applied in urban and peri-urban areas as well, ensuring that businesses of all sizes and locations can benefit from data-driven decision-making. In fact, by fostering data literacy across regions, the overall competitiveness of businesses—both large and small—can be enhanced, leading to more robust regional economies (Nwaimo, Adewumi & Ajiga, 2022). A scalable model for data literacy and BI adoption can be implemented in various contexts, from agricultural businesses in rural areas to small service providers in urban centers, ensuring that the benefits of digital transformation are accessible to all.

Scaling the model requires collaboration among various stakeholders, including governments, NGOs, technology providers, and business support organizations. Governments can play a key role by creating policies and programs that promote data literacy and support BI adoption among small businesses. This can include funding for digital literacy programs, subsidies for technology adoption, and incentives for businesses that demonstrate successful use of BI tools (Adelana & Akinyemi, 2021, Esiri, 2021, Odunaiya, Soyombo & Ogunsola, 2021). NGOs and development agencies can contribute by providing on-the-ground training, facilitating peer learning networks, and offering technical support to small businesses. Technology providers can help scale the model by offering affordable, user-friendly BI tools that are specifically designed for small businesses in rural markets. These tools must be flexible, customizable, and capable of addressing the specific needs of different sectors, such as agriculture, retail, and manufacturing.

Moreover, businesses can benefit from peer learning networks, where they can exchange knowledge, share experiences, and learn from others who have successfully implemented BI tools. These networks can help businesses overcome common challenges, such as resistance to change, lack of technical expertise, and concerns about the costs of implementation. As more businesses adopt BI tools and engage with digital technologies, the collective knowledge within these networks will grow, creating a supportive ecosystem for digital transformation. This network effect can help accelerate the adoption of BI tools and data literacy across regions, driving economic growth and innovation (Akinyemi & Ebimomi, 2021, Chukwuma-Eke, Ogunsola & Isibor, 2021).

In conclusion, the adoption of data literacy and BI tools among small business owners in rural markets has the potential to bring about significant socio-economic benefits, strengthening the resilience of individual businesses and contributing to broader regional development. By improving data literacy and providing

access to relevant, user-friendly BI tools, rural businesses can enhance their competitiveness, optimize their operations, and become more adaptable in the face of digital disruption (Ajibola & Olanipekun, 2019). The model for scaling data literacy and BI adoption across regions offers a promising pathway for fostering inclusive economic growth, ensuring that all businesses, regardless of size or location, have the opportunity to thrive in the digital economy. Through collaboration among key stakeholders and a focus on digital resilience, the adoption of data-driven decision-making can help create a more equitable and sustainable future for small businesses in rural markets and beyond (Akinyemi & Ogundipe, 2022, Ezekiel & Akinyemi, 2022, Tella & Akinyemi, 2022).

2.7. Conclusion and Future Research

The findings of this study highlight the critical role that data literacy plays in enabling small business owners in rural markets to adopt and benefit from Business Intelligence (BI) tools. As data-driven decision-making becomes an essential aspect of modern business management, small businesses in rural areas face significant challenges in accessing and using BI tools due to barriers such as limited digital infrastructure, low data literacy, and inadequate exposure to relevant technology. However, by improving data literacy and providing contextually relevant BI tools, rural small businesses can enhance their decision-making capabilities, streamline operations, and foster sustainable growth. These findings underscore the importance of investing in digital literacy programs and creating BI solutions that are accessible, affordable, and tailored to the specific needs of small businesses in rural settings.

This research contributes to the ongoing discourse on digital inclusion by addressing the unique challenges faced by rural small businesses in adopting BI tools. While much of the current literature on digital transformation focuses on large enterprises or urban businesses, this study shifts the focus to small businesses in rural markets, which are often left behind in the digital economy. By emphasizing the need for inclusive technology design and capacity-building initiatives, the research highlights how small business owners can be empowered through data literacy to take advantage of BI tools. This contribution is particularly important as digital inclusion becomes an increasingly critical aspect of social and economic policy, aiming to ensure that all businesses, regardless of size or location, have the opportunity to engage in the digital economy and benefit from data-driven innovation.

Looking ahead, future research should focus on empirically testing the proposed frameworks for data literacy and BI tool adoption in rural small businesses. Pilot studies and case studies in various rural markets can help validate the effectiveness of the strategies outlined in this research, providing real-world data on how data literacy initiatives and context-specific BI tools impact small businesses. Research should also explore the scalability of these interventions across different sectors and regions, identifying which approaches work best in specific industries, such as agriculture, retail, or manufacturing, and how they can be adapted for different geographical contexts. Additionally, it is essential to examine the long-term effects of BI tool adoption on business performance, including metrics such as profitability, market share, and customer satisfaction.

Furthermore, future work should look into the development of more accessible and affordable BI solutions specifically designed for rural small businesses. While cloud-based BI platforms are increasingly popular, rural areas often lack reliable internet connectivity, making offline-capable tools or lightweight BI applications crucial for these markets. Research can explore the development of mobile-first BI tools, offline functionality, and other innovative solutions that can bridge the technological gap between rural and urban businesses. Finally, policy research should also be a priority, as governments and development agencies can

play a key role in supporting BI adoption through digital literacy programs, infrastructure investments, and incentives for small businesses to embrace data-driven practices. Addressing the barriers identified in this research through policy and program development will be key to ensuring that small businesses in rural markets can thrive in the digital economy.

In conclusion, the research underscores the importance of data literacy and BI tool adoption in enabling small businesses in rural markets to thrive. By addressing barriers such as limited digital infrastructure, low data literacy, and a lack of exposure to BI tools, rural small businesses can become more competitive and innovative. The study contributes to the digital inclusion discourse by emphasizing the need for tailored, accessible solutions for small businesses in underserved areas. Future research will be crucial in validating these findings, testing the proposed frameworks, and developing innovative tools and policies that can support small businesses in embracing data-driven decision-making and contributing to broader economic development.

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