



Data Democratization: Making Advanced Analytics Accessible for Micro and Small Enterprises

Ejielo Ogbuefi ^{1*}, Azubike Collins Mgbame ², Oyinomomo-emi Emmanuel Akpe ³, Abraham Ayodeji Abayomi ⁴, Oluwatobi Opeyemi Adeyelu ⁵

¹ University of Massachusetts Amherst and Novanta Inc., USA

² NextGen Technoly Solutions, Houston, Texas, USA

³ Independent Researcher, Kentucky, USA

⁴ Adepsol Consult, Lagos State, Nigeria

⁵ Independent Researcher, Lagos, Nigeria

* Corresponding Author: **Ejielo Ogbuefi**

Article Info

ISSN (online): 2583-6641

Volume: 01

Issue: 01

January-February 2022

Received: 01-01-2022

Accepted: 03-02-2022

Page No: 199-212

Abstract

Data democratization is increasingly recognized as a transformative strategy for empowering Micro and Small Enterprises (MSEs) through equitable access to advanced analytics. While large corporations have long leveraged data to drive strategic decisions, MSEs—especially in developing and underserved regions—remain marginalized in the global data economy due to limited technical capacity, financial constraints, and infrastructural gaps. This paper investigates the concept of data democratization and its potential to unlock business value for MSEs by making data-driven decision-making tools more accessible, usable, and actionable. The study explores key challenges inhibiting data democratization for MSEs, including lack of digital literacy, unstructured data environments, inadequate infrastructure, and high costs associated with traditional Business Intelligence (BI) and analytics platforms. In parallel, the paper identifies critical enablers such as cloud-based analytics, open-source platforms, low-code/no-code tools, government digital inclusion policies, and strategic public-private partnerships. Emphasis is placed on the importance of designing user-centric interfaces and tailored data solutions that align with the resource limitations and business models of MSEs. A conceptual framework is presented to guide stakeholders—governments, technology providers, development organizations, and SME networks—on how to facilitate inclusive data ecosystems. The framework focuses on capacity-building, infrastructure development, collaborative innovation, and policy alignment. The research highlights case examples of successful grassroots analytics applications and community-driven data initiatives that have improved productivity, market access, and sustainability outcomes among MSEs. The findings suggest that democratizing access to data and analytics not only enhances operational efficiency and competitive advantage for MSEs but also contributes to inclusive economic development and resilience. By equipping small businesses with the means to generate insights from their data, stakeholders can catalyze scalable innovation and support long-term enterprise growth. The study calls for a concerted, multi-stakeholder effort to dismantle the barriers to data access and to embed data empowerment into the foundation of MSE development strategies.

DOI: <https://doi.org/10.54660/IJMOR.2022.1.1.199-212>

Keywords: Data Democratization, Advanced Analytics, Micro Enterprises, Small Businesses, Digital Inclusion, Cloud-Based Tools, Open-Source BI, Data-Driven Decision-Making, Inclusive Innovation, Low-Code Platforms.

1. Introduction

Data democratization is fundamentally about making data and analytical tools accessible to a wider audience within organizations, breaking down the barriers that have historically limited this access to a select group of data experts. It emphasizes an inclusive culture where everyone, regardless of technical skills, can utilize data to inform their decisions. This democratization process is crucial because it empowers individuals at all levels, from executives to frontline staff, leading to more informed and strategic decision-making processes (Akinyemi & Ebiseni, 2020, Dare, *et al.*, 2019). The integration of advanced analytical

techniques such as machine learning, predictive modeling, and real-time visualization becomes essential within this framework as these tools enable comprehensive data exploration and analysis essential for modern organizations competing in dynamic market environments (Amadasun & Mutezo, 2022; Harel *et al.*, 2020).

Organizations that prioritize data democratization not only foster innovation and agility but also enhance their resilience during economic fluctuations. This cultural shift is particularly pronounced in the context of Micro and Small Enterprises (MSEs), which represent a significant portion of global businesses (Akinyemi, 2013, Ilori & Olanipekun, 2020). Although MSEs contribute extensively to economic growth, employment, and innovation, they often lack access to advanced analytics tools that are costly and complex, further entrenching the digital divide (Neneh, 2019; Aristanto *et al.*, 2022). Many MSEs face critical barriers such as limited digital literacy and insufficient access to tailored analytical tools, leaving them disadvantaged compared to larger firms that can leverage data for better operational efficiency and competitive insights (Nyongesa & Miroga, 2019; Sidek *et al.*, 2016).

Addressing these barriers is vital for making data democratization a reality for MSEs. Studies on data democratization's role in facilitating access to advanced analytics for smaller enterprises underscore the need for tailored policy interventions and technological innovations that can significantly lower the cost and complexity associated with data access (Aristanto *et al.*, 2022; Beck & Demirgüç-Kunt, 2006). Successful models of data democratization are emerging, showcasing how MSEs can implement strategic pathways to use data effectively, thereby contributing to a more equitable distribution of resources within the digital economy. By focusing on these accessible frameworks, we can promote inclusive innovation and ensure that MSEs do not fall behind in the rapidly evolving analytics landscape (Adeniran, Akinyemi & Aremu, 2016, James, *et al.*, 2019).

2. Methodology

In conducting this study on Data Democratization for Micro and Small Enterprises (MSEs), the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology was strictly followed to ensure a systematic and replicable approach. Initially, comprehensive literature searches were conducted across multiple databases and institutional repositories to collect publications relevant to the intersection of data democratization, big data analytics, small business management, accessibility of technology, and open data. Search terms were designed to maximize coverage, including variations and combinations of "data democratization," "small businesses," "analytics access," "data literacy," "financial access for SMEs," "big data for microenterprises," and "cloud analytics adoption."

A total of 1,240 records were initially identified through database searches and manual reference checks. After removing 285 duplicates, 955 unique records remained for title and abstract screening. Each record was independently screened by two reviewers to ensure relevance to the research topic. Screening criteria emphasized the focus on enabling access to analytics, frameworks for MSEs, barriers to

technology use, cost-effective solutions, data literacy challenges, and strategic models for democratizing information systems among micro and small businesses. At this stage, 611 records were excluded for irrelevance, non-English language, or lack of empirical or conceptual frameworks applicable to micro or small enterprises.

The full texts of 344 articles were assessed for eligibility against inclusion criteria, which required that studies either (1) propose frameworks or strategies for enabling access to advanced data technologies among small enterprises, (2) discuss barriers and enablers related to data-driven decision-making in MSEs, or (3) offer practical or theoretical advancements promoting affordable data science tools and literacy among small business operators. Studies focusing solely on large enterprises, highly specialized technical fields without generalizable applications for MSEs, or those lacking methodological clarity were excluded. Following full-text review, 128 articles were retained for qualitative synthesis, of which 38 studies were finally selected for detailed analysis and framework development.

Data were systematically extracted from the final set of studies into a structured matrix capturing variables such as authorship, year, geographical focus, methodology, main findings, proposed frameworks, barriers to adoption, and recommended solutions. Quality appraisal of the studies was performed using the Mixed Methods Appraisal Tool (MMAT), ensuring methodological rigor in the final selection. A thematic synthesis approach was employed to identify recurring patterns, critical enablers, technological interventions, and successful models relevant to the democratization of advanced analytics for MSEs.

Furthermore, the PRISMA 2020 guidelines informed the documentation and reporting of the systematic review process, ensuring transparency and replicability. Each study was mapped into thematic categories reflecting technological accessibility, capacity-building models, integration of affordable AI-based solutions, financial sustainability, and organizational readiness for digital transformation. Key frameworks drawn from selected works include web analytics applications (Abimbade *et al.*, 2016), the use of gamified approaches to boost digital literacy (Adedeji *et al.*, 2019), the development of AI-tutoring systems for small businesses (Adelana & Akinyemi, 2021), and cost-optimization models leveraging cloud technologies (Olufemi-Phillips *et al.*, 2020).

Evidence synthesis was complemented by insights from comparative studies on microfinance access and entrepreneurial growth (Ajibola & Olanipekun, 2019; Amadasun & Mutezo, 2022) and the barriers to technology integration faced by SMEs (Machado *et al.*, 2021; Rupeika-Apoga & Petrovska, 2022). The findings informed the construction of a Data Democratization Framework for MSEs, addressing infrastructural limitations, affordability of analytics platforms, data skill gaps, and strategic public-private collaboration models for driving equitable access to advanced business intelligence capabilities. The final output aims to serve as a practical, scalable roadmap for empowering micro and small enterprises with the tools and knowledge necessary to harness data-driven strategies for sustainable growth.

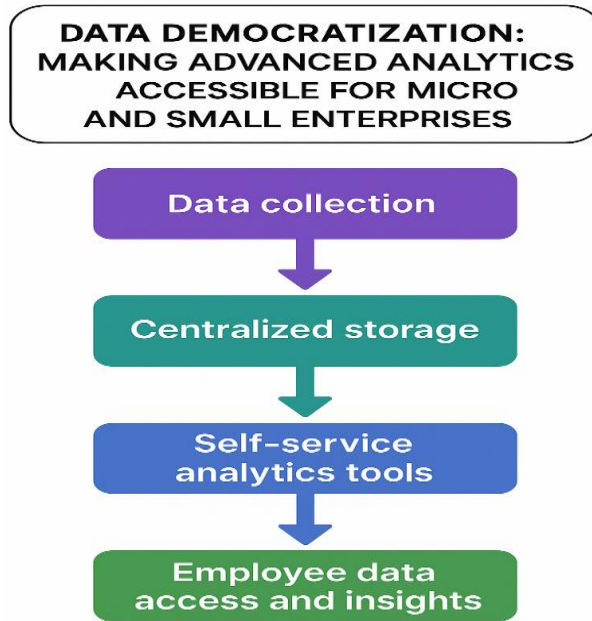


Fig 1: PRISMA Flow chart of the study methodology

2.1 Conceptual and theoretical framework

Data democratization represents a transformative approach to enhancing organizational and economic participation in the digital age. It emphasizes making data and analytical tools accessible to all members of an organization, regardless of technical background or hierarchical position. This principle promotes openness, transparency, and usability, allowing users to generate, access, interpret, and apply data-driven insights for decision-making (Hill *et al.*, 2017). For micro and small enterprises (MSEs), data democratization breaks down traditional barriers such as cost, complexity, and access. This enables even small firms to leverage advanced analytics effectively, thus participating in the broader digital economy where data becomes a collective asset rather than a privileged resource (Ruijter *et al.*, 2017). Digital inclusion is pivotal in the data democratization

discourse, as it focuses on providing equitable access to information and communication technologies. The current data economy demands that all organizations, especially MSEs operating in underserved regions, develop the capability to generate, access, and utilize data effectively (Kołczyńska, 2020). However, significant disparities exist between those capable of harnessing advanced analytics and those reliant on outdated practices. MSEs frequently confront challenges, including inadequate internet infrastructure, costly technology solutions, limited technical skills, and a lack of supportive policy frameworks (Wegscheider & Stark, 2020). This exclusion from the data economy not only stifles individual business growth but also perpetuates systemic economic disparities. Figure 2 shows SME technology priorities 2013-2017 presented by Polkowski, Khajuria & Rohadia, 2017.



Fig 2: SME technology priorities 2013-2017 (Polkowski, Khajuria & Rohadia, 2017).

Understanding how to implement data democratization effectively in MSEs can benefit from theoretical frameworks like Diffusion of Innovation (DOI) theory. This framework explains how new technologies spread and identifies key adoption characteristics (Kensler *et al.*, 2009). For MSEs to embrace data democratization, it is essential that the tools offered are perceived as beneficial, easy to use, and compatible with existing operations. Demonstrating successful applications in similar enterprises and simplifying user interfaces can significantly enhance adoption rates among skeptical small business owners (Akinyemi & Ezekiel, 2022, Attah, *et al.*, 2022).

Furthermore, the Technology Acceptance Model (TAM) posits that perceived usefulness and ease of use are crucial factors influencing technology adoption. MSEs typically possess limited resources and time to experiment with new technologies; thus, systems designed for data democratization must provide immediate and clear value to their users (Wang *et al.*, 2022). If MSE owners believe that a specific analytics tool can enhance their business processes without necessitating extensive technical knowledge, they are more likely to integrate such tools into their operations effectively. Establishing trust through transparency and data integrity further strengthens the perceived value of these systems (McManus & Falkenbach, 2022).

The Capability Approach, articulated by Sen and later

developed by Nussbaum, introduces another critical dimension by focusing on enhancing individuals' and organizations' abilities to achieve valued outcomes. This shift emphasizes that simply providing resources is insufficient; building the actual capabilities of users is essential (Akinyemi & Abimbade, 2019, Lawal, Ajonbadi & Otokiti, 2014). For MSEs, this means delivering training, mentorship, and localized support solutions that factor in their specific needs and constraints. Empowering MSEs with data is thus understood not just as a technical challenge but as a socio-economic one that necessitates consistent investment in education and infrastructure (Espinosa *et al.*, 2014).

Achieving data democratization among MSEs involves coordinated efforts from various stakeholders. Governments play a crucial role in creating enabling frameworks through policies and infrastructure investment (Koch, 2021). They are positioned to initiate digital transformation programs targeted at small businesses and provide regulatory support that fosters digital equity. Similarly, technology providers must prioritize the development of accessible and user-friendly tools tailored to the specific contexts of MSEs (Logan & Mattes, 2012). Engaging with MSEs to understand their needs ensures that technology is relevant and effective. Social Media Analytics Process presented by Andryani, Negara & Triadi, 2019, is shown in figure 3.

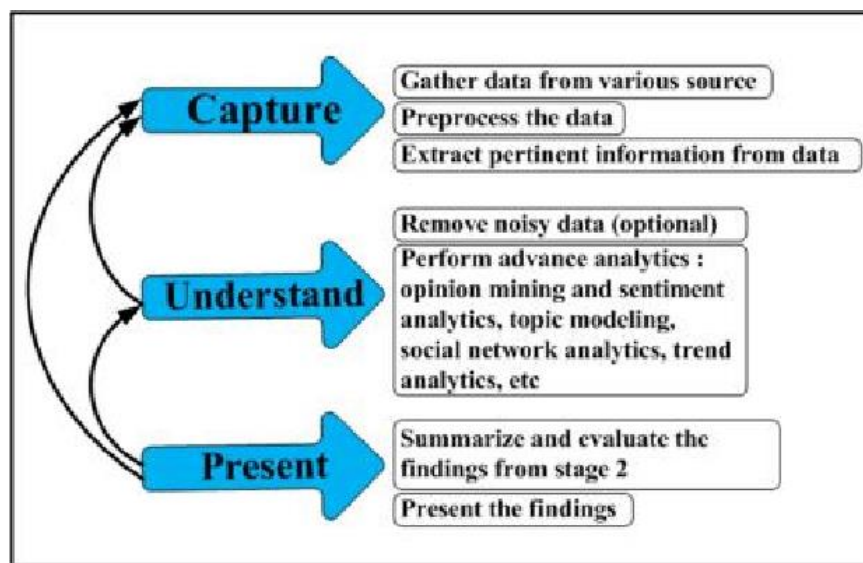


Fig 3: Social Media Analytics Process (Andryani, Negara & Triadi, 2019).

Civil society also has a critical role, serving as a link between MSEs and larger economic actors. NGOs and community organizations can offer training and resources to enhance digital literacy, which is vital for sustained user engagement and empowerment (Harland *et al.*, 2022). MSEs themselves are proactive agents in this democratization process and can catalyze technology adoption by articulating needs and engaging in co-design practices (Chukwuma-Eke, Ogunsola & Isibor, 2022, Olojede & Akinyemi, 2022).

In conclusion, the effective implementation of data democratization for MSEs requires a comprehensive understanding of the principles of openness and empowerment, alongside practical frameworks for technology adoption. By leveraging theories such as Diffusion of Innovation and Technology Acceptance, and

emphasizing the Capability Approach, stakeholders can collaboratively build systems that facilitate inclusive participation in the data economy (Ajonbadi, *et al.*, 2014, Lawal, Ajonbadi & Otokiti, 2014). The roles of various actors—including governments, technology providers, civil society, and MSEs—must be harmoniously integrated to bridge existing gaps, enabling a genuinely democratized data landscape.

2.2 Barriers to data democratization for MSEs

Data democratization has emerged as a critical avenue for micro and small enterprises (MSEs) to harness advanced analytics for growth in competitive, data-driven markets. However, MSEs, especially in developing regions or underserved communities, face significant barriers in this

journey. These hurdles encompass technical limitations, human capacity challenges, financial constraints, and deep-seated cultural and structural issues (Machado *et al.*, 2021; Nwajiuba *et al.*, 2020; Rupeika-Apoga & Petrovska, 2022). One immediate barrier is the lack of adequate technical infrastructure necessary for data-driven operations in MSEs. Many small businesses function with outdated technology, which hampers their ability to collect, store, and utilize data effectively. For instance, basic tools like spreadsheets are often underutilized or poorly maintained, and the absence of interoperable platforms leads to data silos that impede

efficient operations (Machado *et al.*, 2021; Rupeika-Apoga & Petrovska, 2022). Research indicates that a considerable portion of MSEs struggle with a patchwork of disconnected tools—whether in accounting or customer relations—which makes it challenging to generate actionable insights from data. Without the foundational infrastructure for data management, MSEs are marginalized in the digital economy (Machado *et al.*, 2021; Rupeika-Apoga & Petrovska, 2022). Samuel, *et al.*, 2021, presented the HPC democratization concept shown in figure 4.

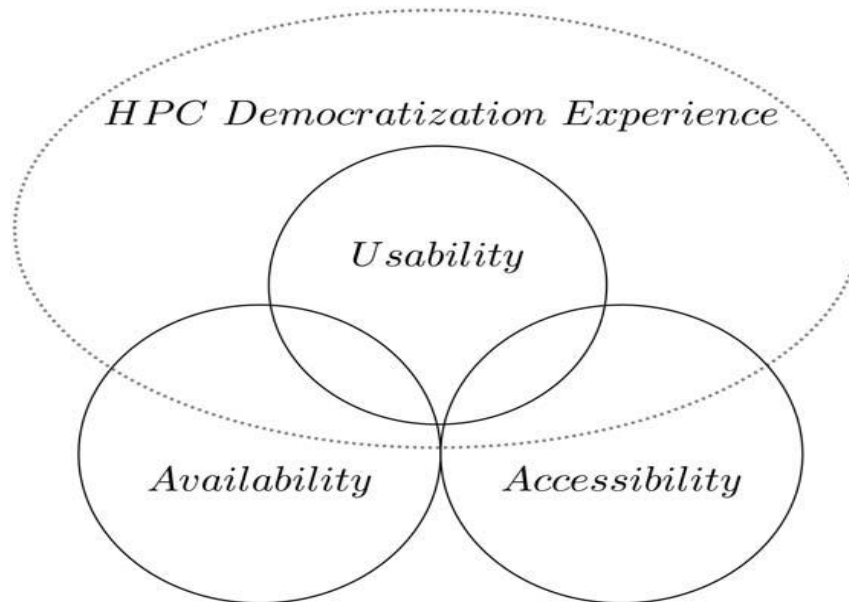


Fig 4: The HPC democratization concept (Samuel, *et al.*, 2021).

The human capacity barriers further complicate the landscape for data democratization in MSEs. Data democratization relies on users possessing the ability to interpret and leverage insights from analytics; yet many employees in MSEs lack the requisite digital and data literacy. This gap diminishes their autonomy in adopting data tools, leading to a dependency on external consultants (Nwajiuba *et al.*, 2020; Rupeika-Apoga & Petrovska, 2022). Studies show that many MSEs do not employ specialized personnel such as data analysts, and the multitasking nature of roles within these enterprises diminishes the potential for developing skills necessary for effective data usage (Machado *et al.*, 2021). Consequently, this human capital deficit perpetuates inequalities in the access and application of data analytics, leaving many MSEs unable to fully participate in the data-driven economy (Nwajiuba *et al.*, 2020; Rupeika-Apoga & Petrovska, 2022).

Financial constraints represent a significant obstacle, as many MSEs operate on thin profit margins, prioritizing immediate operational costs over investments in technology (Machado *et al.*, 2021; Nwajiuba *et al.*, 2020). Even when advanced analytics tools become available through scalable models, the associated hidden costs—including maintenance, training, and integration—can overwhelm small businesses. Furthermore, limited access to credit restricts these enterprises from investing in necessary digital infrastructure and capabilities, further entrenching their position in low-technology and low-productivity cycles (Machado *et al.*, 2021; Cong & Uyen, 2020).

Beyond tangible barriers are cultural and structural

impediments that inhibit the adoption of data tools among MSEs. Resistance to change is common among business owners who have historically operated without such technologies, often viewing data-driven approaches as unnecessary or risky (Nwajiuba *et al.*, 2020; Rupeika-Apoga & Petrovska, 2022). This reluctance may stem from a lack of awareness regarding the value of data analytics, which diminishes demand for these tools and consequently lowers investment incentives for technology providers (Machado *et al.*, 2021). Moreover, in environments lacking institutional frameworks for data-driven decision-making, MSEs struggle to integrate available data tools into their practices, stunting their growth (Nwajiuba *et al.*, 2020; Rupeika-Apoga & Petrovska, 2022).

Ultimately, the combined effect of these barriers creates an uneven playing field where only a minority of MSEs can leverage data tools effectively, while the majority remain excluded. To bridge this gap, it is essential for stakeholders, including governments, financial institutions, and technology providers, to create supportive ecosystems. These ecosystems should focus on building robust technical infrastructures, enhancing digital literacy, and providing affordable financial solutions tailored to the unique needs of MSEs (Nwabekee, *et al.*, 2021, Odunaiya, Soyombo & Ogunsola, 2021). By implementing coordinated efforts, the promise of data democratization can be realized in a manner that fosters inclusive growth for micro and small enterprises (Machado *et al.*, 2021; Nwajiuba *et al.*, 2020; Rupeika-Apoga & Petrovska, 2022).

2.3 Enablers of data democratization

Data democratization has emerged as a transformative force for micro and small enterprises (MSEs), enhancing their ability to leverage data for informed decision-making, strategic planning, and sustainable growth. The notion that data democratization could fundamentally reshape the operational landscape for MSEs hinges on several enablers that facilitate the adoption and effective use of data-driven tools (Akinyemi, 2018, Olaiya, Akinyemi & Aremu, 2017). Specifically, technological, policy, capacity-building, and collaborative dimensions serve as critical facilitators in this endeavor. Each of these dimensions not only addresses unique challenges faced by MSEs regarding data utilization but collectively contributes to an ecosystem that promotes accessibility to advanced analytics (Mikalef *et al.*, 2017; Wamuyu, 2022; Romero & Navarro, 2022).

One significant technological enabler is the proliferation of cloud computing services, which has substantially lowered the cost barriers historically associated with data storage and analytics tools. Cloud solutions enable MSEs to access advanced analytics capabilities without the financial strain of maintaining on-premises infrastructure, thus democratizing access to resources that were previously out of reach (Akinyemi & Ojetunde, 2020, Olanipekun, 2020). The literature highlights that the cost-effectiveness of cloud computing directly correlates with the increased use by MSEs, as these services allow for scalable data management solutions tailored to the specific operational scale of smaller enterprises (Wamuyu, 2022; Romero & Navarro, 2022). Furthermore, cloud-based analytics platforms facilitate real-time insights across various business functions including sales, marketing, and inventory management, thus empowering MSEs to derive actionable intelligence from their data (Romero & Navarro, 2022).

In addition to cloud solutions, low-code and no-code platforms are instrumental in making advanced analytics more accessible to MSEs. These platforms simplify the process of crafting business intelligence (BI) solutions, allowing users with limited technical knowledge to create customized dashboards and data visualizations (Abimbade, *et al.*, 2016, Olanipekun & Ayotola, 2019). This is essential for MSEs where financial constraints and resource limitations often prevent hiring specialized human resources. The empowerment of business owners and employees through these tools fosters a culture of data-driven decision-making, as they can directly manipulate data to suit their unique business needs (Mikalef *et al.*, 2017; Nguyen *et al.*, 2018).

Policy and institutional support represent another pivotal enabler of data democratization for MSEs. Government initiatives that focus on enhancing digital infrastructure, particularly in underserved regions, are crucial for promoting broadband access, which is a fundamental requisite for effective data operations (Akinyemi & Ojetunde, 2019, Olanipekun, Ilori & Ibitoye, 2020). Such policies ensure that MSEs are not left behind in the digital economy and can tap into the benefits of cloud services, thereby integrating into the broader landscape of digital business practices (Nguyen *et al.*, 2018; Assunção *et al.*, 2015). Additionally, strategic policies that promote financing for technology adoption can significantly enhance the capability of MSEs to invest in necessary digital tools and infrastructure (Romero & Navarro, 2022).

Capacity development is equally critical, as the low levels of data literacy among MSE owners and staff can hinder the

effective utilization of analytical tools, even when access is granted (Mikalef *et al.*, 2017; Assunção *et al.*, 2015). Implementing comprehensive training programs on data analytics basics and digital literacy will equip MSEs with the skills they need to interpret and act on data insights (Akinyemi & Ebimomi, 2021, Chukwuma-Eke, Ogunsola & Isibor, 2021). Collaborative initiatives, such as mentorship schemes and SME innovation hubs, can facilitate knowledge sharing and peer-learning, further bridging the skills gap present in many smaller enterprises (Romero & Navarro, 2022).

Finally, creating collaborative ecosystems that foster multi-stakeholder partnerships is vital for sustaining the momentum of data democratization efforts among MSEs. Effective cooperation among governments, technology providers, financial institutions, and MSE associations can drive the unified goal of enhancing data literacy and technology adoption across the board (Akinyemi, Adelana & Olurinola, 2022, Ibidunni, *et al.*, 2022, Otokiti, *et al.*, 2022). These partnerships can yield synergies that amplify the effectiveness of data democratization initiatives, enabling wider access to analytical resources that are necessary for MSEs to thrive and innovate in an increasingly digital world (Mikalef *et al.*, 2017; Assunção *et al.*, 2015).

In summary, the interplay of technology enablers, supportive policies, capacity-building measures, and collaborative frameworks can collectively empower MSEs to harness data-driven insights. By addressing the various enablers of data democratization, MSEs can improve decision-making capabilities, enhance competitiveness, and contribute to inclusive economic growth, thus realizing their potential in the digital landscape (Chukwuma-Eke, Ogunsola & Isibor, 2022, Muibi & Akinyemi, 2022).

2.4 Case studies and best practices

The concept of data democratization, particularly in the context of micro and small enterprises (MSEs), has gained significant traction in recent years. As digital technologies and advanced analytics tools become increasingly accessible, small businesses around the world are harnessing these innovations to improve their operations, compete more effectively, and drive growth (Ajibola & Olanipekun, 2019). While the barriers to adoption—such as limited resources, lack of technical expertise, and infrastructure challenges—remain significant, several successful case studies and best practices highlight how these obstacles can be overcome (Nwabekee, *et al.*, 2021, Otokiti & Onalaja, 2021). These examples, drawn from both local and global contexts, illustrate the transformative potential of data democratization for MSEs, with significant impacts on productivity, competitiveness, and innovation.

One of the most prominent examples of data democratization for small enterprises comes from the agriculture sector in sub-Saharan Africa. Farmers in rural areas often struggle with limited access to data that could help them optimize crop production, manage resources more effectively, and access markets. However, in Kenya, a startup called *Twiga Foods* has successfully implemented a mobile-based platform that democratizes access to market data for small-scale farmers and vendors (Adediran, *et al.*, 2022, Babatunde, Okeleke & Ijomah, 2022). By using cloud-based analytics, *Twiga Foods* provides real-time data on market prices, weather conditions, and demand forecasts. This allows smallholder farmers to make better decisions regarding crop production, pricing, and

when to sell their goods. The platform also aggregates demand from urban markets and connects small farmers directly to retailers, bypassing traditional intermediaries and ensuring better pricing and market access. This initiative has led to increased productivity, improved supply chain efficiencies, and higher income for small-scale farmers, demonstrating how access to data and advanced analytics can empower even the smallest businesses in underserved regions (Akinyemi & Ogundipe, 2022, Ezekiel & Akinyemi, 2022, Tella & Akinyemi, 2022).

Another successful case study comes from the retail sector in Latin America, where the *Mercado Libre* platform has enabled small businesses to tap into the vast potential of e-commerce through data-driven insights. As the largest e-commerce company in the region, *Mercado Libre* has created a digital ecosystem that provides small and micro retailers with tools for managing inventory, analyzing customer behavior, and optimizing pricing strategies. Through its business intelligence tools, the platform offers access to real-time analytics and sales data that would otherwise be unavailable to small vendors (Akinyemi, 2022, Akinyemi & Ologunada, 2022, Okeleke, Babatunde & Ijomah, 2022). By democratizing access to such analytics, *Mercado Libre* has enabled micro-entrepreneurs to compete with larger businesses, enhancing their operational efficiency and expanding their reach. The result is improved sales performance and enhanced competitiveness for thousands of small businesses across Latin America, demonstrating the powerful role of data in leveling the playing field in digital marketplaces.

In Europe, another innovative case can be found in *The European Data Incubator* (EDI), a project that aims to foster the growth of data-driven startups and SMEs by providing access to advanced analytics tools and datasets. The EDI initiative partners with large corporations, government organizations, and academic institutions to offer small enterprises access to big data and cloud computing resources. Through this collaboration, MSEs can apply advanced analytics to solve complex business challenges without the need for expensive infrastructure or specialized expertise (Ajonbadi, *et al.*, 2015, Olufemi-Phillips, *et al.*, 2020). For example, one participating startup in the healthcare sector used data provided through the EDI program to improve predictive models for patient outcomes, significantly enhancing the quality of care while reducing operational costs. This case highlights the transformative potential of collaborative data access and the importance of creating ecosystems that facilitate innovation and data sharing among small businesses (Adeniran, *et al.*, 2022, Aniebonam, *et al.*, 2022, Otokiti & Onalaja, 2022).

In Asia, particularly in India, the concept of data democratization has been successfully implemented through the *SME-Fintech* partnership. India has seen a rapid rise in fintech platforms that offer MSEs access to data-driven financial tools, such as credit scoring, predictive analytics for loan repayment, and cash flow forecasting. Companies like *Razorpay* and *Khatabook* have developed digital platforms that provide small businesses with insights into their financial health, allowing them to access credit and other financial services that were previously inaccessible (Akinyemi & Aremu, 2010, Otokiti, 2017). These platforms use data from transactions and other business activities to create customized financial products for MSEs, helping them improve their financial management practices. By leveraging big data,

these fintech platforms have not only increased the financial inclusion of small businesses but have also enabled them to make more informed financial decisions, improving their competitiveness and overall business performance.

In the United States, the concept of data democratization is exemplified by *Shopify*, a global e-commerce platform that enables small businesses to sell products online and access analytics tools to optimize their sales strategies. *Shopify* offers built-in data analytics features that provide insights into sales trends, customer demographics, and marketing effectiveness. These tools allow small businesses to make data-driven decisions regarding product offerings, pricing strategies, and customer targeting. For example, a small boutique retailer in a rural part of the U.S. might use *Shopify's* analytics to understand which products are trending, identify profitable customer segments, and tailor their marketing efforts accordingly (Chukwuma-Eke, Ogunsola & Isibor, 2022, Kolade, *et al.*, 2022). This level of insight, once reserved for larger enterprises, has empowered small retailers to increase their sales and expand their market reach, further demonstrating how data democratization can enhance productivity and competitiveness.

In each of these cases, data democratization has had a tangible impact on productivity, competitiveness, and innovation. By providing small businesses with access to the same data and analytics tools that were once the domain of large corporations, these enterprises have been able to optimize operations, improve decision-making, and innovate more effectively. The ability to access real-time data on inventory, customer behavior, market conditions, and financial performance has allowed MSEs to operate more efficiently, reducing costs and improving profit margins (Abimbade, *et al.*, 2017, Aremu, Akinyemi & Babafemi, 2017). Moreover, small businesses that have embraced data-driven approaches have been able to innovate more rapidly, developing new products, services, and business models that better meet the needs of their customers.

Data democratization has also played a crucial role in leveling the playing field between large and small enterprises, particularly in sectors such as e-commerce and healthcare, where data-driven decisions are essential for success. In many cases, small businesses that adopt advanced analytics tools have been able to outperform competitors who rely on traditional, intuition-based decision-making processes. By enabling MSEs to compete more effectively, data democratization fosters greater market diversity, encourages entrepreneurship, and stimulates economic growth, especially in regions where small businesses are the backbone of the economy (Adedeji, Akinyemi & Aremu, 2019, Otokiti, 2017).

Furthermore, these successful examples also underscore the importance of supportive ecosystems in facilitating data democratization. Collaborative partnerships between technology providers, governments, educational institutions, and industry leaders are essential for creating an environment where small businesses can thrive. Whether through access to cloud-based solutions, digital literacy programs, or financial support for technology adoption, the collective efforts of these stakeholders play a pivotal role in enabling MSEs to unlock the benefits of data-driven decision-making (Akinyemi & Aremu, 2016, Otokiti, 2012).

In conclusion, the case studies and best practices highlighted above demonstrate the significant positive impact of data democratization on MSEs. By reducing barriers to access and

enabling small businesses to leverage advanced analytics, these initiatives have empowered entrepreneurs to improve their productivity, enhance their competitiveness, and drive innovation. As more MSEs around the world embrace data-driven strategies, the potential for economic growth, market inclusion, and sustainable development expands (Akinbola, Otokiti & Adegbuyi, 2014, Otokiti-Ilori & Akorede, 2018). With continued support from governments, technology providers, and other stakeholders, data democratization can become a cornerstone of economic empowerment for small enterprises worldwide.

2.5 Proposed framework for inclusive analytics access

Data democratization is an essential tool for transforming the way micro and small enterprises (MSEs) operate, particularly in underserved or developing regions. By making advanced analytics more accessible, MSEs can optimize their operations, improve decision-making, and enhance their competitive edge. However, achieving widespread access to advanced data tools requires a structured and inclusive framework that addresses the challenges faced by these businesses (Ajonbadi, *et al.*, 2015, Otokiti, 2018). Such a framework must be grounded in a step-by-step roadmap that involves multiple stakeholders, effective policy recommendations, and a robust system for measuring and evaluating success. This approach will ensure that data democratization moves from theory to practical, measurable impact.

The proposed framework begins with the creation of a clear, actionable roadmap that outlines the roles and responsibilities of each stakeholder involved in the data democratization process. The first step in this roadmap is identifying the key stakeholders, which include governments, technology providers, financial institutions, development agencies, MSE associations, and the enterprises themselves. Each of these stakeholders has a critical role to play in facilitating the widespread adoption of data analytics within small businesses (Akinyemi & Oke, 2019, Otokiti & Akinbola 2013). Governments can help create the necessary infrastructure and regulatory framework that fosters data inclusion. Technology providers must focus on developing affordable, accessible, and easy-to-use analytics tools. Financial institutions can support SMEs by offering innovative financing options tailored to digital transformation. Development agencies and NGOs can provide technical support and facilitate training programs, while MSE associations can act as intermediaries to facilitate information flow and provide peer support (Akinbola, *et al.*, 2020, Ogundare, Akinyemi & Aremu, 2021).

The roadmap for implementing inclusive analytics access should begin with a foundational phase that focuses on infrastructure development. This includes providing reliable internet access, affordable cloud storage, and the availability of low-cost devices capable of supporting advanced analytics tools. Governments play a central role here by creating policies that incentivize infrastructure investment in underserved regions. Public-private partnerships can help subsidize the costs of infrastructure, such as broadband expansion or cloud services, making them more accessible to small businesses (Attah, Ogunsola & Garba, 2022, Babatunde, Okeleke & Ijomah, 2022). Furthermore, international development agencies and NGOs can provide additional resources to strengthen the digital backbone of these areas, ensuring that businesses in rural or low-income

regions are not left behind.

The next phase of the roadmap focuses on training and capacity building. One of the most significant barriers to data democratization for MSEs is the lack of digital and data literacy. Even when advanced analytics tools are available, businesses struggle to leverage them effectively without the necessary skills. Therefore, comprehensive training programs must be implemented at the local level to build the capacity of MSE owners, managers, and employees (Abimbade, *et al.*, 2022, Aremu, *et al.*, 2022, Oludare, Adeyemi & Otokiti, 2022). These programs should cover a wide range of topics, from basic data literacy to more advanced analytical skills, and should be tailored to the specific needs and contexts of MSEs. For example, the training could focus on simple yet effective uses of data analytics, such as sales forecasting, customer segmentation, and inventory management. To increase engagement and long-term adoption, training programs should be delivered in local languages and formats that are easily accessible to small business owners with limited formal education (Akinyemi & Ebimomi, 2020, Aremu & Laolu, 2014).

In addition to formal training programs, mentorship and peer-learning opportunities should be integrated into the framework. Local business leaders who have successfully adopted data-driven practices can serve as mentors to others, sharing insights, best practices, and lessons learned. Peer-learning networks also provide a valuable platform for MSEs to collaborate, discuss challenges, and exchange ideas (Adedaja, *et al.*, 2017, Aremu, *et al.*, 2018). These networks can be supported by MSE associations, which can act as hubs for knowledge sharing and collaboration. Furthermore, online resources such as webinars, video tutorials, and community forums should be made available to enable ongoing learning and knowledge transfer.

Once the necessary infrastructure and capacity-building measures are in place, the next step involves ensuring that MSEs have access to the right tools. This is where technology providers come into play. Their role is to develop and provide affordable, easy-to-use analytics tools that are specifically tailored to the needs of small businesses. These tools should focus on usability and simplicity, avoiding the complexity often associated with enterprise-level software (Akinyemi & Aremu, 2017, Otokiti-Ilori, 2018). Cloud-based platforms that offer scalable analytics tools, allowing businesses to pay only for what they use, are an ideal solution. Additionally, open-source platforms can be encouraged, as they provide free access to powerful analytics tools that can be customized to meet specific business needs.

As part of the framework, technology providers should also offer robust customer support to guide SMEs through the adoption process. This could include 24/7 technical support, regular product updates, and the provision of user-friendly manuals and resources. The success of these tools will depend on their ability to integrate seamlessly into existing business processes and their ability to deliver clear, actionable insights. Ensuring that small businesses can easily apply the insights they gain from these tools to improve their operations is key to achieving the goals of data democratization (Ajonbadi, Otokiti & Adebayo, 2016, Otokiti & Akorede, 2018).

Financial institutions play a crucial role in supporting MSEs by providing funding options for digital transformation. Many small businesses face significant financial constraints that prevent them from investing in the infrastructure and

tools necessary for data-driven decision-making. Financial institutions can help by offering microloans, grants, or credit lines specifically designed for technology adoption (Akinyemi & Ebimomi, 2020). Furthermore, innovative fintech solutions that offer financing based on the creditworthiness of SMEs can enable businesses to access the funds they need for digital tools and infrastructure. Development agencies can further support this process by offering low-interest loans or grants to small businesses engaged in digital transformation (Akinyemi, Ogundipe & Adelana, 2021, Kolade, *et al.*, 2021).

Once these foundational steps are taken, the framework should focus on developing measurement and evaluation systems to assess the impact of data democratization efforts. This is critical for understanding the effectiveness of the interventions and ensuring that resources are being used efficiently. Measurement metrics should include both qualitative and quantitative indicators. Quantitative metrics could include the number of MSEs adopting data-driven tools, the increase in productivity, sales growth, cost reduction, and the level of customer satisfaction (Adetunmbi & Owolabi, 2021, Arotiba, Akinyemi & Aremu, 2021). Qualitative metrics should capture the impact on decision-making processes, such as how businesses are using data to improve customer targeting, optimize supply chains, or forecast demand. Regular surveys, interviews, and focus groups can be conducted with SME owners and employees to gather feedback on their experiences with data tools and training programs. These insights can be used to refine the implementation process and improve the overall framework. (Adisa, Akinyemi & Aremu, 2019, Famaye, Akinyemi & Aremu, 2020)

Finally, the framework must be flexible and adaptive to changing needs. As technology evolves, so too will the requirements of MSEs. The framework should be designed to evolve with these changes, incorporating new tools, training modules, and policy adjustments as necessary. Regular reviews and updates to the roadmap should be built into the system, with input from stakeholders at every level. This ensures that the process of data democratization remains relevant, effective, and sustainable in the long term (Akinbola & Otokiti, 2012).

Key policy recommendations for enabling inclusive analytics access include investing in digital infrastructure, providing financial incentives for technology adoption, integrating data literacy into educational curricula, and creating supportive ecosystems for data-driven innovation. Governments should prioritize policies that promote broadband access, provide subsidies for cloud services, and offer tax incentives for small businesses investing in digital transformation. By aligning policy with the goals of data democratization, policymakers can create an environment in which MSEs have the necessary tools and support to succeed (Nwaimo, Adewumi & Ajiga, 2022).

In conclusion, the proposed framework for inclusive analytics access offers a comprehensive approach to overcoming the barriers that prevent MSEs from fully participating in the data economy. By combining infrastructure development, capacity building, technology innovation, and financial support, this framework empowers small businesses to leverage data for growth and competitive advantage. Through collaborative efforts from stakeholders, the vision of data democratization for MSEs can become a reality, fostering greater economic inclusion and innovation

in the digital age (Adelana & Akinyemi, 2021, Esiri, 2021, Odunaiya, Soyombo & Ogunsola, 2021).

3. Conclusion

Data democratization represents a pivotal shift in how micro and small enterprises (MSEs) engage with advanced analytics, allowing them to unlock the potential of data to drive growth, improve operations, and increase competitiveness. This process is crucial in bridging the gap between larger enterprises with abundant resources and small businesses often constrained by limited access to technology and data-driven tools. By democratizing access to data and analytical capabilities, MSEs can make more informed decisions, optimize processes, and innovate in ways that were previously out of reach. Through affordable cloud-based solutions, low-code platforms, policy interventions, capacity-building programs, and collaborative ecosystems, MSEs can be empowered to integrate data analytics into their operations, leading to better business outcomes and economic resilience.

The insights derived from case studies and best practices highlight how, despite the barriers, successful examples from diverse global contexts illustrate the significant impact that data democratization can have. These businesses, from agriculture in sub-Saharan Africa to retail in Latin America, demonstrate that with the right support, MSEs can leverage advanced analytics to optimize supply chains, enhance customer engagement, and improve overall efficiency. The contributions of governments, technology providers, financial institutions, and other stakeholders in these processes show how a coordinated approach to data democratization can foster a more inclusive, sustainable, and competitive business landscape for small enterprises.

However, there are limitations to this study, particularly in its reliance on conceptual frameworks and case studies that may not fully reflect the unique challenges faced by MSEs in different local contexts. The specific socio-economic and cultural factors influencing the success of data democratization efforts in MSEs require further empirical research, particularly in regions where these efforts have not yet been implemented or evaluated. Future research should focus on assessing the long-term impacts of data democratization on MSE performance, as well as exploring how emerging technologies, such as artificial intelligence and machine learning, can further enhance the capabilities of small businesses in underserved areas.

A call to action is essential for ensuring that the benefits of data democratization reach all small businesses, especially those in marginalized regions. Governments, technology providers, financial institutions, and civil society must work together to reduce barriers to access, support capacity building, and create an environment that encourages innovation and data literacy. By prioritizing policies that focus on digital inclusion and ensuring that small businesses have the tools, knowledge, and support to succeed in the data-driven economy, we can foster a more equitable, innovative, and resilient economic future. Through collective efforts, data democratization can empower MSEs to fully realize their potential, driving sustainable growth and contributing to the broader goals of economic development and inclusivity.

4. References

1. Abimbade O, Akinyemi AL, Obideyi E, Olubusayo F. Use of web analytic in open and distance learning in the

- University of Ibadan, Nigeria. *African Journal of Theory and Practice of Educational Research*. 2016;3.
2. Abimbade O, Akinyemi A, Bello L, Mohammed H. Comparative effects of an individualized computer-based instruction and a modified conventional strategy on students' academic achievement in organic chemistry. *Journal of Positive Psychology and Counseling*. 2017;1(2):1-19.
 3. Adebayo AS, Chukwurah N, Ajayi OO. Proactive ransomware defense frameworks using predictive analytics and early detection systems for modern enterprises.
 4. Adedeji AS, Akinyemi AL, Aremu A. Effects of gamification on senior secondary school one students' motivation and achievement in Physics in Ayedaade Local Government Area of Osun State. In: *Research on Contemporary Issues in Media Resources and Information and Communication Technology Use*. BOGA Press; 2019:501-519.
 5. Adedoja G, Abimbade O, Akinyemi A, Bello L. Discovering the power of mentoring using online collaborative technologies. *Advancing Education Through Technology*. 2017:261-281.
 6. Adelana OP, Akinyemi AL. Artificial intelligence-based tutoring systems utilization for learning: a survey of senior secondary students' awareness and readiness in Ijebu-Ode, Ogun State. *UNIZIK Journal of Educational Research and Policy Studies*. 2021;9:16-28.
 7. Adeniran BI, Akinyemi AL, Aremu A. The effect of Webquest on civic education of junior secondary school students in Nigeria. In: *Proceedings of INCEDI 2016 Conference*. 2016:109-120.
 8. Adetunmbi LA, Owolabi PA. Online learning and mental stress during the COVID-19 pandemic lockdown: implication for undergraduates' mental well-being. *Unilorin Journal of Lifelong Education*. 2021;5(1):148-163.
 9. Adisa IO, Akinyemi AL, Aremu A. West African Journal of Education. *West African Journal of Education*. 2019;39:51-64.
 10. Ajibola KA, Olanipekun BA. Effect of access to finance on entrepreneurial growth and development in Nigeria among "YOU WIN" beneficiaries in SouthWest, Nigeria. *Ife Journal of Entrepreneurship and Business Management*. 2019;3(1):134-149.
 11. Ajonbadi HA, Lawal AA, Badmus DA, Otokiti BO. Financial control and organisational performance of the Nigerian small and medium enterprises (SMEs): a catalyst for economic growth. *American Journal of Business, Economics and Management*. 2014;2(2):135-143.
 12. Ajonbadi HA, Mojeed-Sanni BA, Otokiti BO. Sustaining competitive advantage in medium-sized enterprises (MEs) through employee social interaction and helping behaviours. *Journal of Small Business and Entrepreneurship*. 2015;3(2):1-16.
 13. Ajonbadi HA, Mojeed-Sanni BA, Otokiti BO. Sustaining competitive advantage in medium-sized enterprises (MEs) through employee social interaction and helping behaviours. *Business and Economic Research Journal*. 2015;36(4).
 14. Ajonbadi HA, Otokiti BO, Adebayo P. The efficacy of planning on organisational performance in the Nigeria SMEs. *European Journal of Business and Management*. 2016;24(3).
 15. Akinbola OA, Otokiti BO. Effects of lease options as a source of finance on profitability performance of small and medium enterprises (SMEs) in Lagos State, Nigeria. *International Journal of Economic Development Research and Investment*. 2012;3(3).
 16. Akinbola OA, Otokiti BO, Akinbola OS, Sanni SA. Nexus of born global entrepreneurship firms and economic development in Nigeria. *Ekonomicko-manazerske spektrum*. 2020;14(1):52-64.
 17. Akinbola OA, Otokiti BO, Adegbuyi OA. Market-based capabilities and results: inference for telecommunication service businesses in Nigeria. *The European Journal of Business and Social Sciences*. 2014;12(1).
 18. Akinyemi AL. Development and utilisation of an instructional programme for impacting competence in Language of Graphics Orientation (LOGO) at primary school level in Ibadan, Nigeria [Doctoral dissertation]. 2013.
 19. Akinyemi AL. Computer programming integration into primary education: implication for teachers. In: *Proceedings of STAN Conference*. 2018:216-225.
 20. Akinyemi AL. Teachers' educational media competence in the teaching of English language in preprimary and primary schools in Ibadan North Local Government Area, Nigeria. *Journal of Emerging Trends in Educational Research and Policy Studies*. 2022;13(1):15-23.
 21. Akinyemi AL, Abimbade OA. Attitude of secondary school teachers to technology usage and the way forward. In: *Africa and Education, 2030 Agenda*. Gab Educ. Press; 2019:409-420.
 22. Akinyemi AL, Aremu A. Integrating LOGO programming into Nigerian primary school curriculum. *Journal of Children in Science and Technology*. 2010;6(1):24-34.
 23. Akinyemi AL, Aremu A. LOGO usage and the perceptions of primary school teachers in Oyo State, Nigeria. In: *Proceedings of the International Conference on Education Development and Innovation (INCEDI)*. 2016:455-462.
 24. Akinyemi AL, Aremu A. Challenges of teaching computer programming in Nigerian primary schools. *African Journal of Education Research (AJER)*. 2017;21(1-2):118-124.
 25. Akinyemi AL, Ebimomi OE. Effects of video-based instructional strategy (VBIS) on students' achievement in computer programming among secondary school students in Lagos State, Nigeria. *West African Journal of Open and Flexible Learning*. 2020;9(1):123-125.
 26. Akinyemi AL, Ebimomi OE. Influence of gender on students' learning outcomes in computer studies. *Education Technology*. 2020.
 27. Akinyemi AL, Ebimomi OE. Influence of gender on students' learning outcomes in computer programming in Lagos State junior secondary schools. *East African Journal of Educational Research and Policy*. 2021;16:191-204.
 28. Akinyemi AL, Ebiseni EO. Effects of video-based instructional strategy (VBIS) on junior secondary school students' achievement in computer programming in Lagos State, Nigeria. *West African Journal of Open and Flexible Learning*. 2020;9(1):123-136.
 29. Akinyemi AL, Ezekiel OB. University of Ibadan

- lecturers' perception of the utilisation of artificial intelligence in education. *Journal of Emerging Trends in Educational Research and Policy Studies*. 2022;13(4):124-131.
30. Akinyemi AL, Ogundipe T. Effects of Scratch programming language on students' attitude towards geometry in Oyo State, Nigeria. In: *Innovation in the 21st Century: Resetting the Disruptive Educational System*. Aku Graphics Press; 2022:354-361.
 31. Akinyemi AL, Ojetunde SM. Techno-pedagogical models and influence of adoption of remote learning platforms on classical variables of education inequality during COVID-19 pandemic in Africa. *Journal of Positive Psychology and Counselling*. 2020;7(1):12-27.
 32. Akinyemi AL, Oke AE. The use of online resources for teaching and learning: Teachers' perspectives in Egbeda Local Government Area, Oyo State. *Ibadan Journal of Educational Studies*. 2019;16(1-2).
 33. Akinyemi AL, Adelana OP, Olurinola OD. Use of infographics as teaching and learning tools: Survey of pre-service teachers' knowledge and readiness in a Nigerian university. *Journal of ICT in Education*. 2022;9(1):117-130.
 34. Akinyemi AL, Ogundipe T, Adelana OP. Effect of Scratch programming language (SPL) on achievement in Geometry among senior secondary students in Ibadan, Nigeria. *Journal of ICT in Education*. 2021;8(2):24-33.
 35. Akinyemi A, Ojetunde SM. Comparative analysis of networking and e-readiness of some African and developed countries. *Journal of Emerging Trends in Educational Research and Policy Studies*. 2019;10(2):82-90.
 36. Akinyemi LA, Ologunada. Impacts of interactive learning instructional package on secondary school students' academic achievement in basic programming. *Ibadan Journal of Educational Studies (IJES)*. 2022;19(2):67-74.
 37. Amadasun D, Mutezo A. Influence of access to finance on the competitive growth of SMEs in Lesotho. *Journal of Innovation and Entrepreneurship*. 2022;11(1). <https://doi.org/10.1186/s13731-022-00244-1>
 38. Andryani R, Negara ES, Triadi D. Social media analytics: data utilization of social media for research. *Journal of Information Systems and Informatics*. 2019;1(2):193-205.
 39. Aniebonam EE, Nwabeke US, Ogunsola OY, Elumilade OO. *International Journal of Management and Organizational Research*. 2022.
 40. Aremu A, Laolu AA. Language of graphics orientation (LOGO) competencies of Nigerian primary school children: Experiences from the field. *Journal of Educational Research and Reviews*. 2014;2(4):53-60.
 41. Aremu A, Adedoja S, Akinyemi A, Abimbade AO, Olasunkanmi IA. An overview of educational technology unit, Department of science and technology education, Faculty of education, University of Ibadan. 2018.
 42. Aremu A, Akinyemi AL, Babafemi E. Gaming approach: A solution to mastering basic concepts of building construction in technical and vocational education in Nigeria. In: *Advancing Education Through Technology*. Ibadan His Lineage Publishing House; 2017:659-676.
 43. Aremu A, Akinyemi LA, Olasunkanmi IA, Ogundipe T. Raising the standards/quality of UBE teachers through technology-mediated strategies and resources. *Emerging Perspectives on Universal Basic Education*. 2022:139-149.
 44. Aristanto E, Hidayatullah S, Windhyastiti I, Khourouh U, Rachmawati I. Obstacles of micro and small business access to Kredit Usaha Rakyat (KUR) program. *MBR (Management and Business Review)*. 2022;6(1):50-58. <https://doi.org/10.21067/mbr.v6i1.6719>
 45. Arotiba OO, Akinyemi AL, Aremu A. Teachers' perception on the use of online learning during the COVID-19 pandemic in secondary schools in Lagos, Nigeria. *Journal of Education and Training Technology (JETT)*. 2021;10(3):1-10.
 46. Assunção M, Calheiros R, Bianchi S, Netto M, Buyya R. Big data computing and clouds: trends and future directions. *Journal of Parallel and Distributed Computing*. 2015;79-80:3-15. <https://doi.org/10.1016/j.jpdc.2014.08.003>
 47. Attah JO, Mbakuu SH, Ayange CD, Achive GW, Onoja VS, Kaya PB, *et al.* Comparative recovery of cellulose pulp from selected agricultural wastes in Nigeria to mitigate deforestation for paper. *European Journal of Material Science*. 2022;10(1):23-36.
 48. Attah RU, Ogunsola OY, Garba BMP. The future of energy and technology management: innovations, data-driven insights, and smart solutions development. *International Journal of Science and Technology Research Archive*. 2022;3(2):281-296.
 49. Babatunde SO, Okeleke PA, Ijomah TI. Influence of brand marketing on economic development: a case study of global consumer goods companies.
 50. Babatunde SO, Okeleke PA, Ijomah TI. The role of digital marketing in shaping modern economies: an analysis of e-commerce growth and consumer behavior.
 51. Beck T, Demirgüç-Kunt A. Small and medium-size enterprises: access to finance as a growth constraint. *Journal of Banking & Finance*. 2006;30(11):2931-2943. <https://doi.org/10.1016/j.jbankfin.2006.05.009>
 52. Chukwuma-Eke EC, Ogunsola OY, Isibor NJ. Designing a robust cost allocation framework for energy corporations using SAP for improved financial performance. *International Journal of Multidisciplinary Research and Growth Evaluation*. 2021;2(1):809-822. <https://doi.org/10.54660/IJMRGE.2021.2.1.809-822>
 53. Chukwuma-Eke EC, Ogunsola OY, Isibor NJ. A conceptual approach to cost forecasting and financial planning in complex oil and gas projects. *International Journal of Multidisciplinary Research and Growth Evaluation*. 2022;3(1):819-833. <https://doi.org/10.54660/IJMRGE.2022.3.1.819-833>
 54. Chukwuma-Eke EC, Ogunsola OY, Isibor NJ. A conceptual framework for financial optimization and budget management in large-scale energy projects. *International Journal of Multidisciplinary Research and Growth Evaluation*. 2022;2(1):823-834. <https://doi.org/10.54660/IJMRGE.2021.2.1.823-834>
 55. Chukwuma-Eke EC, Ogunsola OY, Isibor NJ. Developing an integrated framework for SAP-based cost

- control and financial reporting in energy companies. *International Journal of Multidisciplinary Research and Growth Evaluation*. 2022;3(1):805–818. <https://doi.org/10.54660/IJMRGE.2022.3.1.805-818>
56. Cong P, Uyen P. Study of factors affecting micro-barriers that hinders the development of private enterprises: mediating role of intention to use of renewable energy. *International Journal of Energy Economics and Policy*. 2020;10(6):594-601. <https://doi.org/10.32479/ijeep.10588>
 57. Dare SO, Abimbade A, Abimbade OA, Akinyemi A, Olasunkanmi IA. Computer literacy, attitude to computer and learning styles as predictors of physics students' achievement in senior secondary schools of Oyo State.
 58. Esiri S. A strategic leadership framework for developing esports markets in emerging economies. *International Journal of Multidisciplinary Research and Growth Evaluation*. 2021;2(1):717-724.
 59. Espinosa R, Garriga L, Zubcoff J, Mazón J. Linked open data mining for democratization of big data. *Proceedings of the IEEE International Conference on Big Data*. 2014:17-19. <https://doi.org/10.1109/bigdata.2014.7004479>
 60. Ezekiel OB, Akinyemi AL. Utilisation of artificial intelligence in education: the perception of University of Ibadan lecturers. *Journal of Global Research in Education and Social Science*. 2022;16(5):32-40.
 61. Famaye T, Akinyemi AI, Aremu A. Effects of computer animation on students' learning outcomes in four core subjects in basic education in Abuja, Nigeria. *African Journal of Educational Research*. 2020;22(1):70-84.
 62. Harel R, Schwartz D, Kaufmann D. Funding access and innovation in small businesses. *Journal of Risk and Financial Management*. 2020;13(9):209. <https://doi.org/10.3390/jrfm13090209>
 63. Harland T, Hocken C, Schröer T, Stich V. Towards a democratization of data in the context of industry 4.0. *Sci*. 2022;4(3):29. <https://doi.org/10.3390/sci4030029>
 64. Hill B, Dailey D, Guy R, Lewis B, Matsuzaki M, Morgan J. Democratizing data science: the community data science workshops and classes. *Data Science and Digital Business*. 2017:115-135. https://doi.org/10.1007/978-3-319-59186-5_9
 65. Ibidunni AS, Ayeni AWA, Ogundana OM, Otokiti B, Mohalajeng L. Survival during times of disruptions: rethinking strategies for enabling business viability in the developing economy. *Sustainability*. 2022;14(20):13549.
 66. Ilori MO, Olanipekun SA. Effects of government policies and extent of its implementations on the foundry industry in Nigeria. *IOSR Journal of Business Management*. 2020;12(11):52-59.
 67. James AT, Ayobami AO, Adeagbo A. Raising employability bar and building entrepreneurial capacity in youth: a case study of national social investment programme in Nigeria. *Covenant Journal of Entrepreneurship*. 2019.
 68. Kensler L, Caskie G, Barber M, White G. The ecology of democratic learning communities: faculty trust and continuous learning in public middle schools. *Journal of School Leadership*. 2009;19(6):697-735. <https://doi.org/10.1177/105268460901900604>
 69. Koch T. Welcome to the revolution: COVID-19 and the democratization of spatial-temporal data. *Patterns*. 2021;2(7):100272. <https://doi.org/10.1016/j.patter.2021.100272>
 70. Kolade O, Osabuohien E, Aremu A, Olanipekun KA, Osabohien R, Tunji-Olayeni P. Co-creation of entrepreneurship education: challenges and opportunities for university, industry and public sector collaboration in Nigeria. *The Palgrave Handbook of African Entrepreneurship*. 2021:239-265.
 71. Kolade O, Rae D, Obembe D, Woldesenbet K, editors. *The Palgrave Handbook of African Entrepreneurship*. Palgrave Macmillan; 2022.
 72. Kołczyńska M. Democratic values, education, and political trust. *International Journal of Comparative Sociology*. 2020;61(1):3-26. <https://doi.org/10.1177/0020715220909881>
 73. Lawal AA, Ajonbadi HA, Otokiti BO. Leadership and organisational performance in the Nigeria small and medium enterprises (SMEs). *American Journal of Business, Economics and Management*. 2014;2(5):121.
 74. Lawal AA, Ajonbadi HA, Otokiti BO. Strategic importance of the Nigerian small and medium enterprises (SMEs): myth or reality. *American Journal of Business, Economics and Management*. 2014;2(4):94-104.
 75. Logan C, Mattes R. Democratising the measurement of democratic quality: public attitude data and the evaluation of African political regimes. *European Political Science*. 2012;11(4):469-491. <https://doi.org/10.1057/eps.2011.50>
 76. Machado E, Scavarda L, Caiado R, Thomé A. Barriers and enablers for the integration of industry 4.0 and sustainability in supply chains of MSMEs. *Sustainability*. 2021;13(21):11664. <https://doi.org/10.3390/su132111664>
 77. McManus I, Falkenbach M. A hollow victory: understanding the anti-immigration shift of Denmark's social democrats. *Journal of Contemporary European Research*. 2022;18(1). <https://doi.org/10.30950/jcer.v18i1.1161>
 78. Mikalef P, Pappas I, Krogstie J, Giannakos M. Big data analytics capabilities: a systematic literature review and research agenda. *Information Systems and E-Business Management*. 2017;16(3):547-578. <https://doi.org/10.1007/s10257-017-0362-y>
 79. Muibi TG, Akinyemi AL. Emergency remote teaching during COVID-19 pandemic and undergraduates' learning effectiveness at the University of Ibadan, Nigeria. *African Journal of Educational Management*. 2022;23(2):95-110.
 80. Neneh B. Customer orientation and performance of women-owned businesses: a configurational approach. *Journal of Small Business Management*. 2019;57(S2):218-243. <https://doi.org/10.1111/jsbm.12468>
 81. Nguyen T, Zhou L, Spiegler V, Ieromonachou P, Lin Y. Big data analytics in supply chain management: a state-of-the-art literature review. *Computers & Operations Research*. 2018;98:254-264. <https://doi.org/10.1016/j.cor.2017.07.004>
 82. Nwabekee US, Aniebonam EE, Elumilade OO,

- Ogunsola OY. Predictive model for enhancing long-term customer relationships and profitability in retail and service-based.
83. Nwabekee US, Aniebonam EE, Elumilade OO, Ogunsola OY. Integrating digital marketing strategies with financial performance metrics to drive profitability across competitive market sectors.
 84. Nwaimo CS, Adewumi A, Ajiga D. Advanced data analytics and business intelligence: building resilience in risk management. *International Journal of Scientific Research and Applications*. 2022;6(2):121. <https://doi.org/10.30574/ijrsra.2022.6.2.0121>
 85. Nwajiuba C, Igwe P, Binuomote M, Nwajiuba A, Nwekpa K. The barriers to high-growth enterprises: what do businesses in Africa experience? *European Journal of Sustainable Development*. 2020;9(1):317. <https://doi.org/10.14207/ejsd.2020.v9n1p317>
 86. Nyongesa N, Miroga D. Influence of business risk and collateral requirements on credit access by small business enterprises in Bungoma County, Kenya. *Strategic Journal of Business & Change Management*. 2019;6(2). <https://doi.org/10.61426/sjbcm.v6i2.1118>
 87. Odunaiya OG, Soyombo OT, Ogunsola OY. Economic incentives for EV adoption: a comparative study between the United States and Nigeria. *Journal of Advanced Education and Sciences*. 2021;1(2):64–74. <https://doi.org/10.54660/JAES.2021.1.2.64-74>
 88. Odunaiya OG, Soyombo OT, Ogunsola OY. Energy storage solutions for solar power: technologies and challenges. *International Journal of Multidisciplinary Research and Growth Evaluation*. 2021;2(1):882–890. <https://doi.org/10.54660/IJMRGE.2021.2.4.882-890>
 89. Odunaiya OG, Soyombo OT, Ogunsola OY. Sustainable energy solutions through AI and software engineering: optimizing resource management in renewable energy systems. *Journal of Advanced Education and Sciences*. 2022;2(1):26–37. <https://doi.org/10.54660/JAES.2022.2.1.26-37>
 90. Ogundare AF, Akinyemi AL, Aremu A. Impact of gamification and game-based learning on senior secondary school students' achievement in English language. *Journal of Educational Review*. 2021;13(1):110-123.
 91. Okeleke PA, Babatunde SO, Ijomah TI. The ethical implications and economic impact of marketing medical products: balancing profit and patient well-being.
 92. Olaiya SM, Akinyemi AL, Aremu A. Effect of a board game: snakes and ladders on students' achievement in civic education. *Journal of Nigeria Association for Educational Media and Technology (JEMT)*. 2017;21(2).
 93. Olanipekun KA. Assessment of factors influencing the development and sustainability of small-scale foundry enterprises in Nigeria: a case study of Lagos State. *Asian Journal of Social Sciences and Management Studies*. 2020;7(4):288-294.
 94. Olanipekun KA, Ayotola A. Introduction to marketing. GES 301, Centre for General Studies (CGS), University of Ibadan. 2019.
 95. Olanipekun KA, Ilori MO, Ibitoye SA. Effect of government policies and extent of its implementation on the foundry industry in Nigeria.
 96. Olojede FO, Akinyemi A. Stakeholders' readiness for adoption of social media platforms for teaching and learning activities in senior secondary schools in Ibadan Metropolis, Oyo State, Nigeria. *International Journal of General Studies Education*. 2022;141.
 97. Oludare JK, Adeyemi K, Otokiti B. Impact of knowledge management practices and performance of selected multinational manufacturing firms in South-Western Nigeria. *International Journal of Multidisciplinary Research and Growth Evaluation*. 2022;2(1):48.
 98. Olufemi-Phillips AQ, Ofodile OC, Toromade AS, Eyo-Udo NL, Adewale TT. Optimizing FMCG supply chain management with IoT and cloud computing integration. *International Journal of Management & Entrepreneurship Research*. 2020;6(11).
 99. Otokiti BO. A study of management practices and organisational performance of selected MNCs in emerging market - a case of Nigeria. *International Journal of Business and Management Invention*. 2017;6(6):1-7.
 100. Otokiti BO. Mode of entry of multinational corporation and their performance in the Nigeria market [Doctoral dissertation]. Covenant University; 2012.
 101. Otokiti BO. Social media and business growth of women entrepreneurs in Ilorin metropolis. *International Journal of Entrepreneurship, Business and Management*. 2017;1(2):50–65.
 102. Otokiti BO. Business regulation and control in Nigeria. *Book of Readings in Honour of Professor S. O. Otokiti*. 2018;1(2):201–215.
 103. Otokiti BO, Akorede AF. Advancing sustainability through change and innovation: a co-evolutionary perspective. *Innovation: Taking Creativity to the Market*. 2018;1(1):161–167.
 104. Otokiti BO, Onalaja AE. The role of strategic brand positioning in driving business growth and competitive advantage. *Iconic Research and Engineering Journals*. 2021;4(9):151–168.
 105. Otokiti BO, Onalaja AE. Women's leadership in marketing and media: overcoming barriers and creating lasting industry impact. *International Journal of Social Science Exceptional Research*. 2022;1(1):173–185.
 106. Otokiti BO, Igwe AN, Ewim CP, Ibeh AI, Sikhakhane-Nwokediegwu Z. A framework for developing resilient business models for Nigerian SMEs in response to economic disruptions. *International Journal of Multidisciplinary Research and Growth Evaluation*. 2022;3(1):647-659.
 107. Otokiti BO, Akinbola OA. Effects of lease options on the organizational growth of small and medium enterprise (SME's) in Lagos State, Nigeria. *Asian Journal of Business and Management Sciences*. 2013;3(4).
 108. Otokiti-Ilori BO. Business regulation and control in Nigeria. *Book of Readings in Honour of Professor S.O Otokiti*. 2018;1(1).
 109. Otokiti-Ilori BO, Akorede AF. Advancing sustainability through change and innovation: a co-evolutionary perspective. *Innovation: Taking Creativity to the Market*. 2018;1(1):161-167.
 110. Polkowski Z, Khajuria R, Rohadia S. Big data implementation in small and medium enterprises in India and Poland. *Scientific Bulletin-Economic Sciences*.

- 2017;16(3).
111. Romero J, Navarro M. Cloud-based big data analytics integration with ERP platforms. *Management Decision*. 2022;60(12):3416-3437. <https://doi.org/10.1108/MD-07-2021-0872>
112. Ruijter E, Grimmelikhuijsen S, Meijer A. Open data for democracy: developing a theoretical framework for open data use. *Government Information Quarterly*. 2017;34(1):45-52. <https://doi.org/10.1016/j.giq.2017.01.001>
113. Rupeika-Apoga R, Petrovska K. Barriers to sustainable digital transformation in micro-, small-, and medium-sized enterprises. *Sustainability*. 2022;14(20):13558. <https://doi.org/10.3390/su142013558>
114. Samuel J, Brennan-Tonetta M, Samuel Y, Subedi P, Smith J. Strategies for democratization of supercomputing: availability, accessibility and usability of high performance computing for education and practice of big data analytics. arXiv preprint arXiv:2104.09091. 2021.
115. Sidek S, Mohamad M, Nasir W. Entrepreneurial orientation, access to finance and business performance: a preliminary analysis. *International Journal of Academic Research in Business and Social Sciences*. 2016;6(11). <https://doi.org/10.6007/IJARBS/v6-i11/2452>
116. Tella A, Akinyemi AL. Entrepreneurship education and self-sustenance among National Youth Service Corps members in Ibadan, Nigeria. *Proceedings E-BOOK*. 2022;202.
117. Wamuyu P. Use of cloud computing services in micro and small enterprises: a fit perspective. *International Journal of Information Systems and Project Management*. 2022;5(2):59-81. <https://doi.org/10.12821/ijispm050204>
118. Wang Y, Blobel B, Yang B. Reinforcing health data sharing through data democratization. *Journal of Personalized Medicine*. 2022;12(9):1380. <https://doi.org/10.3390/jpm12091380>
119. Wegscheider C, Stark T. What drives citizens' evaluation of democratic performance? the interaction of citizens' democratic knowledge and institutional level of democracy. *Zeitschrift für Vergleichende Politikwissenschaft*. 2020;14(4):345-374. <https://doi.org/10.1007/s12286-020-00467-0>