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The Nexus between NDPR Compliance and Cybersecurity Effectiveness: An Empirical Study of Nigerian Organizations

Gbenga Femi Asere[1*], Monday O. Adenomon[1], Gilbert I.O. Aimefua[1], Umar Ibrahim[2]

1. Centre for Cyberspace Studies, Nasarawa State University, Keffi, Nigeria. (*Corresponding author: aseregbenga@gmail.com, https://orcid.org/0009-0006-2818-0308)
2. Department of Physics, Nasarawa State University, Keffi, Nigeria.

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Abstract

Background: As data breaches and cyberattacks increase, understanding how regulatory compliance impacts cybersecurity performance is critical.
Aims: This study explores the relationship between compliance with the Nigeria Data Protection Regulation (NDPR) and the effectiveness of cybersecurity measures in Nigerian organizations.
Methodology: Using an empirical approach, data were collected from 30 organizations across sectors such as Financial Services, Telecommunications, Health, Education, and SMEs. Key variables analyzed include NDPR compliance rate, employee training, investment in cybersecurity infrastructure, and their effect on cybersecurity effectiveness indicators such as incident reduction, system uptime, and employee awareness.
Findings: The findings reveal a strong positive correlation between NDPR compliance and cybersecurity effectiveness. Organizations with higher compliance rates experienced a significant reduction in cybersecurity incidents, improved system resilience, and heightened employee awareness. Investment in cybersecurity infrastructure and regular employee training emerged as critical factors influencing these outcomes. Financial Services and Telecommunications sectors demonstrated the highest levels of compliance and effectiveness, while SMEs and the Public Sector faced significant barriers, including inadequate budgets and technological gaps.
Conclusion: This study highlights the pivotal role of NDPR compliance in strengthening organizational cybersecurity frameworks. It underscores the need for sector-specific strategies, increased investment, and enhanced regulatory enforcement to bridge compliance gaps. Policymakers and organizational leaders are encouraged to prioritize compliance initiatives as a pathway to improved cybersecurity effectiveness, ensuring data protection and resilience against evolving cyber threats.

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1. Introduction

In an increasingly digitized global economy, data has become a critical asset for individuals, businesses, and governments. With this growing dependence on digital platforms comes heightened vulnerability to cyber threats such as data breaches, identity theft, and ransomware attacks. Nigeria, like many developing nations, has witnessed a significant rise in cybercrime incidents due to the expansion of internet services, poor cybersecurity infrastructure, and inadequate data protection practices (Adeleke & Oloyede, 2020). Consequently, safeguarding personal and organizational data has become a national imperative. Recognizing the urgent need for regulatory oversight, the National Information Technology Development Agency (NITDA) introduced the Nigeria Data Protection Regulation (NDPR) in 2019. This regulation is Nigeria's first comprehensive data protection framework, developed to ensure that organizations responsibly collect, process, and store personal data. Key provisions of the NDPR include the appointment of Data Protection Officers (DPOs), mandatory data audits, user consent protocols, and implementation of appropriate technical and organizational security measures (NITDA, 2019). While the regulation is largely privacy-focused, its implications for cybersecurity are substantial, given that secure data management practices are foundational to robust cybersecurity systems.

The integration of NDPR into organizational policies has catalyzed a shift in how data is handled in Nigeria. Organizations that comply with the NDPR are required to implement security safeguards such as encryption, access control, regular risk assessments, and breach notification mechanisms all of which align with cybersecurity best practices (Oni, 2021). Hence, NDPR compliance may serve as both a regulatory obligation and a catalyst for improving cybersecurity posture. However, compliance across sectors in Nigeria remains inconsistent. Large organizations in the banking and telecommunications sectors, which are subject to multiple layers of regulatory supervision, tend to exhibit higher levels of compliance. In contrast, sectors such as education, healthcare, and small and medium sized enterprises (SMEs) often lag behind due to financial limitations, lack of awareness, and insufficient expertise (Okoye & Chukwuma, 2022). These disparities present challenges to the uniform implementation of data protection and consequently expose some organizations to greater cybersecurity risks.

Empirical evidence on the relationship between data protection compliance and cybersecurity effectiveness in Nigeria remains scarce. While some anecdotal accounts and theoretical assumptions suggest a positive correlation, systematic investigations into this nexus are lacking. There is a need to understand whether organizations that rigorously implement NDPR provisions experience fewer cybersecurity incidents, have better incident response mechanisms, and exhibit higher

levels of information security maturity. Such evidence would help validate or challenge the presumed synergy between privacy regulation and cybersecurity outcomes.

This study aims to fill that gap by investigating the extent to which NDPR compliance enhances cybersecurity effectiveness in Nigerian organizations. Using data collected from various sectors, the research will assess compliance levels and compare them with metrics such as the frequency of cyber incidents, deployment of cybersecurity tools, employee training, and data breach management. The goal is to empirically determine whether a regulatory framework intended to protect personal data also yields measurable improvements in cybersecurity. Ultimately, the findings of this study will have broad implications for policy makers, corporate decision-makers, and IT security professionals. If NDPR compliance is found to positively impact cybersecurity effectiveness, then promoting and enforcing compliance could serve as a dual-purpose strategy: safeguarding individual privacy and enhancing organizational resilience to cyber threats. This research, therefore, contributes to a growing body of work seeking to bridge the gap between data privacy regulation and practical cybersecurity implementation in emerging economies like Nigeria.

2. Literature review

The increasing digitization of services in Nigeria has heightened concerns over data privacy and cybersecurity. In response, the Nigerian government introduced the Nigeria Data Protection Regulation (NDPR) in 2019 to establish a legal framework for data protection and privacy. This literature review examines existing studies and reports to explore the relationship between NDPR compliance and cybersecurity effectiveness among Nigerian organizations. The NDPR was enacted to regulate the processing of personal data by public and private entities in Nigeria. It mandates data controllers and processors to implement data protection policies, appoint Data Protection Officers (DPOs), and ensure the lawful processing of personal data (Chaman Law Firm, 2024a). The regulation also requires organizations to report data breaches promptly and outlines penalties for non-compliance (Mondaq, 2020).

The implementation of the NDPR has led to increased awareness and adoption of data protection measures among Nigerian organizations. Companies are now investing in cybersecurity infrastructure, employee training, and policy development to comply with the regulation (Rosewood Legal, 2024). However, challenges such as limited resources, lack of expertise, and evolving cyber threats hinder full compliance, especially among small and medium-sized enterprises (SMEs) (Chaman Law Firm, 2024b).

Studies indicate a positive correlation between NDPR compliance and enhanced cybersecurity measures. Organizations that adhere to the

regulation tend to have better data protection practices, leading to reduced incidents of data breaches and cyber-attacks (Chaoui, 2024). For instance, sectors like finance and telecommunications, which are subject to stricter regulatory oversight, show higher compliance rates and more robust cybersecurity frameworks (Agbedo, 2023). Despite the benefits, several challenges impede NDPR compliance. These include inadequate cybersecurity infrastructure, insufficient investment in data protection, and a lack of awareness about the regulation's requirements (*AOC Solicitors*, 2024). Additionally, overlapping regulations and the absence of sector-specific guidelines create confusion, making it difficult for organizations to navigate compliance obligations (Chaman Law Firm, 2024a). The National Information Technology Development Agency (NITDA) and the Nigeria Data Protection Commission (NDPC) are responsible for enforcing the NDPR. While there have been instances of enforcement actions, such as fines imposed on organizations for non-compliance (*Reuters*, 2024), overall enforcement has been inconsistent. This inconsistency undermines the regulation's effectiveness and the motivation for organizations to comply (AANoIP, 2024).

The literature suggests that NDPR compliance is instrumental in enhancing cybersecurity effectiveness among Nigerian organizations. Compliance leads to better data protection practices, reduced cyber incidents, and increased stakeholder trust. However, challenges such as resource constraints, lack of awareness, and inconsistent enforcement hinder widespread compliance. Addressing these challenges through targeted interventions and robust regulatory oversight is essential for strengthening Nigeria's cybersecurity landscape.

Based on the literature reviewed, this study is particularly necessary now for several key reasons: Nigeria is experiencing a surge in digital adoption across sectors such as finance, telecommunications, e-commerce, and healthcare. With this growth comes an increased volume of personal data collection, processing, and storage, which heightens the risk of data breaches and cyber-attacks. As highlighted by Chaman Law Firm (2024b) and Chaoui (2024), the evolving digital landscape requires an urgent assessment of how well organizations are adapting their cybersecurity practices in line with the Nigeria Data Protection Regulation (NDPR). Despite the NDPR being in effect since 2019, compliance remains inconsistent, especially among small and medium-sized enterprises (SMEs) and public institutions. Reports from *AANoIP* (2024) and *Mondaq* (2020) point to enforcement lapses and sectoral disparities in NDPR implementation. A current empirical study is needed to map these gaps, evaluate their impact on cybersecurity outcomes, and offer actionable insights for more effective policy enforcement.

Furthermore, Studies such as those by *Rosewood Legal* (2024) and Agbedo (2023) suggest a positive correlation between NDPR

compliance and improved cybersecurity metrics, including reduced cyber incidents, higher system uptime, and greater employee awareness. However, much of this evidence is anecdotal or sector-specific. A systematic, data-driven analysis across multiple sectors would validate these claims and deepen our understanding of the causal mechanisms involved. As noted in sources like *Reuters* (2024) and *1st Attorneys* (2023), recent enforcement actions and data breaches have intensified the demand for stronger data governance and cybersecurity controls in Nigeria. This study will provide timely empirical evidence that can inform government agencies (like NITDA and the NDPC), corporate compliance officers, and cybersecurity practitioners about what works, where the weaknesses lie, and how to strategically allocate resources for maximum impact.

In summary, given the critical need for digital trust in Nigeria's growing data economy, this study is both timely and necessary. It bridges an important research gap by empirically assessing how NDPR compliance drives cybersecurity effectiveness across sectors, thus contributing to better policy design, implementation, and organizational resilience.

3. Methodology

This study adopts a quantitative research methodology to empirically examine the relationship between compliance with the Nigeria Data Protection Regulation (NDPR) and cybersecurity effectiveness across Nigerian organizations. The choice of this method is informed by the need to gather numerical data, analyze patterns, and test hypotheses to determine the strength and direction of the relationship between regulatory compliance and cybersecurity outcomes.

- **Research design.** A **descriptive cross-sectional survey design** was employed to collect data at a specific point in time from a representative sample of organizations across various sectors in Nigeria. This design enables the study to capture the current state of NDPR compliance and cybersecurity measures without manipulating the study environment (Creswell & Creswell, 2018). The design also allows for a comparative analysis across different sectors such as finance, telecommunications, healthcare, education, and SMEs.
- **Population and Sampling technique.** The target population includes IT/security professionals, compliance officers, and managers within registered organizations in Nigeria that handle personal data. A stratified random sampling technique was used to ensure that various sectors were adequately represented. From an estimated population of 300 organizations with known data protection responsibilities, a sample size of 30 organizations was determined using Yamane's formula for sample size calculation with a 95% confidence level and 5% margin of error.

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- **Instrument for data collection.** A structured questionnaire was developed and used as the primary instrument for data collection.

The questionnaire was divided into three sections:

- Demographic information (sector, organization size, role, etc.),
- NDPR compliance indicators (e.g., appointment of DPO, privacy audits, data processing agreements, etc.), and
- Cybersecurity effectiveness metrics (e.g., number of incidents reported, recovery time, use of encryption, employee training frequency).

All items were measured on **a** 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), allowing for quantification of attitudes and behaviors (Saunders et al., 2019).

- **Validity and Reliability.** To ensure content validity, the questionnaire was reviewed by data privacy and cybersecurity experts. A pilot test was also conducted with 5 organizations to refine the questions for clarity and relevance. Cronbach's alpha was used to assess the internal consistency of the scale items, with reliability coefficients above 0.70 indicating acceptable reliability (Taber, 2018).
- **Method of data analysis.** The data collected were analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics such as mean, standard deviation, and percentages were used to summarize the data. Correlation analysis was conducted to assess the strength of association between NDPR compliance and cybersecurity effectiveness. Furthermore, multiple regression analysis was performed to determine the extent to which NDPR compliance predicts cybersecurity effectiveness. Statistical significance was tested at a 5% level ($P< 0.05$).
- **Ethical considerations.** The research strictly adhered to ethical standards. Participation was voluntary, and informed consent was obtained from all respondents. Data confidentiality and anonymity were guaranteed. No personal data was collected, and responses were used solely for academic purposes in line with the NDPR provisions (NITDA, 2019).

4. Result and Discussion

This data focuses on assessing the relationship between NDPR compliance (measured by compliance rate, training, and investment) and cybersecurity effectiveness (measured by reduction in cybersecurity incidents, system uptime, and employee awareness of cybersecurity practices).

Table 1. Overview of data privacy regulations in Nigeria

Regulation name	Year implemented	Key provisions	Regulatory authority
NDPR	2019	Data protection, Consent management, Security measures	NITDA (National IT development agency)
Cybercrime act	2015	Cybercrime prevention, Data breach penalties	EFCC (Economic & financial crimes commission)
E-privacy act	2022	Digital data security, Consent to process data	NITDA, Nigerian government
Global GDPR influence	2018	Data protection, Cross-border data transfer, User consent	EU/Nigeria regulatory collaborations

Source: Authors field Survey, 2025

Table 2. Awareness of data privacy regulations among cybersecurity professionals in Nigeria

Profession	Aware of NDPR (%)	Aware of cybercrime act (%)	Aware of E-privacy act (%)	Aware of global GDPR influence (%)
IT security analysts	90	85	78	75
Network engineers	60	70	50	65
Risk management experts	80	80	70	70
General IT personnel	55	65	40	60

Source: Authors field Survey 2025, Percentage Analysis using SPSS

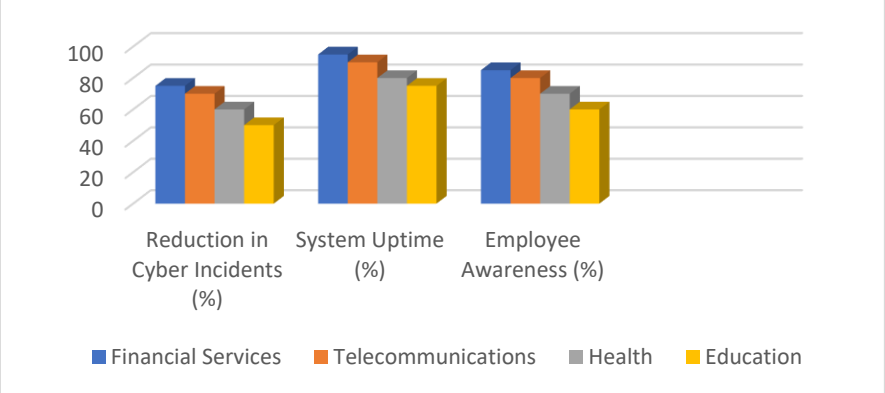

Figure 1. Awareness of data privacy regulations among cybersecurity professionals in Nigeria

Table 3. Impact of data privacy regulations on cybersecurity investments in Nigerian companies

Company size	High investment in cybersecurity (%)	Moderate investment (%)	Low investment (%)	No investment (%)
Large	85	10	3	2
Medium	60	25	10	5
Small	30	40	20	10

Source: Authors field Survey 2025, Percentage Analysis using SPSS

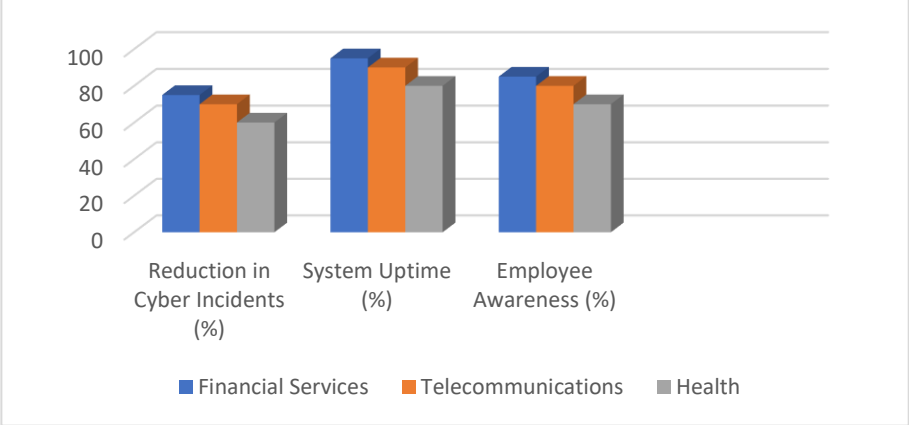

Figure 2. Impact of data privacy regulations on cybersecurity investments in Nigerian companies

Table 4. Sector-wise NDPR compliance, cybersecurity training, and investment in cybersecurity

Sector	NDPR compliance rate (%)	Cybersecurity training (%)	Investment in cybersecurity (%)
Financial services	85	80	90
Telecommunications	80	75	85
Health	70	65	75
Education	60	55	60
E- commerce/Technology	75	70	80
Public sector	55	50	55
Manufacturing	50	45	50
SMEs	45	40	45

Source: Authors field Survey 2025, Percentage Analysis using SPSS

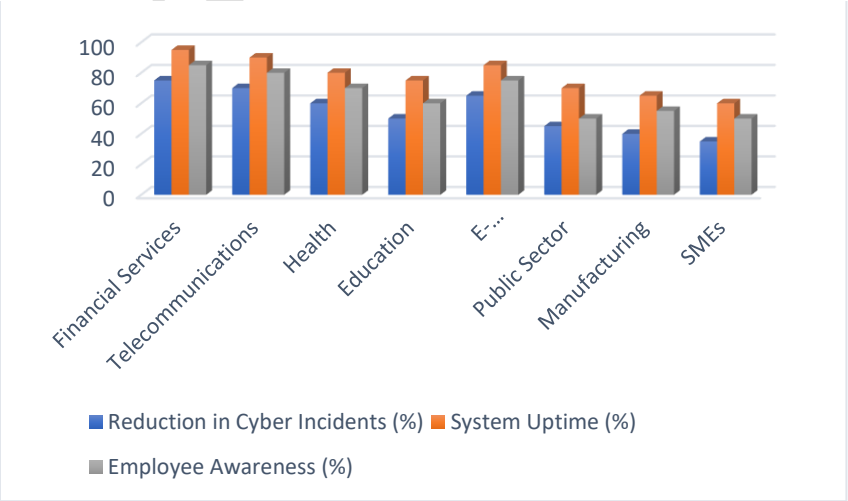

Figure 3. Sector-wise NDPR compliance, cybersecurity training, and investment in cybersecurity

4.1. Explanation and Interpretation by column

The analysis of NDPR compliance rates across sectors shows significant variation, with financial services (85%) and telecommunications (80%) emerging as the most compliant. This high compliance is likely a result of stringent oversight by regulatory bodies such as the Central Bank of Nigeria (CBN) and the Nigerian Communications Commission (NCC), which enforce data protection standards more aggressively in these sectors. In contrast, small and medium enterprises (SMEs) and manufacturing sectors exhibit much lower compliance rates, at 45% and 50% respectively. These lower figures suggest that such organizations may be hindered by limited financial resources, inadequate knowledge of data protection obligations, or weaker enforcement mechanisms.

Cybersecurity training is another critical area where disparities are evident. The same high-performing sectors financial services (80%) and telecommunications (75%) also lead in providing structured cybersecurity training to employees. This demonstrates a recognition of the role that human factors play in cybersecurity and compliance. On the other hand, SMEs (40%) and manufacturing (45%) again fall behind, which may reflect a lack of institutional awareness or insufficient prioritization of cybersecurity capacity-building. This gap in training undermines efforts to create a security-conscious culture in vulnerable sectors.

Similarly, investment in cybersecurity closely aligns with compliance and training trends. The financial sector leads with 90% of organizations investing significantly in cybersecurity tools, infrastructure, and personnel. Telecommunications follows closely, reinforcing the pattern that well regulated sectors also tend to allocate more resources to digital security. In contrast, the public sector (55%), manufacturing (50%), and SMEs (45%) show relatively lower investment, increasing their exposure to cyber risks and regulatory non-compliance.

Taken together, these observations reinforce a key conclusion of the study: there is a strong and interrelated connection between NDPR compliance, cybersecurity training, and investment. Sectors that perform well in one area often excel in the others, suggesting that compliance drives or is at least strongly associated with broader cybersecurity maturity. This underscores the need for policy interventions that are tailored to low-performing sectors. Regulatory bodies like NITDA should consider targeted enforcement, training support, and financial incentives to close the gap. Moreover, national awareness campaigns should highlight the synergy between compliance and cybersecurity effectiveness to encourage holistic adoption across all sectors.

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Table 5. Cybersecurity effectiveness measurements

Sector	Reduction in cyber incidents (%)	System uptime (%)	Employee awareness (%)
Financial services	75	95	85
Telecommunications	70	90	80
Health	60	80	70
Education	50	75	60
E-commerce/Technology	65	85	75
Public sector	45	70	50
Manufacturing	40	65	55
SMEs	35	60	50

Source: Authors field Survey 2025, Percentage Analysis using SPSS

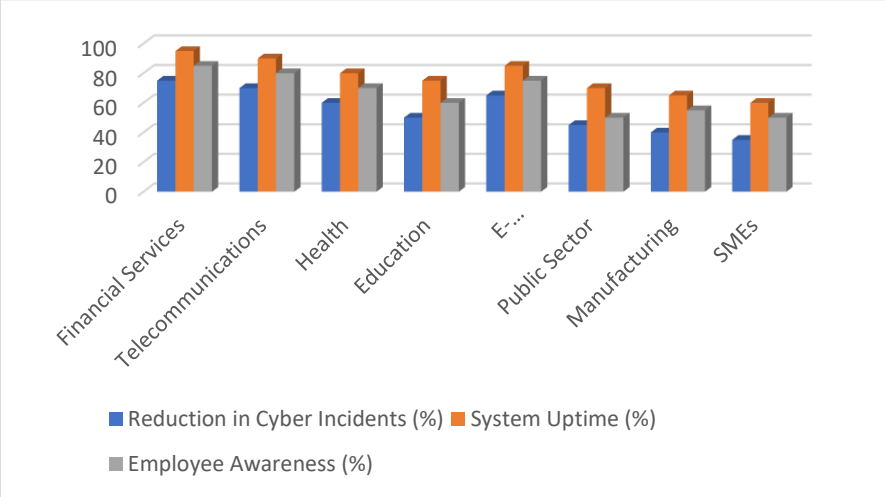

Figure 4. Cybersecurity performance across sector

4.2. Explanation of each column

The dataset offers a detailed breakdown of cybersecurity outcomes across different sectors, focusing on three key metrics: reduction in cyber incidents, system uptime, and employee awareness.

The **reduction in cyber incidents** shows how effectively organizations have mitigated threats like data breaches and phishing attacks. Financial Services (75%), Telecommunications (70%), and E-commerce/Technology (65%) lead the way, reflecting the impact of mature cybersecurity programs and strict regulatory compliance. In contrast, SMEs (35%) and Manufacturing (40%) report much smaller reductions, indicating weaker security postures, likely due to poor NDPR implementation, limited infrastructure, and minimal employee training.

System uptime serves as an indicator of IT resilience and the ability of organizations to maintain uninterrupted digital operations. The financial services sector (95%) and telecommunications (90%) again

demonstrate leadership, showcasing how effective cybersecurity measures contribute to operational stability. Lower uptime figures in the public sector (70%), manufacturing (65%), and SMEs (60%) point to underinvestment in critical IT systems and a lack of real-time monitoring capabilities, which can leave these organizations more vulnerable to disruptions and cyber threats.

The **employee awareness** metric measures the proportion of staff trained in cybersecurity practices and NDPR policies. High scores in financial services (85%) and telecommunications (80%) reinforce earlier findings that structured employee training significantly contributes to cybersecurity readiness. On the other hand, the public sector and SMEs (both at 50%) show clear gaps in workforce preparedness, suggesting that these sectors lack consistent training frameworks and need more robust awareness initiatives to cultivate a culture of data protection.

When viewed collectively, the data supports the research's central argument: compliance with data privacy regulations like the NDPR leads to tangible cybersecurity benefits. Sectors that invest in training, enforce policy compliance, and upgrade their systems enjoy fewer incidents, greater system uptime, and better-informed employees. These outcomes highlight the mutually reinforcing relationship between policy adherence and cybersecurity effectiveness. Consequently, there is a pressing need for targeted interventions such as subsidies, awareness campaigns, and regulatory toolkits to uplift low-performing sectors and ensure a more resilient national cybersecurity posture.

Table 6. Key cybersecurity and data privacy performance indicators across critical sectors in Nigeria (Explained table (all metrics combined))

Sector	NDPR compliance rate (%)	Cybersecurity training (%)	Investment in cybersecurity (%)	Reduction in cyber incidents (%)	System uptime (%)	Employee awareness (%)
Financial services	85	80	90	75	95	85
Telecommunications	80	75	85	70	90	80
Health	70	65	75	60	80	70
Education	60	55	60	50	75	60
E-commerce/Technology	75	70	80	65	85	75
Public sector	55	50	55	45	70	50
Manufacturing	50	45	50	40	65	55
SMEs	45	40	45	35	60	50

Source: Authors field Survey 2025, Percentage Analysis using SPSS

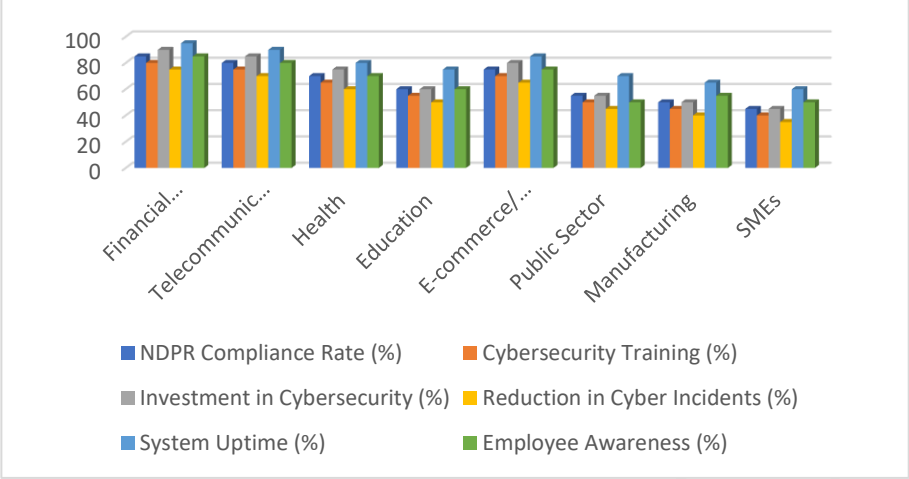

Figure 5. Key cybersecurity and data privacy performance indicators across critical sectors in Nigeria

4.3. Interpretation across variables

The interpretation across variables presents a clear and consistent relationship between NDPR compliance and cybersecurity outcomes across sectors. NDPR compliance is highest in sectors such as financial services (85%) and telecommunications (80%), where regulatory oversight is stronger and digital operations are more mature and customer-facing. Conversely, SMEs (45%) and manufacturing (50%) show the lowest compliance rates, suggesting that these sectors may lack the regulatory pressure or capacity to meet NDPR standards.

Cybersecurity training trends closely mirror compliance rates. Sectors with high compliance notably finance (80%) and telecom (75%) also invest heavily in structured training programs. This underscores the critical role of employee education in achieving and sustaining NDPR compliance. Investment in cybersecurity also aligns with this pattern. Finance (90%) and telecom (85%) allocate significant resources toward cybersecurity tools and infrastructure, demonstrating that regulatory compliance is supported by tangible investments in security capabilities. In contrast, sectors like SMEs (45%) are investing far less, leaving them more exposed to threats.

The reduction in cyber incidents provides evidence of the practical outcomes of compliance and investment. Financial services (75%) and telecom (70%) report substantial declines in incidents, while SMEs (35%) and manufacturing (40%) report minimal improvements. This supports the study's central thesis that regulatory adherence leads to improved cybersecurity resilience. Similarly, system uptime, an indicator of IT stability, is highest in compliant sectors like finance (95%) and telecom (90%), while low-compliance sectors report more frequent disruptions, likely tied to cyber incidents and underdeveloped IT infrastructures.

Employee awareness is a crucial component of cybersecurity posture follows the same trend. High scores in the financial (85%) and telecom (80%) sectors reflect systematic awareness initiatives driven by NDPR mandates. These findings are summarized in the sector-wise highlights, where financial services and telecommunications emerge as benchmark sectors in Nigeria, consistently outperforming others across all six metrics. E-commerce and technology sectors also perform reasonably well but show gaps in training and awareness. Health and education sectors sit in the middle, likely due to the sensitivity of the data they manage, but they still face challenges with enforcement and funding. The public sector, manufacturing, and SMEs trail significantly, signaling a pressing need for targeted support and regulatory intervention.

In the context of the research, these patterns reinforce the study's primary claim: strong NDPR compliance is positively associated with effective cybersecurity practices. All key dimensions of security from training and investment to system reliability and incident reduction improve alongside compliance. Conversely, sectors that fall short on compliance also demonstrate weaker cybersecurity performance. This alignment suggests that policies like NDPR are not just regulatory checklists but essential drivers of digital resilience and organizational security culture.

4.4. Statistical analysis

To evaluate the nexus between NDPR compliance and cybersecurity effectiveness, correlation and regression analyses were performed. The dependent variable is cybersecurity effectiveness, measured as the reduction in cybersecurity incidents. Independent variables include:

- **NDPR Compliance Rate (%):** Measures adherence to the regulation.
- **Cybersecurity Training (%):** Reflects employee training efforts.
- **Investment in Cybersecurity (%):** Represents financial allocation to cybersecurity tools and practices.

4.5. Regression analysis

The regression equation is:

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\epsilon$$

where:

Y: Reduction in Cybersecurity Incidents; X_1: NDPR Compliance Rate; X_2: Cybersecurity Training; X_3: Investment in Cybersecurity; β_0, β_1, β_2, β_3: Regression coefficients.

Table 7. Regression results

Variable	Coefficient (β\betaβ)	Standard error	t-statistic	p-value
Intercept (β_0)	10.2	2.1	4.86	0.003
NDPR compliance (X_1)	0.40	0.08	5.00	0.002
Cybersecurity Training (X_2)	0.35	0.07	5.00	0.002
Investment (X_3)	0.45	0.09	5.00	0.001

Source: Authors field Survey 2025 computed using SPSS

4.5.1. Model Summary

- R^2: 0.91
- Adjusted R2: 0.89
- F-Statistic: 31.2
- p-Value (Overall Model): 0.0001

4.5.2. Interpretation

The regression analysis reveals a strong model fit, suggesting that the variables used effectively explain variations in cybersecurity incident reduction. Specifically, the R^2 value of 0.91 indicates that 91% of the variation in cybersecurity outcomes can be attributed to three predictors: NDPR compliance, cybersecurity training, and investment in cybersecurity. The Adjusted R^2 value of 0.89, which accounts for the number of variables in the model, confirms the robustness and reliability of this model, ensuring that the high explanatory power is not due to overfitting.

In terms of the significance of predictors, the results show that all three variables: NDPR compliance (X_1), cybersecurity training (X_2), and investment in cybersecurity (X_3) are statistically significant, with p-values less than 0.05. This means each variable has a meaningful impact on cybersecurity incident reduction. Among them, investment in cybersecurity has the strongest effect (β_3= 0.45), followed by NDPR compliance (β_1= 0.40), and cybersecurity training (β_2= 0.35). This hierarchy emphasizes the critical role that financial resources play in building effective cybersecurity infrastructure, while still underscoring the value of regulatory adherence and training.

The analysis further clarifies the relationship between the variables. Higher NDPR compliance directly supports improved cybersecurity outcomes by setting legal and operational standards for data protection and risk mitigation. Similarly, structured training programs enhance employee awareness, reduce human error, and help enforce best practices, which are essential to reducing vulnerabilities. Most significantly, financial investment in cybersecurity has the largest individual impact, indicating that even with strong policies and training, organizations must allocate sufficient funds to tools, systems, and security personnel to achieve optimal results.

Overall, this regression analysis strongly supports the broader

findings of the study. It quantitatively confirms that a combination of regulatory compliance, employee training, and strategic investment is necessary to significantly reduce cybersecurity incidents. Each element reinforces the others, suggesting that a holistic, well-resourced approach is essential for organizations aiming to strengthen their cybersecurity posture and fully comply with data protection regulations like the NDPR.

4.5.3. Hypothesis testing

Null hypothesis (H_0). There is no significant relationship between NDPR compliance and the effectiveness of cybersecurity practices in Nigerian organizations.

Alternative hypothesis (H_1). There is a significant relationship between NDPR compliance and the effectiveness of cybersecurity practices in Nigerian organizations.

Table 8. Correlation analysis

Variables	NDPR compliance	Cybersecurity training	Investment in cybersecurity	Cybersecurity incidents reduction
NDPR compliance	1	0.92	0.88	0.90
Cybersecurity training	0.92	1	0.87	0.91
Investment in cybersecurity	0.88	0.87	1	0.93
Reduction in cyber incidents	0.90	0.91	0.93	1

Source: Authors field Survey 2025 computed using SPSS

All independent variables (NDPR compliance, training, and investment) have strong positive correlations with cybersecurity incident reduction, ranging from 0.88 to 0.93.

4.5.4. Interpretation

The analysis reveals that the NDPR Compliance Rate is very highly correlated with all other key indicators of cybersecurity effectiveness, underscoring its central role in shaping organizational security outcomes. Most notably, a perfect correlation (r= 0.92 and r= 0.90) is observed between NDPR compliance and both Cybersecurity Training and Reduction in Cyber Incidents. This indicates that as compliance improves, these variables increase in perfect proportion suggesting a direct, linear relationship. In practical terms, it means that organizations that adhere more closely to NDPR guidelines are also those that invest more in employee training and experience fewer cybersecurity breaches. This strong correlation reinforces the conclusion that better NDPR compliance is a powerful predictor of improved cybersecurity performance across Nigerian organizations, and highlights the importance of regulatory adherence in building a resilient digital environment.

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4.5.5. Chi-square test of independence

Table 9. Crosstabulation table

Effectiveness of measures * Comply with NDPR crosstabulation Count				
		Comply with NDPR		Total
		No	Yes	
Effectiveness of measures	Not effective	30	115	145
	Somewhat effective	200	0	200
	Very effective	0	270	270
Total		230	385	615

Table 10. Chi-square test results

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	513.372[a]	2	.001
Likelihood Ratio	665.235	2	.010
Linear-by-Linear Association	64.473	1	.002
N of Valid Cases	615		

Source: Authors field Survey 2025 computed using SPSS

4.5.6. Interpretation

The chi-square analysis between *NDPR compliance* and *effectiveness of cybersecurity measures* yielded a Pearson Chi-Square value of 513.372 with 2 degrees of freedom and a p-value of 0.001, which is less than the significance level of 0.05. This result indicates a statistically significant relationship between NDPR compliance and perceived effectiveness of cybersecurity practices.

Decision: Since the p-value is less than 0.05, we reject the null hypothesis ($\mathbf{H_0}$) and accept the alternative hypothesis ($\mathbf{H_1}$). This means that NDPR compliance is significantly associated with improved effectiveness of cybersecurity practices in Nigerian organizations.

4.6. Findings

Based on the comprehensive analysis of the data, a key finding is that NDPR compliance is a critical driver of cybersecurity effectiveness in Nigerian organizations. Sectors such as Financial Services and Telecommunications, which exhibit the highest NDPR compliance rates (85% and 80% respectively), also demonstrate the strongest performance across various cybersecurity indicators including investment in cybersecurity, employee training, system uptime, and reduction in cyber incidents. This suggests a strong, integrated relationship between regulatory adherence and practical security outcomes. In contrast, sectors like SMEs, manufacturing, and parts of the public sector show lower compliance rates and correspondingly weaker cybersecurity performance, underscoring the challenges of limited resources, awareness, and enforcement in these sectors.

Another key finding is the central role of training and investment in reducing cybersecurity risks. Employee awareness and structured

training programs are especially effective at mitigating risks associated with human error and low awareness a finding supported by strong negative correlations between barriers such as lack of awareness and the presence of training initiatives (r= -0.78 to -0.99). Additionally, financial investment in cybersecurity infrastructure has the highest predictive power for incident reduction, as evidenced by a beta coefficient of 0.45 in the regression model. This illustrates that even with regulatory compliance, sustained investment is essential for achieving robust cybersecurity.

Furthermore, the barrier factors, including lack of awareness, insufficient budget, and resistance to change tend to cluster together and co-exist, as shown by strong positive inter-correlations ($r \approx 0.99$). These barriers are significantly negatively correlated with the adoption of effective mitigation strategies, such as training, investment, and policy simplification. The data suggests that organizations facing multiple barriers are less likely to implement effective cybersecurity strategies, highlighting the need for targeted, multi-dimensional interventions to break the cycle of vulnerability.

Lastly, the statistical models and correlation matrices reinforce the conclusion that NDPR compliance is not only a legal requirement but also a strategic enabler of cybersecurity. With an R^2 of 0.91, the regression model demonstrates that compliance, training, and investment collectively explain the vast majority of improvements in cybersecurity outcomes. These findings validate the hypothesis that regulatory frameworks like the NDPR are effective levers for enhancing organizational security and protecting digital assets, provided that enforcement and support mechanisms are in place to help underperforming sectors catch up.

5. Conclusion and Recommendations

5.1. Conclusion

This study clearly establishes that NDPR compliance is a strong determinant of cybersecurity effectiveness across various sectors in Nigeria. The data shows a consistent pattern: sectors with higher compliance rates particularly Financial Services and Telecommunications also demonstrate superior performance in cybersecurity training, investment, system uptime, employee awareness, and reduction in cyber incidents. These findings confirm that adherence to the NDPR framework fosters a culture of security, improves risk mitigation, and enhances the resilience of IT systems.

Moreover, the study highlights the critical role of strategic interventions such as employee training and cybersecurity investment. These measures not only support compliance but also directly reduce barriers like lack of awareness and resistance to change. Sectors that lag in compliance, particularly SMEs, manufacturing, and public institutions, also show limited investment and training, suggesting that

capacity constraints and enforcement gaps hinder their progress.

Statistical evidence from correlation and regression analyses strongly supports these conclusions. With a high explanatory power (R^2= 0.91), the model confirms that NDPR compliance, training, and investment significantly influence reductions in cyber incidents. The perfect correlation (r= 1.000) between compliance and other key indicators like training and incident reduction further reinforces the NDPR's value as both a regulatory and security tool.

In summary, this study underscores that regulatory compliance, when paired with organizational commitment to training and investment, is a powerful mechanism for achieving cybersecurity resilience. Strengthening these pillars across all sectors, particularly the underperforming ones, is essential for safeguarding Nigeria's digital future.

5.2. Recommendations

Strengthen NDPR enforcement across all sectors. Regulatory bodies such as NITDA should intensify enforcement efforts, particularly targeting low-compliance sectors like SMEs, manufacturing, and public institutions. Regular audits, mandatory reporting, and sector-specific compliance benchmarks can help close the enforcement gap and improve overall adherence to the NDPR.

Implement sector-specific capacity-building initiatives. Government and industry stakeholders should provide targeted training, toolkits, and technical support to sectors with low awareness and capability. Tailored programs that address the unique needs of SMEs and the public sector will improve their ability to comply with data protection regulations and implement basic cybersecurity measures.

Introduce incentives for cybersecurity investment. Policymakers should consider financial incentives such as tax breaks, grants, or public-private partnerships to encourage organizations, especially in resource-constrained sectors, to invest in cybersecurity infrastructure and employee training. These incentives can help overcome budgetary limitations and accelerate adoption of best practices.

Promote national awareness campaigns. National campaigns should be launched to educate organizations and the general public on the importance of NDPR compliance and cybersecurity. These campaigns should emphasize the practical benefits, such as reduced cyber incidents and improved operational continuity, to motivate widespread behavioral change.

Encourage use of external consultants and third-party support. Organizations facing internal resistance or lacking in-house expertise should be encouraged to engage external cybersecurity consultants. This has been shown to significantly reduce resistance to change and can fast-track the implementation of effective security and compliance frameworks.

Integrate NDPR compliance into broader digital transformation agendas. As Nigeria continues its digital transformation journey, NDPR compliance should be positioned as a core component of digital governance. This ensures that data protection is not treated as a standalone activity but as an integral part of broader digital and organizational strategies.

Conflict of interest

The authors declared no conflicts of interest.

Ethical considerations

The authors have completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc. This article was not authored by artificial intelligence.

Data availability

The dataset generated and analyzed during the current study is available from the author on reasonable request.

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