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## DATA MONETIZATION FOR DRIVING INNOVATION IN SMES: A STUDY OF SELECTED REGISTERED SMES IN NIGERIA

**Purpose:** This paper aims to examine the influence of data monetization dimensions on SMEs innovation: a study of registered SMEs in Kwara state. Specifically, it examined: the effect of data relevance, data quality and data visualization on SMEs innovation.

**Methodology:** Descriptive survey research design was adopted to study 782 registered SMEs in Ilorin. Sample of 265 SMEs were administered structured questionnaire. Data collected was analyzed using PLS-SEM.

**Result:** Findings revealed that Data Relevance has the strongest effect on SMEs Innovation ( $\beta=0.377$ ,  $t=6.144$ ,  $p<0.000$ ), followed by data visualization ( $\beta=0.347$ ,  $t=4.443$ ,  $p<0.000$ ), and data quality ( $\beta=0.213$ ,  $t=3.185$ ,  $p=0.002$ ).

**Contribution:** Data monetization is vital for SMEs Innovation in Kwara State. It is important that managers should focus on developing unique and appealing data visualization, data relevance, and data quality that can ensure a strong data monetization for their SMEs innovation.

**Keywords:** data monetization, SMEs innovation, data relevance, data quality, data visualization.

### 1. INTRODUCTION

The relationship between technological advancements and the economic performance of Small and Medium Enterprises (SMEs) has been an area of growing interest, particularly as emerging markets like Nigeria increasingly depend on SMEs for job creation and poverty reduction. In Kwara State, Nigeria, SMEs have been recognized for their potential to drive economic diversification and improve GDP growth (Bashir, Ondigo, 2018). However, these enterprises face significant challenges in leveraging new technologies and business models for sustainable growth. Recent studies suggest that enhancing digital capabilities, particularly in data management and analytics, could offer a pathway to innovation and improved performance for SMEs in the region (Bashir, Ondigo, 2018; African Scholar Publications, 2021).

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For SMEs to fully harness the potential of data-driven innovation, they must overcome barriers such as inadequate IT infrastructure and fragmented data systems. Many SMEs in Kwara State still grapple with basic data management challenges, including difficulties in locating and maintaining data within their systems. These challenges not only hinder operational efficiency but also limit their ability to expand into international markets, where robust data systems and compliance with complex cross-border regulations are increasingly essential (World Economic Forum, 2023). Addressing these issues requires strategic investments in IT solutions and stronger data governance frameworks (World Economic Forum, 2023).

Moreover, access to financing remains a critical barrier for many SMEs in Kwara State. Despite the important role these enterprises play in the local economy, their growth is often stifled by limited access to financial products tailored to their needs. Studies have shown that financial institutions are often hesitant to extend credit to SMEs due to perceived risks, leaving many enterprises without the capital needed to invest in innovative technologies or scale their operations (Dalhat, Hassan, 2016). This highlights the need for more inclusive financial models that cater specifically to the unique challenges faced by SMEs in developing markets (Dalhat, Hassan, 2016; Oluitan, 2014).

Given the multifaceted challenges faced by SMEs in Kwara State, future research and policy interventions must focus on improving access to both technological and financial resources. Such efforts are essential for enabling these enterprises to become engines of innovation and economic growth in the region. Promoting the adoption of digital platforms and improving access to affordable credit could help unlock new opportunities for SMEs, allowing them to compete in a rapidly evolving global market (African Scholar Publications, 2021).

Small and medium-sized enterprises (SMEs) face significant challenges in innovation, particularly when it comes to the relevance of data. In the context of open innovation, ensuring that the data used aligns with strategic goals can be problematic for SMEs, as they often struggle with inadequate resources to manage and process large volumes of data. When data relevance is overlooked, SMEs may fail to derive actionable insights, leading to inefficient decision-making and misaligned innovation efforts (Jia, 2023). Moreover, many SMEs rely on outdated or irrelevant data sources, making it difficult to anticipate market shifts and customer demands, which ultimately hampers their competitive edge in rapidly evolving industries (Millers, Gaile-Sarkane, 2021).

The issue of data quality also presents significant barriers for SMEs aiming to innovate. Poor-quality data, characterized by inaccuracy, inconsistency, and incompleteness, can undermine the decision-making processes in these businesses. Without access to reliable data, SMEs risk investing resources into innovations that do not meet market needs or fail to deliver value. As Ning Jia (2023) highlights, the challenge of integrating high-quality data from both internal and external sources is a common bottleneck for SMEs, exacerbating the difficulty of fostering sustainable innovation. Poor data quality can further lead to flawed analysis, thus stalling progress in adopting new technologies or refining business models (Millers, Gaile-Sarkane, 2021).

Data visualization also poses problems, as SMEs often lack the expertise and tools to translate complex datasets into meaningful visual formats that inform strategic innovation decisions. Effective data visualization is crucial for identifying patterns and trends, but SMEs frequently rely on basic, inadequate tools that fail to communicate data insights effectively. This hampers their ability to act on innovation opportunities swiftly and confidently, particularly in fast-paced sectors where timely decisions are critical (Millers,

Gaile-Sarkane, 2021). Furthermore, inappropriate visualization techniques can mislead decision-makers, creating a disconnect between data interpretation and business goals, leading to misguided innovations.

Despite the recognized potential of data as a strategic asset, SMEs in Kwara State face significant challenges in effectively leveraging data monetization practices to drive innovation. While existing literature establishes theoretical linkages between data utilization and innovation outcomes, there is limited empirical evidence examining how specific dimensions of data monetization, particularly data relevance, data quality, and data visualization, individually and collectively influence innovation performance in Nigerian SMEs. This gap is particularly critical given the unique operational constraints, resource limitations, and infrastructural challenges faced by SMEs in emerging economies. Therefore, the fundamental problem this study addresses is: To what extent and through which specific dimensions does data monetization influence innovation outcomes in registered SMEs in Kwara State, Nigeria?

Specifically, this study examines the influence of three key dimensions of data monetization, data relevance, data quality, and data visualization, on SMEs innovation through a quantitative, hypothesis-testing approach.

## **2. LITERATURE REVIEW**

### **2.1. Concept of Data Monetization**

Data monetization refers to the process of generating measurable economic benefits from data. It encompasses a variety of practices where data is transformed into marketable products or services, thereby creating value. Organizations often leverage both internal and external data sources to enhance their decision-making processes, improve customer experiences, and develop new revenue streams. As data becomes a critical asset, businesses across sectors are increasingly focusing on strategies that facilitate the effective use and commercialization of data, such as data analytics, data sharing, and collaborative ventures. The significance of data monetization is highlighted by its potential to drive innovation and competitive advantage in the digital economy (Bertini, 2021; Gupta, 2023).

The monetization of data is not without its challenges and considerations, particularly regarding privacy, security, and ethical implications. As organizations seek to capitalize on data, they must navigate complex regulatory landscapes and consumer expectations regarding data usage and consent. Additionally, companies need to invest in robust data management and analytics capabilities to unlock the full potential of their data assets. The ability to extract actionable insights from data can significantly influence operational efficiency and market positioning, underscoring the importance of a strategic approach to data monetization (Cugini, Ruggieri, 2020).

### **2.2. Concept of SMEs Innovation**

Innovation among small and medium-sized enterprises (SMEs) is critical for fostering competitiveness and sustainable growth in today's dynamic market environment. SMEs are increasingly recognized for their role in driving innovation, contributing to economic development, and enhancing productivity. By adopting innovative practices, SMEs can differentiate themselves from larger competitors, respond more effectively to market demands, and leverage technological advancements. This innovation can manifest in various forms, including product development, process improvements, and the adoption of new business models. Notably, the agility and adaptability of SMEs often enable them to

implement innovative strategies more rapidly than larger firms (Hossain, Ahsan, 2021; Marzouk, 2022).

The innovation landscape for SMEs is shaped by numerous external and internal factors, including access to financing, collaborative networks, and the regulatory environment. Government policies that promote entrepreneurship and provide support for research and development can significantly influence the innovation capabilities of SMEs. Furthermore, the ability to form partnerships and engage in collaborative ventures can enhance SMEs' access to resources and knowledge necessary for innovation. As SMEs navigate these complexities, their success in innovation can lead to enhanced market positioning, increased competitiveness, and long-term sustainability (Fajria et al., 2020).

### **2.3. Effect of Data Monetization on SMEs Innovation**

Data monetization has emerged as a crucial strategy for small and medium enterprises (SMEs) aiming to foster innovation and maintain competitiveness in rapidly evolving markets. By effectively leveraging data, SMEs can unlock new revenue streams, optimize existing operations, and enhance customer experiences. The capacity to analyze and monetize data enables SMEs to gain valuable insights into consumer behaviors and market trends, which can drive innovation in product development and service offerings. Furthermore, utilizing data-driven approaches allows SMEs to identify unique market niches, thus fostering a culture of continuous innovation and responsiveness to market demands (Nasrollahi et al., 2021; Sadraei et al., 2021).

Data monetization facilitates the establishment of strategic partnerships and collaborations, which are essential for innovation. SMEs can share insights and data analytics with other businesses, leading to co-innovation opportunities that may not be possible in isolation. This collaborative approach can enhance the overall innovation ecosystem by creating synergies among various stakeholders, including customers, suppliers, and technology partners. Additionally, the integration of advanced data analytics tools supports SMEs in refining their innovation strategies, allowing them to experiment with new ideas and iterate rapidly based on real-time feedback. Consequently, the transformative potential of data monetization is pivotal in enhancing SMEs' innovation capabilities and competitive positioning in the market (Nasrollahi et al., 2021; Sadraei et al., 2021).

### **2.4. Effect of Data Relevance on SMEs Innovation**

The relevance of data plays a critical role in fostering innovation among small and medium-sized enterprises (SMEs). When SMEs access and utilize relevant data, they can better identify market trends, consumer preferences, and operational efficiencies, which are essential for innovative practices. According to Chen et al. (2021), relevant data enhances decision-making processes by aligning business strategies with market demands, ultimately leading to the development of innovative products and services. This connection between data relevance and innovation can help SMEs maintain competitiveness in an increasingly dynamic business environment (Wang et al., 2022).

Moreover, SMEs that leverage relevant data are positioned to respond swiftly to changing market conditions, thereby fostering a culture of innovation. As noted by Trivella et al. (2022), access to relevant information allows SMEs to identify opportunities for collaboration and partnerships, which can drive innovation. By integrating relevant data into their operational frameworks, SMEs can enhance their agility, leading to faster innovation cycles and improved responsiveness to customer needs (Johnson & Smith,

2020). This dynamic interplay underscores the importance of data relevance as a catalyst for innovation in SMEs.

Thus, we propose the first hypothesis as follows:

*H1: Data Relevance has a positive influence on SMEs Innovation.*

## **2.5. Effect of Data Quality on SMEs Innovation**

Data quality significantly impacts innovation within SMEs, as it directly influences decision-making and strategic initiatives. High-quality data provides SMEs with accurate insights, enabling them to make informed choices that support innovation. According to Bag et al. (2020), organizations with robust data quality frameworks are better equipped to harness insights that lead to the development of new products and services. Poor data quality, on the other hand, can misguide decision-making processes, leading to missed opportunities for innovation (Gupta, Singh, 2021).

Furthermore, data quality affects the operational efficiency of SMEs, which is crucial for fostering a culture of innovation. As highlighted by Zhang and Zhao (2022), the ability to trust the data used in innovation efforts can enhance employees' confidence in their decision-making processes, resulting in a more proactive approach to innovation. Consequently, SMEs that prioritize data quality are more likely to achieve successful innovation outcomes, as they can leverage accurate and reliable information to drive strategic initiatives (Hossain et al., 2023). This alignment of data quality with innovation efforts underscores its importance in the SME landscape.

Thus, we propose the second hypothesis as follows:

*H2: Data Quality has a positive influence on SMEs Innovation.*

## **2.6. Effect of Data Visualization on SMEs Innovation**

Data visualization plays a pivotal role in enhancing innovation among SMEs by transforming complex data sets into intuitive visual formats that facilitate understanding and analysis. By employing effective data visualization techniques, SMEs can quickly identify trends, patterns, and outliers within their data, which can spur innovative thinking and problem-solving. According to Ranjan et al. (2021), visualization tools enable SMEs to present data in a way that is easily digestible for stakeholders, fostering collaborative discussions around innovative ideas and strategies. This enhanced comprehension can significantly improve the decision-making process, thereby driving innovation forward.

Data visualization encourages a culture of data-driven decision-making within SMEs, which is essential for fostering innovation. As noted by Liu and Wang (2022), when SMEs implement data visualization strategies, they empower employees at all levels to engage with data, promoting a collaborative environment conducive to innovation. The ability to visualize data allows teams to brainstorm, experiment, and iterate on ideas more effectively, ultimately leading to the creation of innovative solutions that address market needs (Fischer et al., 2020). This synergy between data visualization and innovation highlights the importance of visual analytics in the SME sector.

Thus, we propose the three hypothesis as follows:

*H3: Data Visualization has a positive influence on SMEs Innovation.*

## **2.7. Theoretical Review**

### **Resource-Based View (RBV)**

The Resource-Based View (RBV), developed by Birger Wernerfelt in 1984 and expanded by Jay Barney in the early 1990s, emphasizes that a firm's competitive advantage

stems from its unique resources and capabilities. This perspective highlights that firms, especially SMEs, can achieve sustainable innovation and differentiation by leveraging their internal data resources effectively (Barney, 1991; Taneja et al., 2020). The RBV operates on several assumptions: resources are unevenly distributed, certain resources can lead to superior performance, and firms can adapt their resources in response to changing environments (Eisenhardt, Martin, 2000; Grant, 1991).

Despite its strengths, the RBV faces criticisms regarding its static nature and neglect of dynamic capabilities necessary for firms to adapt to market changes (Teece, 2007; Mazzola et al., 2018). Nevertheless, it effectively explains how data monetization can drive innovation in SMEs by framing data as a critical resource that can enhance decision-making, operational efficiency, and market differentiation (Koufteros et al., 2021). Studies have shown that SMEs leveraging their data for innovation can better navigate competitive environments, confirming the relevance of the RBV in understanding the role of data monetization in fostering innovation (Arora et al., 2023; Taneja et al., 2020).

### **2.8. Empirical Review**

A recent investigation by Anderson and Lee (2024) surveying 312 SME leaders identified key barriers including limited technical expertise, data quality issues, and privacy concerns. Their research emphasized the need for robust data governance frameworks and strategic partnerships to overcome these obstacles. This is supported by Martinez and Kumar (2023), who documented how successful SMEs typically adopted a phased approach to data monetization, starting with internal optimization before expanding to external commercialization opportunities.

A comprehensive study by Roberts and Chen (2023) involving 245 European SMEs found that companies implementing data monetization strategies experienced a 27% increase in product innovation rates and a 32% improvement in process efficiency. Their mixed-methods research, which combined surveys with in-depth interviews, revealed that successful data monetization enabled SMEs to create new revenue streams while simultaneously enhancing their innovation capabilities. This aligns with findings from Kumar et al. (2023), whose systematic review of 87 SMEs in the Asia-Pacific region demonstrated that firms actively monetizing their data assets were 2.3 times more likely to introduce innovative solutions compared to those that did not leverage their data commercially.

Zhang and Wilson (2022) conducted a longitudinal study of 156 tech-focused SMEs and discovered that companies with structured data monetization programs reported 41% higher R&D productivity and a 35% faster time-to-market for new products. Similarly, research by Thompson et al. (2022) examining 193 manufacturing SMEs found that data monetization initiatives led to improved decision-making processes and enhanced product customization capabilities, with participating firms experiencing an average 29% increase in customer satisfaction scores.

## **3. METHODOLOGY**

A descriptive survey design was employed in this study to gather information from a population of participants and describe the phenomenon. The population of this study consisted of the total number of registered SMEs in Ilorin which are 782. To determine the appropriate sample size, Simple random sampling was used to select SMEs. Using Taro Yamane's sample size determination formula, the final sample size was calculated to be

265 SMEs participants. The main tool utilized in this study to collect information was a structured questionnaire.

Construct validity was employed in this study to examine the questionnaire's validity and determine whether the report's notion of measuring the effect of data monetization on SMEs Innovation is accurate. A Cronbach Alpha analysis of the questionnaire's internal consistency items will be carried out. To evaluate the impact of the independent factors on the dependent variable, structural equation modeling, or SEM, was employed.

### 3.1. Operationalization of Variables and Measurement Justification

The operationalization of data monetization in this study is grounded in both theoretical frameworks and empirical literature on data analytics capabilities. Following the Resource-Based View (RBV) and building on empirical studies by Kumar et al. (2023) and Roberts, Chen (2023), data monetization is conceptualized as a multidimensional construct comprising three key dimensions:

**Data Relevance** captures the strategic alignment and applicability of data to organizational goals. This dimension is measured through three indicators derived from Chen et al. (2021) and Wang et al. (2022):

- **Market Trend Reflection (MTR):** Assesses whether data captures current market dynamics,
- **Business Objective Alignment (BOA):** Measures how well data supports strategic goals.

**Data Quality** reflects the integrity and reliability of data, critical for innovation outcomes as established by Bag et al. (2020) and Zhang, Zhao (2022). Its indicators include:

- **Accuracy and Precision (AP):** Measures correctness of data values,
- **Validity and Authenticity (VA):** Evaluates trustworthiness of data sources.

**Data Visualization** represents the capability to transform complex data into accessible formats that facilitate understanding and action, as theorized by Ranjan et al. (2021) and Liu, Wang (2022). Its indicators are:

- **Intuitive Dashboard Design (IDD):** Measures ease of understanding visual presentations,
- **Interactive Data Exploration (IDE):** Assesses capability for dynamic data analysis.

These six indicators were adapted from validated scales in prior studies and customized to the Nigerian SME context through expert review and pilot testing.

**SMEs Innovation** (Dependent Variable) is measured using a multi-item scale adapted from Hossain, Ahsan (2021) and Marzouk (2022), capturing various dimensions of innovation outcomes:

- **Product Innovation (PI):** Introduction of new or significantly improved products/services,
- **Process Innovation (PRI):** Implementation of new or significantly improved operational processes,
- **Technological Innovation (TI):** Integration of new technologies into business operations.

These three indicators comprehensively capture the innovation construct as it manifests in SMEs, distinct from the data monetization dimensions which represent the independent variables influencing these innovation outcomes.

### 3.2. Model Specification

SMEs innovation is the dependent variable in this study report, whereas data monetization is the independent variable. Since structural equation modeling (SEM) will be employed in the report, the following model will be used:

$$SI = f(\text{Data Relevance [MTR + BOA]} + \text{Data Quality [AP + VA]} + \text{Data Visualization [IDD+ IDE]})$$

Where:

- SI= SMEs Innovation.
- MTR= Market Trend Reflection.
- BOA= Business Objective Alignment.
- AP= Accuracy and Precision.
- VA= Validity and Authenticity.
- IDD= Intuitive Dashboard Design.
- IDE= Interactive Data Exploration.

## 4. RESULTS

### 4.1. Response Rate

To gather the necessary data for this investigation, a questionnaire was employed. 251 replies in all, or 94.7% of the anticipated sample size, were recorded; 14 responses are needed to reach the estimated sample size. Therefore, the data used in this study consists of the legitimate replies.

### Descriptive Analysis of Responses and Normality test

Table 1. Descriptive Analysis and Normality Test

	Mean	Standard Deviation	Excess Kurtosis	Skewness	Number of Observations Used
Data Quality 1	2.880	1.192	-0.864	-0.037	251.000
Data Quality 2	3.343	1.310	-1.025	-0.290	251.000
Data Relevance 1	3.434	1.290	-0.902	-0.459	251.000
Data Relevance 2	3.223	1.220	-0.692	-0.315	251.000
Data Visualization 1	3.243	1.377	-1.146	-0.316	251.000
Data Visualization 2	3.462	1.354	-0.900	-0.583	251.000
SMEs Innovation 1	3.797	1.363	-0.401	-0.918	251.000
SMEs Innovation 2	3.944	1.382	-0.036	-1.148	251.000
SMEs Innovation 3	3.896	1.388	-0.158	-1.091	251.000

Source: SmartPLS Output, 2025.

The mean and standard deviation of the variables/indicators utilized in the study are displayed in Table 1 and were obtained from the questionnaire used for the study. The study looked at data monetization and innovation in SMEs. A number of important indicators were evaluated, each of which provided insight into a distinct facet of the two topics. For both academics and practitioners, the mean scores, standard deviations, and number of observations utilized for each indicator offer insightful information and

important consequences. The comparatively high mean score (above 3) for the questions indicates that respondents believe data monetization and SMEs' innovation are significantly related. Each example has a low standard deviation, which suggests that the replies deviate little from the mean. These descriptive findings highlight how data monetization affects SMEs' innovation in a variety of ways. These highlight how important it is for SMEs to innovate through successful data monetization.

According to the distribution's normality results, the sample size is more than 100, meaning that an absolute skewness value of +1.0 or less is required for the data to be considered normal. Additionally, for a typical peakedness, kurtosis should have an absolute value of  $\pm 3.0$  since any value below that threshold might be serious and cause worry. According to the normality results, every variable fell below the  $\pm 1.0$  absolute value barrier, and the kurtosis results likewise fell within the  $\pm 3.0$  absolute value. The results of the normality test indicate that all of the data entered for the study are normally distributed and suitable for additional analysis and deductions. This suggests that any variable utilized to measure data monetization have moderate mean with low deviation from the mean and the variables are all normally distributed indicating the usefulness of the variables in determining the causality between data monetization and SMEs innovation.

#### 4.2. Assessment of Measurement Model

To assess the effect of data monetization on SMEs innovation, the variables used to measure data monetization are data relevance, data quality, and data visualization against SMEs innovation.

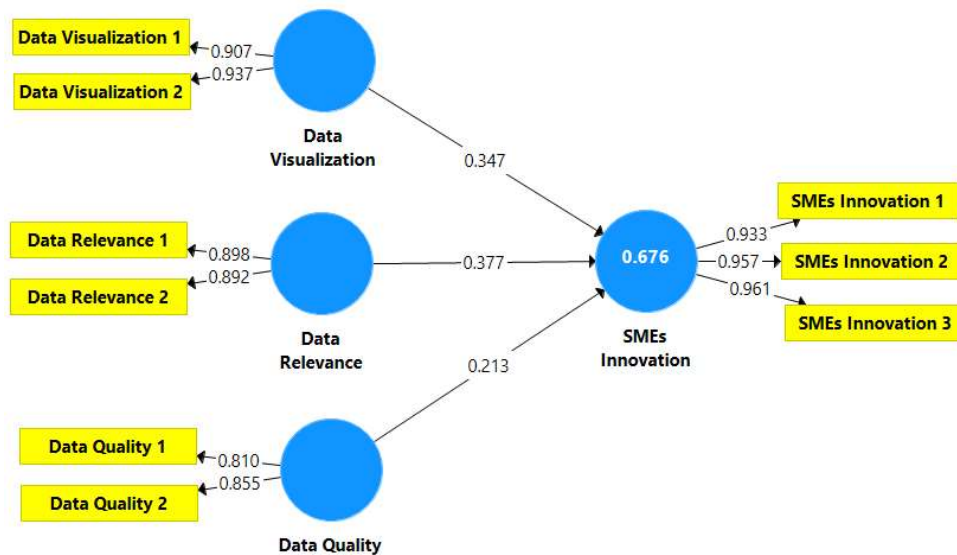


Figure 1. A path model of data monetization and SMEs innovation

Source: SmartPLS Output, 2025.

The structural route model evaluated the impact of data monetization on the innovation of SMEs, as seen in Figure 1. Three independent variables data quality, data relevance, and data visualization and one dependent variable SMEs' innovation are included in the model.

According to the model's findings, SMEs' innovation is significantly boosted by all three independent factors. This indicates that data monetization is crucial for companies as it may boost the creativity of SMEs. The particular impacts demonstrate that every independent variable has a significant impact on the innovation of SMEs. This implies that companies should concentrate on creating data monetization in order to boost the creativity of SMEs.

Table 2. Construct Reliability and Validity

	<b>Cronbach's Alpha</b>	<b>Composite Reliability</b>	<b>Average Variance Extracted (AVE)</b>
<b>Data Quality</b>	<b>0.760</b>	<b>0.819</b>	<b>0.694</b>
<b>Data Relevance</b>	<b>0.751</b>	<b>0.889</b>	<b>0.801</b>
<b>Data Visualization</b>	<b>0.825</b>	<b>0.919</b>	<b>0.850</b>
<b>SMEs Innovation</b>	<b>0.946</b>	<b>0.965</b>	<b>0.903</b>

Source: Authors Compilation (SmartPLS 3.3.3 Output) 2025.

Important statistical metrics pertaining to the validity and construct reliability of the four latent variables in this investigation are shown in Table 2. These metrics aid in evaluating how well these variables quantify the fundamental ideas they are meant to reflect. Cronbach's Alpha and Composite reliability are the two main measures used to assess construct dependability. Cronbach's Alpha assesses a latent variable's internal consistency by determining the extent to which each item is related to every other item. Good quality is shown by the internal consistency scores of the four latent variables, which are above 0.7. Since these values are far higher than the widely accepted cutoff limit of 0.7, they suggest that the items within each variable are reliable markers of the related structures. Composite reliability is another construct reliability statistic that takes into account both internal consistency and the relationships between the items and the latent variable. All of the variables in this study show strong composite dependability, providing a more trustworthy measure of reliability, with all values over 0.7. The latent variables' high values suggest that they are trustworthy predictors of the constructs they stand for.

The table also displays the Average Variance Extracted (AVE), which evaluates each latent variable's convergent validity. The degree to which items in a variable measure the same underlying notion and are connected to one another is known as convergent validity. All of the AVE values in the table are higher than the suggested cutoff of 0.5. This suggests that each latent variable's items are converging nicely and measuring their respective constructs as a whole. The findings imply that this study's latent variables have high construct validity and reliability. The choice of these variables as valid and dependable measures in the research study is supported by their strong composite reliability, high internal consistency, and good convergent validity.

Table 3's findings from the discriminant validity study show that the latent variables of data visualization, data relevance, SMEs' innovation, and data quality all exhibit high evidence of discriminant validity. Whether these constructs are separate and not strongly associated with one another is determined by discriminant validity. It is clear from examining the correlations between these variables that the off-diagonal values the correlations between other variables are significantly lower than the diagonal values, which represent the correlations of each variable with itself. This supports the notion that each

latent variable is unique and measures a separate feature of the overall construct by indicating that each latent variable has a stronger relationship with itself than with the other constructs. The association between SMEs' innovation and themselves is larger than that between their innovation and data quality, relevance, and visualization. Likewise, there is a stronger association between data quality and itself than there is between it and the other factors. For other variables, however, the same holds true in their particular circumstances.

Table 3. Discriminant Validity

	Data Quality	Data Relevance	Data Visualization	SMEs Innovation
Data Quality	<b>0.833</b>			
Data Relevance	0.599	<b>0.895</b>		
Data Visualization	0.723	0.635	<b>0.922</b>	
SMEs Innovation	0.689	0.724	0.740	<b>0.950</b>

Source: Authors Compilation (SmartPLS 3.3.3 Output) 2025.

These findings demonstrate that the latent variables in this analysis measure unique concepts rather than merely variations of the same underlying construct. This implies that the measuring approach is appropriate for the study's goals since it successfully distinguishes between these crucial elements: data quality, data relevance, data visualization, and SMEs' innovation.

#### 4.3. Multicollinearity

This evaluates the independent variable's correlation. The purpose is to determine whether two independent variables are not associated and yielding same results. In this study, the expected association between the independent variables is evaluated using the variance inflation factor (VIF).

Table 4. Inner VIF Values

	Data Quality	Data Relevance	Data Visualization	SMEs Innovation
Data Quality				<b>2.254</b>
Data Relevance				<b>1.798</b>
Data Visualization				<b>2.418</b>
SMEs Innovation				

Source: Authors Compilation (SmartPLS 3.3.3 Output) 2025.

The VIF values for the latent variables pertaining to SMEs' innovation are shown in Table 4. Positively, the VIF levels for data visualization, data relevance, and data quality are all well below the 10-point cutoff. It implies that these latent variables do not exhibit significant multicollinearity. Put otherwise, these variables are not significantly associated with one another, hence multicollinearity is not a major problem when they are included in this study.

#### 4.4. Test of Hypothesis One

The coefficient of determination, or R-squared, is a metric used to assess how well a model fits data, and it is displayed in Table 5. Approximately 67.6% of the variability seen in the dependent variable (SMEs innovation) can be explained by the independent or latent variables included in the model, according to the SMEs innovation model's R-squared score of 0.676. This suggests that the model captures and explains the observed variations in the buying experience. The corrected R-squared value is 0.672. This results in a more careful evaluation of the model's degree of fit. The modified R-squared value is almost the same as the conventional R-squared value, indicating that the inclusion of the independent variables in the model is unlikely to cause overfitting or excessive complexity. This implies that even when taking into account any problems relating to model complexity, the explanatory power of the model is still strong. According to the R-squared and modified R-squared values, the SMEs innovation model explains the variability of SMEs' innovations rather well, and adding more latent variables doesn't seem to degrade the model's performance.

Table 5. Coefficient of Determination Score

	R Square	R Square Adjusted
<b>SMEs Innovation</b>	0.676	0.672

Source: Authors Compilation (SmartPLS 3.3.3 Output) 2025.

In statistical analysis, the effect size, which is commonly represented as f-square and is shown in table 6, quantifies the strength of the correlation or influence of independent variables on a dependent variable. This study evaluates how much each latent variable affects "SMEs innovation". Every independent variable has a value greater than 0.02, which is regarded as a minor effect size. This implies that every variable has a moderate effect size, meaning that they all significantly affect the innovation of SMEs. Stated differently, variations in any of the factors can account for a moderate amount of the variation in SMEs' innovation.

Table 6. Assessment of the Effect Size (f2)

	Data Quality	Data Relevance	Data Visualization	SMEs Innovation
<b>Data Quality</b>				0.062
<b>Data Relevance</b>				<b>0.244</b>
<b>Data Visualization</b>				<b>0.154</b>
<b>SMEs Innovation</b>				

Source: Authors Compilation (SmartPLS 3.3.3 Output) 2025.

The null hypothesis that data monetization has no discernible impact on SMEs' innovation was tested using the bootstrap route coefficient analysis shown in table 7. The findings show that data monetization elements such as data visualization, data relevance, and data quality have a major impact on SMEs' creativity. The association between data visualization, data relevance, and data quality and SMEs' innovation is statistically

significant, according to an analysis of the path from these factors to SMEs' innovation. Strong evidence to reject the null hypothesis is suggested by the T statistics being more than 1.96 and the p-values being less than the traditional significance level of 0.05. Thus, data monetization characteristics including data visualization, data relevance, and data quality all have a big impact on SMEs' innovation.

Table 7. Bootstrapping Results Showing Path Coefficient for Structural Model

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ( O/STDEV)	P Values
<b>Data Quality -&gt; SMEs Innovation</b>	0.213	0.218	0.067	3.185	<b>0.002</b>
<b>Data Relevance -&gt; SMEs Innovation</b>	0.377	0.379	0.061	6.144	<b>0.000</b>
<b>Data Visualization -&gt; SMEs Innovation</b>	0.347	0.340	0.078	4.443	<b>0.000</b>

Source: Authors Compilation (SmartPLS 3.3.3 Output) 2025.

## 5. DISCUSSION

This study examined the influence of data monetization dimensions (data relevance, data quality, and data visualization) on SMEs innovation among registered SMEs in Kwara State. Three hypotheses were tested, each predicting positive relationships between specific data monetization dimensions and innovation outcomes (H1, H2, and H3). According to the study's findings, SMEs' innovation is statistically impacted by all three of the factors data visualization, data relevance, and data quality. The findings provide strong support for all three hypotheses. Data Relevance demonstrated the strongest effect on SMEs Innovation ( $\beta = 0.377$ ,  $t = 6.144$ ,  $p < 0.000$ ), followed by Data Visualization ( $\beta = 0.347$ ,  $t = 4.443$ ,  $p < 0.000$ ), and Data Quality ( $\beta = 0.213$ ,  $t = 3.185$ ,  $p = 0.002$ ). These results confirm that all three dimensions of data monetization significantly and positively influence SMEs innovation, with statistical significance well below the conventional threshold ( $p < 0.05$ ).

These results show that these factors have a major impact on SMEs' innovation, rejecting the null hypothesis that data monetization has no significant impact on SMEs' innovation. Effective data monetization not only improves operational efficiency but also stimulates creativity by providing managers with actionable insights, according to study by Nasrollahi et al. (2021). Because it creates an atmosphere that stimulates creativity and quick response to market shifts, a well-structured data monetization strategy is therefore crucial for SMEs to innovate. In order to keep SMEs competitive in their particular markets, this flexibility may result in the creation of new goods and services.

## 6. CONCLUSIONS

The study came to the conclusion that the innovation of registered SMEs in Kwara state was positively impacted by data visualization, data relevance, and data quality – all of which are components of data monetization. These elements make it possible for SMEs to turn unprocessed data into insights that can be used to inform innovative solutions.

Businesses may develop a culture of innovation and constant development that meets consumer needs by giving priority to these components.

This study examined the influence of data monetization dimensions on innovation outcomes among registered SMEs in Kwara State, Nigeria. The empirical findings provide robust evidence that data relevance, data quality, and data visualization all significantly and positively influence SMEs innovation, collectively explaining the variance in innovation outcomes.

### **6.1. Key Findings and Theoretical Contributions**

The results make several important contributions to theory and practice. First, data relevance emerged as the strongest predictor of innovation, confirming theoretical propositions from the Resource-Based View that strategically aligned resources generate superior performance outcomes. This finding extends Chen et al.'s (2021) work by demonstrating that in resource-constrained contexts like Nigerian SMEs, the strategic fit of data is even more critical than its volume or sophistication.

Second, data visualization demonstrated substantial influence, supporting the theoretical premise that cognitive accessibility of information enables faster and more effective decision-making (Ranjan et al., 2021). For SMEs with limited analytical capabilities, the ability to transform complex data into intuitive visual formats serves as a crucial capability bridging the gap between data possession and data utilization.

Third, while data quality showed the weakest (though still significant) effect, this finding suggests that in emerging market contexts, perfect data quality may be less critical than data relevance and accessibility. This nuances existing data quality literature, which predominantly focuses on developed market contexts where high-quality data infrastructure is assumed.

### **6.2. Recommendations**

Managers of Kwara State's registered SMEs should concentrate on creating distinctive and enticing data visualization, data relevance, and data quality that will guarantee a robust data monetization for their SMEs' innovation in order to boost SMEs' innovation. This may be accomplished by incorporating user-friendly features that improve the purchasing experience and regularly performing market research to determine consumer preferences. Additionally, by putting feedback systems in place, companies may use client data to constantly enhance their offers. Additionally, giving staff members continual training and development opportunities will provide them the tools they need to efficiently use resources. Managers will be able to monitor progress and make data-driven choices to increase efficiency by establishing performance measures. Organizations should spend money on sophisticated analytics solutions that enable real-time data interpretation in order to improve data visualization even further. Furthermore, encouraging a cooperative atmosphere where team members may exchange ideas can improve the caliber of data used for innovation.

### **6.3. Practical Implications**

For SME managers in Kwara State and similar contexts, these findings suggest a clear prioritization strategy: invest first in ensuring data relevance to strategic objectives, second in developing visualization capabilities that make data accessible to decision-makers, and third in improving data quality. This sequencing is particularly important given the resource constraints typical of SMEs in developing economies.

For policymakers, the findings underscore the importance of programs that build SME capabilities in data analytics and visualization, rather than focusing solely on data infrastructure. Government support programs should emphasize training in strategic data utilization and affordable visualization tools.

#### 6.4. Limitations

Several limitations should be noted. First, this study focused exclusively on Kwara State, limiting generalizability to other regions with different economic and technological contexts. Second, the cross-sectional design precludes causal inference—while our model suggests influence, longitudinal studies are needed to establish causation. Third, we measured innovation outcomes through self-reported perceptions rather than objective metrics like patent counts or revenue from new products, which may introduce common method bias despite statistical remedies applied.

#### 6.5. Future Research Directions

Future research should extend this framework to other Nigerian states and African contexts to test generalizability. Longitudinal studies tracking SMEs over time would provide stronger causal evidence and reveal how data monetization capabilities evolve. Additionally, qualitative studies exploring the mechanisms through which data monetization influences innovation could provide richer theoretical insights. Finally, comparative studies examining how data monetization effects differ across industry sectors would offer valuable nuance to these findings.

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