**CHAPTER ONE**

**INTRODUCTION**

**1.1 Introduction**

**Background and Context of the Research**

In recent years, with the rapid advancement of technology and the increasing reliance on digital platforms, the protection of personal data has become a paramount concern globally (Petrović, 2023). This concern stems from the growing prevalence of cyber threats and data breaches, which pose significant risks to individuals' privacy and security. In response to these challenges, governments around the world have implemented various data protection regulations to safeguard individuals' rights and mitigate the risks associated with data misuse and unauthorized access (Bwire, 2023).

**Brief Overview of the Research Topic**

The focus of this research is to conduct a vulnerability assessment of web applications, with specific emphasis on the data protection implications, using Baze University as a case study. Vulnerability assessment is a crucial aspect of cybersecurity, as it helps identify and address potential weaknesses in web applications that could be exploited by malicious actors (Armando et al., 2022). By examining the vulnerabilities present in Baze University's web applications, this research aims to enhance the institution's cybersecurity posture and ensure compliance with data protection regulations, particularly the National Data Protection Regulation (NDPR) in Nigeria.

#### Introduction to NDPR

The National Data Protection Regulation (NDPR) is a comprehensive data protection regulation introduced by the National Information Technology Development Agency (NITDA) of Nigeria in 2019 (NITDA, 2019). It aims to safeguard the privacy and security of personal data and regulate its processing by data controllers and processors (Narayan and Aggarwal, 2023). The NDPR is aligned with international data protection standards, such as the General Data Protection Regulation (GDPR) of the European Union, and reflects Nigeria's commitment to protecting individuals' rights in the digital age (Okechukwu Ukwueze and Ibegbulem, 2021).

#### Evolution and Development of Data Protection Regulations

The development of data protection regulations, including the NDPR, has been shaped by various factors, including technological advancements, globalization, and the increasing volume of personal data generated and processed worldwide (Chassang, 2017). The evolution of data protection regulations can be traced back to the enactment of the Data Protection Directive by the European Union in 1995, which laid the foundation for comprehensive data protection legislation (Damen et al., 2021). Subsequently, other countries and regions, including Nigeria, have implemented their own data protection laws and regulations to address the challenges posed by the digital economy (Abdulkadir and Sambo, 2022).

In Nigeria, the enactment of the NDPR represents a significant milestone in the country's data protection landscape. Prior to the introduction of the NDPR, data protection in Nigeria was governed by various sectoral regulations and guidelines, which lacked comprehensive provisions for protecting personal data in line with international best practices (Okechukwu Ukwueze and Ibegbulem, 2021). The NDPR seeks to address these gaps by providing a unified framework for data protection across different sectors of the economy.

#### Importance of NDPR in Ensuring Data Privacy

The NDPR plays a crucial role in ensuring data privacy and promoting trust in Nigeria's digital ecosystem. By establishing clear rules and standards for the collection, processing, and storage of personal data, the NDPR enhances transparency and accountability in data processing activities (Okechukwu Ukwueze and Ibegbulem, 2021). This, in turn, helps build confidence among individuals regarding the handling of their personal information by organizations and institutions.

Furthermore, the NDPR strengthens individuals' rights with regard to their personal data by providing mechanisms for exercising control over their data and seeking redress in case of data breaches or violations (Okechukwu Ukwueze and Ibegbulem, 2021). For instance, the NDPR requires data controllers and processors to obtain consent from individuals before processing their personal data and provides guidelines for obtaining valid consent (NITDA, 2019). Additionally, the NDPR mandates data controllers and processors to implement appropriate technical and organizational measures to protect personal data from unauthorized access, disclosure, or alteration (Bisiukov, 2020a).

Overall, the NDPR serves as a cornerstone of data protection in Nigeria, ensuring that personal data is processed lawfully, fairly, and transparently, and that individuals' privacy rights are respected and upheld.

**1.2 Statement of the Research Problem**

The overarching research problem addressed in this study revolves around the need to enhance cybersecurity and ensure compliance with data protection regulations in the context of web applications, with a specific focus on Baze University. In an era marked by increasing cyber threats and data breaches, educational institutions like Baze University face significant challenges in safeguarding sensitive information and protecting individuals' privacy (Iqra University North Campus Karachi, Pakistan et al., 2022). The research problem stems from the recognition of the potential vulnerabilities present in Baze University's web applications, which could expose personal data to unauthorized access and misuse. Therefore, the primary objective of this study is to conduct a comprehensive vulnerability assessment of Baze University's web applications to identify potential weaknesses and recommend measures for improving cybersecurity and ensuring compliance with data protection regulations.

**1.3 Research Objectives and Hypotheses**

The research objectives of this study are twofold:

1. To assess the vulnerabilities present in Baze University's web applications
2. To propose recommendations for enhancing cybersecurity and ensuring compliance with data protection regulations.

To achieve these objectives, the following hypotheses are formulated:

* **Hypothesis 1**: Baze University's web applications exhibit vulnerabilities that could be exploited by malicious actors.
* **Hypothesis 2**: Implementation of recommended cybersecurity measures will improve the security posture of Baze University's web applications and ensure compliance with data protection regulations.

These hypotheses guide the research process and provide a framework for evaluating the effectiveness of the proposed recommendations in addressing the identified vulnerabilities and enhancing cybersecurity at Baze University.

**Research Questions Addressed in the Study**

To address the research problem and achieve the stated objectives, the following research questions are formulated:

1. What are the common vulnerabilities present in Baze University's web applications?
2. How can the identified vulnerabilities be exploited by malicious actors?
3. What recommendations can be proposed to improve the security posture of Baze University's web applications and ensure compliance with data protection regulations?

### 1.4 Significance of the Study

**Significance of the Study**

The significance of this study lies in its contribution to both academia and practical cybersecurity measures. Firstly, by conducting a comprehensive vulnerability assessment of web applications, this research will contribute to the existing body of knowledge on cybersecurity and data protection. The findings of this study will shed light on the common vulnerabilities present in web applications and provide insights into effective mitigation strategies.

Secondly, from a practical perspective, this research is significant for Baze University and other educational institutions in Nigeria. As educational institutions increasingly rely on web-based platforms for various administrative and academic functions, ensuring the security and privacy of sensitive data is paramount (Felix C Aguboshim et al., 2023). By identifying and addressing vulnerabilities in Baze University's web applications, this research will help enhance the institution's cybersecurity posture and protect the personal data of its students, staff, and other stakeholders.

### In summary, this research is significant for its potential to advance knowledge in the field of cybersecurity and data protection, as well as its practical implications for improving the security of web applications in educational institutions like Baze University.

#### Academic Contributions and Practical Implications

This study holds significant academic contributions and practical implications for the field of cybersecurity and data protection. Firstly, the vulnerability assessment conducted as part of this study contributes to the existing body of knowledge on cybersecurity by identifying common vulnerabilities present in web applications and providing insights into effective mitigation strategies. The findings of this study will enrich the academic literature on vulnerability assessment methodologies and contribute to enhancing the overall understanding of cybersecurity best practices.

From a practical perspective, the recommendations proposed as a result of the vulnerability assessment have direct implications for enhancing cybersecurity measures at Baze University and other educational institutions facing similar challenges (Cheng and Wang, 2022). By implementing the recommended cybersecurity measures, institutions can improve the security posture of their web applications and better protect sensitive data from unauthorized access and misuse. This, in turn, enhances the trust and confidence of stakeholders, including students, faculty, and administrative staff, in the institution's ability to safeguard their personal information.

#### Potential Societal Impact of the Research

The societal impact of this research extends beyond the academic and institutional realms to broader societal implications. Educational institutions like Baze University serve as custodians of vast amounts of personal data belonging to students, faculty, and staff (Hamida et al., 2019). Ensuring the security and privacy of this data is not only a legal and ethical responsibility but also a fundamental requirement for fostering trust and confidence in the digital ecosystem (Gfeller and Hardjono, 2021). By conducting a vulnerability assessment and proposing recommendations for enhancing cybersecurity at Baze University, this research contributes to the broader societal goal of promoting data privacy and security.

Furthermore, the findings and recommendations of this study have the potential to influence policy decisions and regulatory frameworks related to data protection and cybersecurity in Nigeria. As cybersecurity threats continue to evolve and escalate, policymakers and regulatory authorities rely on empirical research and evidence-based recommendations to formulate effective strategies for mitigating cyber risks and protecting individuals' rights in the digital age. Therefore, the insights generated from this research have the potential to inform policy discussions and shape the future direction of data protection regulations in Nigeria and beyond.

In summary, this study holds significant academic contributions and practical implications for enhancing cybersecurity measures at educational institutions like Baze University, as well as broader societal implications for promoting data privacy and security and influencing policy decisions related to cybersecurity and data protection.

### 1.5 Scope and Limitations

#### Definition of the Scope of the Study

The scope of this study encompasses the vulnerability assessment of web applications at Baze University, with a specific focus on identifying potential weaknesses that could compromise data security and privacy. The study will evaluate various aspects of Baze University's web applications, including but not limited to authentication mechanisms, data storage practices, input validation procedures, and access control measures. The vulnerability assessment will be conducted using three different tools: NIPTO, Nexus, and Vega, to comprehensively identify and analyze vulnerabilities in the web applications.

#### Identification of Limitations and Constraints

Despite the comprehensive nature of the vulnerability assessment, this study is subject to certain limitations and constraints. Firstly, the scope of the study is limited to Baze University's web applications, and the findings may not be generalizable to other institutions or organizations. Additionally, the effectiveness of the recommended cybersecurity measures may vary depending on factors such as resource constraints and technological limitations (Allodi et al., 2020). Furthermore, the availability of data and access to certain systems or applications may pose constraints on the depth and accuracy of the vulnerability assessment.

#### Explanation of How Limitations Will Be Addressed

To address the identified limitations and constraints, several measures will be implemented throughout the research process. Firstly, efforts will be made to ensure the transparency and reproducibility of the vulnerability assessment methodology, allowing for the validation of findings by other researchers or cybersecurity professionals. Additionally, the research findings will be contextualized within the specific organizational and technological environment of Baze University, acknowledging the potential limitations in generalizability.

Furthermore, where possible, the study will leverage alternative sources of data and information to supplement the vulnerability assessment findings and mitigate the impact of data constraints. Collaboration with relevant stakeholders at Baze University, including IT personnel and administrators, will also be sought to gain insights into the institutional context and address any practical limitations encountered during the research process.

In summary, while this study acknowledges the inherent limitations and constraints associated with conducting a vulnerability assessment in a real-world setting, proactive measures will be taken to ensure the validity and reliability of the research findings, and to maximize the utility of the recommendations for enhancing cybersecurity at Baze University.

**CHAPTER TWO**

**LITERATURE REVIEW**

**2.1 Introduction**

**Overview of the Literature Review Chapter**

The literature review chapter serves as a critical component of this research, providing a comprehensive analysis of existing literature related to vulnerability assessment in web applications, with a specific focus on the National Data Protection Regulation (NDPR) and its implications. This chapter aims to review and synthesize relevant academic research, industry reports, case studies, and regulatory documents to gain insights into best practices, emerging trends, and challenges in vulnerability assessment and data protection in the digital age.

The literature review is structured to explore various dimensions of vulnerability assessment, including conceptual frameworks, theoretical foundations, empirical studies, and practical applications. By examining a wide range of sources, this chapter seeks to build a solid theoretical foundation and inform the methodology and analysis conducted in subsequent chapters. Additionally, the literature review will highlight gaps in existing research and identify areas for further investigation, contributing to the advancement of knowledge in the field of cybersecurity and data protection.

**Importance of Literature Review in Vulnerability Assessment**

The literature review plays a crucial role in vulnerability assessment by providing valuable insights, theoretical frameworks, and empirical evidence that inform the development of effective assessment methodologies and strategies (Jessin et al., 2023). Vulnerability assessment is a multidisciplinary field that draws on insights from computer science, cybersecurity, risk management, and regulatory compliance (Allodi et al., 2020). As such, a comprehensive literature review is essential for understanding the theoretical underpinnings, methodological approaches, and practical challenges associated with vulnerability assessment in web applications.

Furthermore, the literature review helps contextualize the research within the broader academic discourse and industry practices, facilitating a deeper understanding of the complexities and nuances of vulnerability assessment. By synthesizing and critically analyzing existing literature, researchers can identify key trends, recurring themes, and divergent viewpoints, which inform the development of research questions, hypotheses, and methodology.

Moreover, the literature review serves as a foundation for theoretical development and conceptual frameworks in vulnerability assessment. By drawing on established theories and models from relevant disciplines, researchers can develop theoretical frameworks that guide the interpretation of empirical findings and the formulation of practical recommendations. Additionally, the literature review helps identify gaps in existing research and areas for future exploration, stimulating further academic inquiry and innovation in vulnerability assessment.

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| **Author** | **Year** | **Title** | **Methodology** | **Limitation** |
| Allodi et al. | 2020 | Vulnerability assessment in cybersecurity | Identifying and analyzing vulnerabilities in software, networks, and systems to assess security posture and mitigate potential risks. | Potential biases in vulnerability identification. |
| Moshika et al. | 2021 | Vulnerability assessment in web applications | Identifying weaknesses in web application code, configuration, and architecture to prevent data security breaches. | May not address all possible vulnerabilities in complex web applications. |
| Widjajarto et al. | 2021 | Vulnerability concept in cybersecurity | Identifying weaknesses or flaws in systems that could be exploited by attackers to gain unauthorized access or disrupt operations. | Difficulty in quantifying the impact of vulnerabilities on data security. |
| Gajrani et al. | 2020 | Vulnerabilities in cybersecurity | Sources of vulnerabilities include programming errors, misconfigurations, and design flaws, posing risks to data privacy and security. | Lack of comprehensive vulnerability coverage due to evolving attack techniques. |
| Jacobs et al. | 2021 | Risk assessment in cybersecurity | Assessing the likelihood of vulnerability exploitation and the potential impact on data confidentiality, integrity, and availability. | Subjectivity in risk assessment criteria and potential underestimation of risks. |
| Alma-Ata et al. | 2020 | Data privacy protection | Protecting personal data from unauthorized access, use, disclosure, and alteration. | Challenges in enforcing data privacy regulations across different jurisdictions. |
| Morales-Trujillo et al. | 2019 | Data protection by design and by default | Integrating privacy-enhancing measures such as encryption, access controls, and anonymization into software and system design to minimize data breach risks. | Implementation challenges in applying privacy-preserving techniques effectively. |
| Howland | 2023 | Common Vulnerability Scoring System (CVSS) | Standardized method for assessing vulnerability severity based on impact, exploitability, and remediation level. | Limited scope in capturing all aspects of vulnerability severity. |
| Moshtari et al. | 2022 | Attack Surface Model | Conceptualizing a system's attack surface as the sum of its vulnerabilities and entry points exploitable by attackers. | May overlook some attack vectors and entry points in complex systems. |
| Paul and Rao | 2022 | Zero Trust Security Model | Emphasizing continuous verification and validation of user identities, devices, and applications regardless of location or network environment. | Implementation challenges in dynamically verifying user identities and devices. |
| Schwerin | 2018 | General Data Protection Regulation (GDPR) | European Union regulation establishing data protection standards and obligations on organizations for protecting individuals' personal data. | Compliance complexities for organizations operating across multiple jurisdictions. |
| NITDA | 2019 | National Data Protection Regulation (NDPR) | Nigerian regulation aligning with international standards to safeguard personal data and regulate its processing. | Challenges in enforcement and compliance monitoring, particularly for smaller organizations. |
| Nam | 2023 | Overview of NDPR | Describes NDPR as designed to safeguard personal data privacy and security, reflecting Nigeria's commitment to protecting individuals' rights. | Potential gaps in regulatory coverage and enforcement mechanisms. |
| Opara | 2020 | NDPR and international data protection | Highlights NDPR's alignment with international data protection standards, such as the GDPR, and its significance in Nigeria's digital age. | Challenges in reconciling NDPR requirements with other international regulations. |
| Okechukwu et al. | 2021 | NDPR compliance requirements | Outlines requirements for organizations handling personal data in Nigeria, including obtaining valid consent, implementing data minimization measures, and ensuring data security. | Resource constraints for smaller organizations in meeting compliance requirements. |
| Sultan and Jensen | 2021 | NDPR consent provisions | Mandates organizations to obtain valid consent from individuals before processing their personal data, with clear information on purposes and legal basis. | Challenges in obtaining explicit consent and ensuring compliance with consent provisions. |
| Russo et al. | 2022 | NDPR data minimization principle | Requires organizations to collect and retain only the minimum personal data necessary for intended purposes to reduce risks. | Balancing data minimization with business needs and operational requirements. |
| Bisiukov | 2020 | NDPR security measures | Mandates implementing technical and organizational measures (e.g., access controls, encryption) to ensure personal data security. | Resource constraints and technical challenges in implementing comprehensive security measures. |
| Akindele | 2017 | NDPR Data Protection Officer (DPO) | Requires organizations to appoint a Data Protection Officer responsible for overseeing NDPR compliance and handling data protection inquiries and complaints. | Availability of qualified personnel for the role of DPO. |
| Ciclosi and Massacci | 2023 | NDPR Data Protection Impact Assessments (DPIAs) | Mandates conducting regular assessments to identify and mitigate risks associated with personal data processing activities. | Resource-intensive process and potential challenges in conducting comprehensive DPIAs. |
| Pandit | 2022 | NDPR records of processing activities | Requires organizations to maintain records detailing processing purposes, legal basis, data transfers, retention periods, and security measures. | Administrative burden in record-keeping and potential challenges in ensuring accuracy and completeness of records. |

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| **Author** | **Year** | **Title** | **Methodology** | **Limitation** |
| Tomashchuk | 2020 | Risk Management Framework (RMF) | Structured approach to identifying, assessing, and mitigating risks associated with information security and data privacy. | Potential challenges in applying RMF to diverse organizational contexts and varying risk landscapes. |
| Joint Task Force Transformation Initiative | 2018 | Risk Management Framework (RMF) | Consists of stages such as risk identification, assessment, mitigation, monitoring, and communication, guiding organizations in effective risk management. | Complexity in integrating RMF stages into existing organizational processes and workflows. |
| Ibrahim | 2018 | Technology Acceptance Model (TAM) | Explores factors influencing individuals' acceptance and adoption of technology, including web applications, focusing on perceived usefulness and ease of use. | May not capture all relevant factors influencing technology acceptance in diverse user populations. |
| Marandu et al. | 2019 | Technology Acceptance Model (TAM) | Key determinants of individuals' intention to use technology and their actual usage behavior, providing insights into users' attitudes, perceptions, and behaviors towards security measures in web applications. | TAM's focus on individual perceptions may overlook organizational and contextual factors influencing technology adoption. |
| CHRIST (Deemed to be University), Pune, Lavasa and Modi | 2023 | Security Development Lifecycle (SDL) | Systematic approach to integrating security considerations into the software development process, including stages like requirements analysis, design, testing, and maintenance. | SDL implementation challenges, including resource constraints, time limitations, and compatibility with agile development methodologies. |
| NITDA | 2019 | Security Development Lifecycle (SDL) | Incorporates security practices such as threat modeling, code reviews, and security testing throughout the software development lifecycle, enhancing security and privacy of web applications. | SDL's effectiveness may vary depending on organizational commitment, expertise, and adherence to security best practices. |
| Sion et al. | 2021 | Regulatory frameworks (GDPR, NDPR) | Establish legal obligations and standards for protecting individuals' personal data in web applications, influencing organizations' behavior and practices related to data protection. | Compliance challenges for organizations operating across multiple jurisdictions, varying interpretations of regulatory requirements. |
| **Missing** | **Year** | **Title** | **Methodology** | **Limitation** |
| CHRIST (Deemed to be University), Pune, Lavasa and Modi | 2023 | Regulatory frameworks (GDPR, NDPR) | Establish legal obligations and standards for protecting individuals' personal data in web applications, influencing organizations' behavior and practices related to data protection. | Challenges in interpreting and implementing regulatory requirements, potential conflicts with other legal frameworks or industry standards. |

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| **Author** | **Year** | **Title** | **Methodology** | **Limitation** |
| Ravindran and Potukuchi | 2022 | Vulnerability Landscape of Web Applications | Analysis of vulnerability landscape across various industries, identifying common vulnerabilities such as SQL injection, XSS, and insecure authentication mechanisms. | Limited scope in examining vulnerabilities specific to individual industries or web application types. |
| Allodi et al. | 2020 | Effectiveness of Vulnerability Assessment Tools and Techniques | Evaluation of vulnerability assessment tools and techniques, comparing automated scanning tools, manual code reviews, and penetration testing. | Potential bias in the selection of tools and techniques evaluated, limited consideration of emerging vulnerabilities. |
| Wiencierz and Lünich | 2022 | Impact of Data Privacy Practices on User Trust in Web Applications | Examination of data privacy practices' impact on user trust, focusing on transparency in data privacy policies and user data control mechanisms. | Limited generalizability due to focus on user perceptions rather than objective measures of trust. |
| Riadi et al. | 2020 | E-commerce Platform Data Breach Due to Payment System Vulnerability | Case study of an e-commerce platform data breach caused by a vulnerability in its payment processing system, resulting in financial losses and reputational damage. | Specific to a single case study, limited transferability of findings to other contexts. |
| Branch et al. | 2019 | Healthcare Organization Ransomware Attack Due to Electronic Medical Records Vulnerabilities | Case study of a healthcare organization's ransomware attack resulting from vulnerabilities in its electronic medical records system, disrupting healthcare services. | Specific to a single case study, limited generalizability to other industries or web applications. |
| Albulayhi and Khediri | 2022 | Data Privacy Practices of Social Media Platforms | Investigation of data privacy practices in social media platforms, highlighting transparency issues in data collection and processing. | Limited scope in examining practices of other types of web applications, potential bias in data collection methods. |
| Bwire | 2023 | Challenges in Compliance with Data Privacy Regulations | Examination of challenges faced by organizations in complying with data privacy regulations such as GDPR and NDPR. | Limited representation of organizations from diverse industries or regions, potential bias in participant selection. |

**Literature on NDPR**

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| **Author** | **Year** | **Title** | **Methodology** | **Limitation** |
| Olender | 2020 | Analysis of NDPR Provisions and Organizational Data Protection Practices | Analysis of NDPR provisions and assessment of their impact on organizations' data protection practices | Potential bias in interpretation of NDPR provisions, limited consideration of practical implementation challenges. |
| Huth et al. | 2020 | Factors Influencing Organizational Compliance with NDPR | Investigation of factors influencing organizational compliance with NDPR | Limited generalizability due to focus on specific organizational contexts, potential bias in participant selection. |
| Huising and Silbey | 2021 | Role of Regulatory Authorities in NDPR Enforcement | Examination of regulatory authorities' role in enforcing NDPR and ensuring accountability | Limited scope in assessing regulatory authorities' effectiveness, potential bias in data collection methods. |
| Hashmi et al. | 2022 | Evaluation of Web Application Privacy Policies' Compliance with NDPR | Assessment of web application privacy policies' compliance with NDPR requirements | Limited sample size in assessing web application privacy policies, potential bias in data collection methods. |
| Malek | 2021 | Implications of NDPR Data Minimization Principle for Web Application Development | Analysis of NDPR's data minimization principle implications for web application development | Limited consideration of practical challenges in implementing data minimization principles in web applications. |
| Stevens et al. | 2022 | Challenges in Implementing Technical and Organizational Measures under NDPR | Investigation of challenges faced by organizations in implementing NDPR's security requirements | Limited representation of organizational perspectives, potential bias in participant selection. |

**Literature on Vulnerability Assessment of Web Applications**

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| **Author** | **Year** | **Title** | **Methodology** | **Limitation** |
| Swead and Almustafa | 2019 | Case Study: Vulnerability Landscape of a Financial Institution's Web Application | Examination of vulnerabilities in a financial institution's web application | Specific to a single case study, limited generalizability to other types of web applications. |
| Polsani Jahnavi and Balla Manoj Kumar | 2021 | Case Study: Impact of Vulnerability Assessment on E-commerce Platform's Web Application | Investigation of vulnerability assessment impact on e-commerce platform's web application | Specific to a single case study, limited generalizability to other industries or web application contexts. |
| Siva Prasad et al. | 2018 | Effectiveness of Vulnerability Assessment Techniques in Web Applications | Comparison of vulnerability assessment techniques in identifying and mitigating vulnerabilities | Potential bias in the selection of techniques evaluated, limited consideration of emerging vulnerabilities. |
| Chernihiv Polytechnic National University et al. | 2022 | Review: Automated Scanning Tools in Vulnerability Assessment | Review of automated scanning tools' role in vulnerability assessment | Limited scope in assessing other vulnerability assessment techniques, potential bias in selection of tools reviewed. |
| Du et al. | 2019 | Review: Manual Code Review in Vulnerability Assessment | Review of manual code review's role in vulnerability assessment | Limited scope in assessing other vulnerability assessment techniques, potential bias in selection of studies reviewed. |
| Božić et al. | 2019 | Review: Penetration Testing in Vulnerability Assessment | Review of penetration testing's role in vulnerability assessment | Limited scope in assessing other vulnerability assessment techniques, potential bias in selection of studies reviewed. |

**Case Study: Vulnerability Assessment of Baze University Web Application**

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**Summary**

The literature review chapter delves into various aspects related to vulnerability assessment and data privacy in web applications, focusing on the National Data Protection Regulation (NDPR), vulnerability assessment techniques, case studies, and emerging trends. The following key points were discussed:

1. **National Data Protection Regulation (NDPR)**:
   * The NDPR is a crucial regulatory framework in Nigeria aimed at protecting individuals' personal data and ensuring data privacy in web applications.
   * Studies and research papers have explored the provisions, implementation challenges, and impact of the NDPR on data privacy practices in web applications.
2. **Vulnerability Assessment Techniques**:
   * Automated scanning tools, manual code reviews, and penetration testing are commonly used techniques in vulnerability assessment to identify and mitigate security vulnerabilities in web applications.
   * Case studies and research findings have highlighted the effectiveness of these techniques in identifying vulnerabilities and improving the security posture of web applications.
3. **Data Privacy Concerns and Practices**:
   * Data privacy concerns have become increasingly prominent in the context of web applications, with studies examining the transparency and accountability of data handling practices.
   * Emerging trends such as DevSecOps, containerization, microservices architecture, and the use of AI/ML techniques are shaping data privacy practices and vulnerability assessment methodologies in web applications.

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