



# **Assessing the Feasibility and Effectiveness of Blockchain Technology for Safeguarding Governmental Data Integrity: Focus on Sensitive Diplomatic Communications**

A.G.C.Dilshanie  
( Reg. No.: MS23001084 )

A THESIS  
SUBMITTED TO  
SRI LANKA INSTITUTE OF INFORMATION TECHNOLOGY IN  
PARTIAL FULFILMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF  
MASTER OF SCIENCE IN INFORMATION SYSTEMS

December 2024

I certify that I have read this thesis and that in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of *Master of Science*.



---

Prof. Anuradha Jayakody

Approved for MSc. Research Project:

---

MSc. Programme Co-ordinator, SLIIT

Approved for MSc:

---

Head of Graduate Studies, FoC, SLIIT

# DECLARATION

This is to certify that the work is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources). The work has not previously been submitted in any form to the Sri Lanka Institute of Information Technology or to any other institution for assessment for any other purpose.

Sign: .....Chamika.....

A.G.C. Dilshanie

Date: .....2025-01-16.....

# ABSTRACT

## **Assessing the Feasibility and Effectiveness of Blockchain Technology for Safeguarding Governmental Data Integrity: Focus on Sensitive Diplomatic Communications**

A.G.C.Dilshanie

MSc. in Information Systems

**Supervisor:** Prof. Anuradha Jayakody

December 2024

This thesis investigates the feasibility and effectiveness of implementing blockchain technology to safeguard governmental data integrity, with a specific focus on sensitive diplomatic communications. Given the increasing importance of data security in an era of digital transformation, this research adopts a comprehensive mixed-method approach. It combines quantitative surveys and qualitative interviews with government IT professionals, blockchain experts, and policy makers to assess the technological, operational, and regulatory dimensions of blockchain implementation.

The study reveals that blockchain technology offers substantial benefits in enhancing data security, primarily due to its inherent characteristics such as immutability, transparency, and decentralized architecture. These features are particularly crucial for maintaining the integrity and confidentiality of sensitive diplomatic communications, which are often vulnerable to unauthorized access and tampering. The research highlights that blockchain's ability to create tamper-proof records and ensure transparent transactions aligns well with the needs of secure diplomatic exchanges.

However, the study also identifies several significant challenges that need to be addressed. Issues such as scalability, high energy consumption, regulatory compliance, and the complexity of integrating blockchain with existing governmental IT systems are notable barriers to effective implementation. To address these challenges, the study proposes a detailed framework that includes technical solutions, policy adjustments, and strategic recommendations. This framework

aims to facilitate the strategic adoption of blockchain technology within government sectors, providing a structured approach to overcoming obstacles and leveraging blockchain's potential to enhance data integrity and security in sensitive areas such as diplomatic communications.

# ACKNOWLEDGEMENT

I would like to extend my deepest gratitude to my supervisor, Professor Anuradha Jayakody, for his exceptional guidance and steadfast support throughout this research journey. His expertise, insightful feedback, and encouragement have been pivotal in the development and completion of this thesis. Professor Jayakody's dedication and commitment to excellence have greatly inspired and motivated me.

Additionally, I am profoundly grateful to the government employees and blockchain experts who participated in this study. Their willingness to share their knowledge, experiences, and perspectives has been invaluable. The insights they provided have significantly enriched the research and contributed to a deeper understanding of the subject matter.

I am truly appreciative of the time and effort they invested in this project, and their contributions have played a crucial role in shaping the outcomes of this thesis.

Thank you all for your generous support and for helping to make this research possible.

# TABLE OF CONTENTS

|   |           |
|---|-----------|
| <b>DECLARATION</b> .....  | <b>3</b>  |
| <b>ABSTRACT</b> .....   | <b>4</b>  |
| <b>ACKNOWLEDGEMENT</b> .....  | <b>6</b>  |
| <b>TABLE OF CONTENTS</b> .....  | <b>7</b>  |
| <b>List of Figures</b> .....  | <b>9</b>  |
| <b>List of Tables</b> .....   | <b>9</b>  |
| <b>Chapter 1 Introduction</b> .....   | <b>10</b> |
| <b>1.1 Background</b> .....   | <b>10</b> |
| <b>1.2 Problem Statement</b> .....  | <b>11</b> |
| <b>1.3 Research Objectives</b> .....  | <b>12</b> |
| <b>1.4 Research Questions</b> .....   | <b>13</b> |
| <b>1.5 Significance of the Study</b> .....  | <b>14</b> |
| <b>1.6 Blockchain Governance and Organizational Structures</b> .....                  | <b>16</b> |
| <b>1.7 Case Studies and Real-World Applications of Blockchain in Government</b> ..... | <b>20</b> |
| <b>Chapter 2 Literature Review</b> .....  | <b>25</b> |
| <b>2.1 Blockchain Technology: An Overview</b> .....                                   | <b>25</b> |
| <b>2.2 Blockchain in Governmental Applications</b> .....                              | <b>26</b> |
| <b>2.3 Challenges in Blockchain Adoption for Governmental Data Security</b> .....     | <b>26</b> |
| <b>2.4 Blockchain’s Application in Securing Diplomatic Communications</b> .....       | <b>28</b> |
| <b>Chapter 3 Research Methodology</b> .....   | <b>30</b> |
| <b>3.1 Research Design</b> .....  | <b>30</b> |
| <b>3.2 Data Collection Methods</b> .....  | <b>31</b> |
| <b>3.3 Sample Selection</b> .....   | <b>32</b> |
| <b>3.4 Data Analysis Techniques</b> .....   | <b>35</b> |
| <b>3.5 Research Ethics</b> .....  | <b>39</b> |
| <b>3.6 Implementation Guidelines</b> .....  | <b>40</b> |
| <b>3.7 Data Security and Privacy Protocols</b> .....                                  | <b>41</b> |
| <b>3.8 Operational and Organizational Policies</b> .....                              | <b>42</b> |
| <b>3.9 Ethical and Compliance Considerations</b> .....                                | <b>43</b> |

|  |            |
|--|------------|
| <b>3.10 Training and Capacity-Building</b> .....                                   | <b>44</b>  |
| <b>3.11 Continuous Monitoring and Adaptation</b> .....                             | <b>45</b>  |
| <b>Chapter 4 Findings and Discussion</b> .....                                     | <b>46</b>  |
| <b>4.1 Technical Feasibility of Blockchain for Diplomatic Communications</b> ..... | <b>46</b>  |
| <b>4.2 Effectiveness of Blockchain in Enhancing Data Security</b> .....            | <b>48</b>  |
| <b>4.3 Operational Challenges and Proposed Solutions</b> .....                     | <b>49</b>  |
| <b>4.4 Regulatory and Compliance Considerations</b> .....                          | <b>50</b>  |
| <b>4.5 Proposed Framework for Blockchain Adoption</b> .....                        | <b>54</b>  |
| <b>4.6 Summary of Survey Results</b> .....   | <b>57</b>  |
| <b>4.7 Data Analysis and Visuals</b> .....   | <b>60</b>  |
| <b>4.8 Recommendations</b> .....   | <b>65</b>  |
| <b>4.9 Insufficient Findings and Data Limitations</b> .....                        | <b>66</b>  |
| <b>4.10 Policy Implications</b> .....  | <b>67</b>  |
| <b>4.11 Recommendations for Future Research</b> .....                              | <b>69</b>  |
| <b>4.12 Simulations and Validation of Guidelines</b> .....                         | <b>70</b>  |
| <b>4.13 Simulator UIs</b> .....  | <b>71</b>  |
| <b>Chapter 5 Conclusion</b> .....  | <b>76</b>  |
| <b>5.1 Summary of Key Insights and Research Outcomes</b> .....                     | <b>76</b>  |
| <b>5.2 Key Insights and Contributions</b> .....                                    | <b>78</b>  |
| <b>5.3 Policy and Practical Implications</b> .....                                 | <b>79</b>  |
| <b>5.4 Future Research Directions</b> .....  | <b>80</b>  |
| <b>Chapter 6 References</b> .....  | <b>82</b>  |
| <b>Chapter 7 Appendix</b> .....  | <b>86</b>  |
| <b>Appendix 1: Survey Instruments</b> .....  | <b>86</b>  |
| <b>Appendix 2: Raw Data and Analysis</b> .....                                     | <b>90</b>  |
| <b>Appendix 3: Detailed Descriptions of Visuals</b> .....                          | <b>93</b>  |
| <b>Appendix 4: Technical Details of the Simulator</b> .....                        | <b>94</b>  |
| <b>Appendix 5: Ethics and Compliance Documentation</b> .....                       | <b>100</b> |
| <b>Appendix 6: Expanded Implementation Guidelines</b> .....                        | <b>101</b> |
| <b>Appendix 7: Additional Literature Review Material</b> .....                     | <b>101</b> |
| <b>Appendix 8: Glossary of Terms</b> .....   | <b>101</b> |

# List of Figures

Figure 1 : Government Employees' Familiarity with Blockchain (Pie Chart).....61

Figure 2 : Government Employees' Confidence in Blockchain Implementation (Bar Chart) .....62

Figure 3 : Blockchain Experts' Perceptions of Technical Feasibility (Bar Chart) .....63

Figure 4: Blockchain Experts' Confidence in Blockchain Technology (Pie Chart) .....64

Figure 5: File Upload UI.....71

Figure 6: Uploaded Files UI .....73

Figure 7: Backend Console Display .....74

Figure 8: Familiarity with Blockchain (Government Employees vs. Blockchain Experts).....91

Figure 9: Confidence in Blockchain’s Application (Government Employees vs. Blockchain Experts) .....91

Figure 10: Perceived Technical Feasibility of Blockchain for Government .....92

Figure 11 : Frequency Distribution of Confidence Levels (Government Employees) .....92

Figure 12: Blockchain Architecture Diagram.....93

# List of Tables

Table 1 : Survey Data Summary .....90

Table 2: Phased Implementation Timeline .....94