MSc Computing Project Research Proposal and Ethical Approval

# **Student Details**

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| **Student Name** | Anrich Potgieter |
| **Proposed Research Title** | A permissioned blockchain prototype facilitating banking record interoperability. |
| **Supervisor** | Dr Imtiaz Kahn |

Contents

[**Student Details** 1](#_Toc105566663)

[**Section 1: Research Proposal** 3](#_Toc105566664)

[**Research Area** 3](#_Toc105566665)

[**Working Title** 3](#_Toc105566666)

[**Introduction** 3](#_Toc105566667)

[**Aim of Project** 4](#_Toc105566668)

[**Research Questions** 4](#_Toc105566669)

[**Objectives** 4](#_Toc105566670)

[**Literature Review Outline** 5](#_Toc105566671)

[**Defining blockchain technology** 5](#_Toc105566672)

[**Organisational interoperability** 5](#_Toc105566673)

[**Facilitating interoperability using blockchain** 5](#_Toc105566674)

[**Blockchain technology in banking organisations** 5](#_Toc105566675)

[**Blockchain data storage and retrieval** 5](#_Toc105566676)

[**Methodology** 5](#_Toc105566677)

[**Key Literature** 6](#_Toc105566678)

[**Human Participants** 8](#_Toc105566679)

[**Timeline** 9](#_Toc105566680)

[**Section 2: Ethical Approval** 10](#_Toc105566681)

[**Consent** 10](#_Toc105566682)

[**Right to Withdraw** 10](#_Toc105566683)

[**Confidentiality** 11](#_Toc105566684)

[**Harm** 11](#_Toc105566685)

[**Data Access, Storage and Security** 11](#_Toc105566686)

[**Section 3: Risk Assessment** 11](#_Toc105566687)

[**Section 4: Confirmation Statements** 11](#_Toc105566688)

[**References** 12](#_Toc105566689)

[**Appendices** 12](#_Toc105566690)

[**Appendix A: Participant Information Sheet** 12](#_Toc105566691)

[**Appendix B: Participant Consent Form** 15](#_Toc105566692)

# **Section 1: Research Proposal**

## **Research Area**

Blockchain technology.

## **Working Title**

A permissioned blockchain prototype facilitating banking record interoperability.

## **Introduction**

Banking organisations deal with significant amounts of customer records used by various departments such as insurance, personal lending and marketing ('Blockchain in Banking - 15 Possible Use Cases', 2022). The organisations use customer information to fulfil multiple processes, such as processing insurance claims or communicating with customers through various marketing campaigns (IBM, 2022).

Banking organisations use fragmented technologies to fulfil such functions where data required to perform tasks is stored in databases that lack interoperability. For organisations to achieve interoperability, various challenges arise from legacy systems interoperating with newly developed systems (European Commission. Directorate General for Informatics., 2017). The ('IEEE Standard Computer Dictionary: A Compilation of IEEE Standard Computer Glossaries', 1991) outlines that interoperability is "The ability of two or more systems or components to exchange information and to use the information that has been exchanged." Furthermore, the (European Commission. Directorate General for Informatics., 2017) outlines an interoperability framework for defining the various interoperability layers. They outline that technical interoperability includes "applications and infrastructures linking systems and services".

Achieving interoperability mentioned previously has been an arduous task. Organisations typically facilitate data exchange through complex data structures and use APIs to enable data interoperability for their legacy systems. In recent years we have seen the explosion of blockchain technology and its applicability to decentralised finance, specifically in cryptocurrencies. Additionally, as research and development around blockchain technology has continued, we have seen the emergence of alternative uses for blockchain technology, such as facilitating data integrity and immutability in public service organisations (Shahaab *et al.*, 2021) and health record interoperability, as seen in research by (Jabbar *et al.*, 2020). These emerging research areas propose exciting solutions to the legacy problems that have plagued systems that require secure, seamless data exchange that facilitates the interoperation of legacy systems.

## **Aim of Project**

This project aims to explore organisational data interoperability by developing a prototype blockchain application that facilitates data interoperability between departments within a banking organisation.

### **Research Questions**

#### **Research Question 1**

How can blockchain technology facilitate data interoperability in a banking organisation?

## **Objectives**

* Explore the definition of organisational data interoperability.
* Contrast the differences between organisational interoperability and blockchain interoperability.
* Identify an open-source framework for developing blockchain applications.
* Design and develop a permissioned blockchain network that facilitates inter-organisational data sharing and organisational interoperability.
* Evaluate whether the system meets a series of defined requirements.
* Interview actors from relevant industries and evaluate the artefacts’ requirements.

## **Literature Review Outline**

### **Defining blockchain technology**

### **Organisational interoperability**

### **Facilitating interoperability using blockchain**

### **Blockchain technology in banking organisations**

### **Blockchain data storage and retrieval**

## **Methodology**

I will use the research design and methodology Design Science Research (DSR). DSR is traditionally used in the information systems field, where an artefact is created throughout the research process. (Hevner *et al.*, 2004) suggest the purpose of DSR is to create an artefact that improves the "effectiveness and efficiency of the context of the project". (Sein *et al.*, 2011) outline a design science method that provides a framework for approaching such research, the stages of the research are as follows:

1. Problem Formulation
2. Building, Intervention and Evaluation (Artefact)
3. Reflection and learning
4. Formalisation of Learning

The above method provides an iterative agile style approach that is well suited to computing projects.

The research performed in this project will take place within the context of a banking organisation. It will explore the research questions through interviews that will define system requirements within the context of departments within a baking organisation. Furthermore, participants will be further interviewed to determine whether the system's requirements were met and whether the user interface provided by the artefact can fulfil their business needs.

The interview processes will reveal a series of requirements for the system; these will define unit tests that determine whether the resulting artefact has met the requirements outlined in the interview process. Whether the unit tests have passed will determine the success of the project's development phase and will provide means to present data about the development.

## **Key Literature**

Abebe, E. *et al.* (2019) 'Enabling Enterprise Blockchain Interoperability with Trusted Data Transfer (Industry Track)', in *Proceedings of the 20th International Middleware Conference Industrial Track*. New York, NY, USA: Association for Computing Machinery (Middleware' 19), pp. 29–35. doi:[10.1145/3366626.3368129](https://doi.org/10.1145/3366626.3368129).

Belchior, R. *et al.* (2021) 'A Survey on Blockchain Interoperability: Past, Present, and Future Trends', *ACM Computing Surveys*, 54(8), p. 168:1-168:41. doi:[10.1145/3471140](https://doi.org/10.1145/3471140).

Hevner, A.R. *et al.* (2004) 'Design Science in Information Systems Research', *MIS Quarterly*, 28(1), pp. 75–105. doi:[10.2307/25148625](https://doi.org/10.2307/25148625).

IBM (2022) 'Blockchain: Emerging Use Cases  for Insurance'. Available at: <https://www.the-digital-insurer.com/wp-content/uploads/2019/02/1409-Blockchain-Emerging-Use-Cases-for-Insurance.pdf> (Accessed: 11 May 2022).

Jabbar, R. *et al.* (2020) 'Blockchain technology for healthcare: Enhancing shared electronic health record interoperability and integrity', in *2020 IEEE International Conference on Informatics, IoT, and Enabling Technologies (ICIoT)*. *2020 IEEE International Conference on Informatics, IoT, and Enabling Technologies (ICIoT)*, pp. 310–317. doi:[10.1109/ICIoT48696.2020.9089570](https://doi.org/10.1109/ICIoT48696.2020.9089570).

Kappen, D.L. (2019) 'Simplifying Design Science Research, Action Research and Design Research', *Medium*, 22 September. Available at: <https://medium.com/@3D_Ideation/simplifying-design-science-research-action-research-and-design-research-bf564959402b> (Accessed: 11 May 2022).

Peffers, K., Tuunanen, T. and Niehaves, B. (2018) 'Design science research genres: introduction to the special issue on exemplars and criteria for applicable design science research', *European Journal of Information Systems*, 27(2), pp. 129–139. doi:[10.1080/0960085X.2018.1458066](https://doi.org/10.1080/0960085X.2018.1458066).

Shahaab, A. *et al.* (2021) 'A Hybrid Blockchain Implementation to Ensure Data Integrity and Interoperability for Public Service Organisations', in *2021 IEEE International Conference on Blockchain (Blockchain)*. *2021 IEEE International Conference on Blockchain (Blockchain)*, pp. 295–305. doi:[10.1109/Blockchain53845.2021.00047](https://doi.org/10.1109/Blockchain53845.2021.00047).

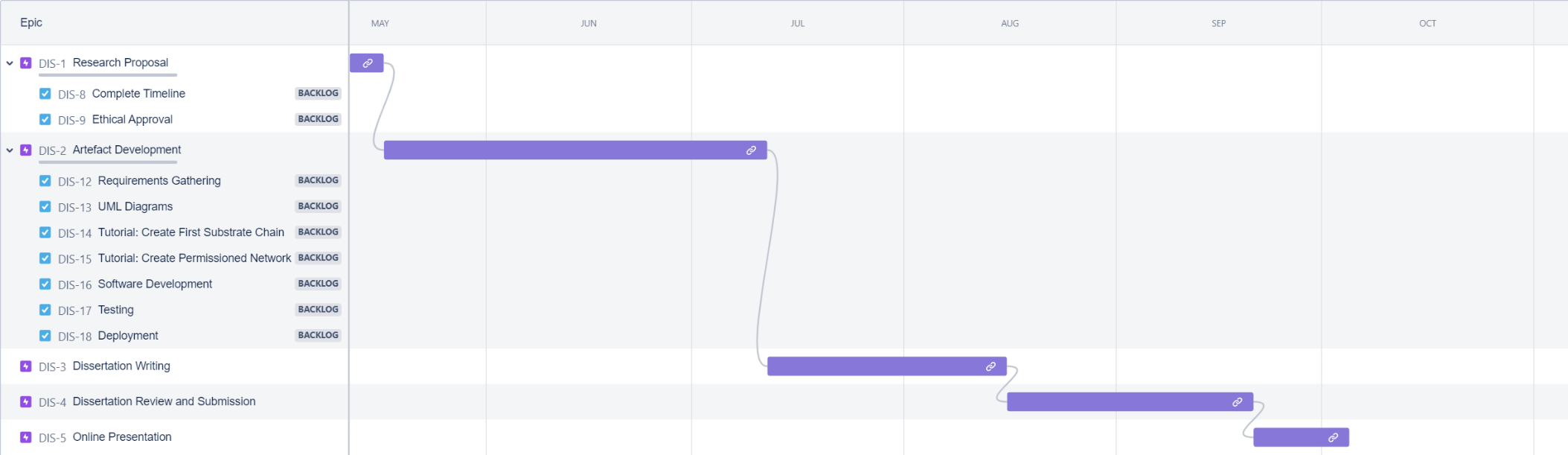
Substrate (no date) *Start a Permissioned Network*, *Substrate*. Available at: <https://docs.substrate.io> (Accessed: 11 May 2022).

Zhang, P. *et al.* (2018) 'FHIRChain: Applying Blockchain to Securely and Scalably Share Clinical Data', *Computational and Structural Biotechnology Journal*, 16, pp. 267–278. doi:[10.1016/j.csbj.2018.07.004](https://doi.org/10.1016/j.csbj.2018.07.004).

## **Human Participants**

In this research project, human participants will represent members of various parts of a banking organisation. These participants will participate in Zoom meetings where they will be interviewed regarding their expertise. They will complete a series of manual user tests on a graphical user interface so that it is possible to determine the effectiveness of the application developed and whether the requirements are met.

## **Timeline**



# **Section 2: Ethical Approval**

## **Consent**

Participants are provided with a participant information sheet (See Appendix A) and a participant consent form (See Appendix B). Within the information sheet, participants are provided with the following information:

* Research Project Title
* Invitation
* The Purpose of the Research
* Where and When the Research Will Take Place
* What the participant will need to do
* The possible benefits of taking part in the research
* The possible disadvantages and risks of taking part in the research
* Whether or not they have to take place
* How I will keep the participant data confidential
* Whether the participant will receive payment
* Who has reviewed and provided ethical clearance for the research project
* Further information and contact details

## **Right to Withdraw**

Students are informed within the participant information sheet (See Appendix A) that they have the right to withdraw from the study. They are encouraged to make contact with the researcher at their nearest convenience. Once I have received the email from the participant, I will ensure that I remove all data collected to date from the participant.

## **Confidentiality**

All participants' data will be securely stored within a Google Drive directory that is password protected with a secure password and two-factor authentication. Furthermore, all participants will be referred to anonymously, and no personally identifiable information will be used within the project or dissertation.

## **Harm**

All participants will be treated with the utmost respect and dignity. Personally identifiable information and sensitive data will only be collected when necessary. Finally, all participants will be reminded that they have the right to withdraw at any time during the research project and will be provided with relevant information if they indicate that they are a harm to themselves.

## **Data Access, Storage and Security**

All data processing will be done per the GDPR directive. Personally identifiable information will be accurately captured, and only essential data will be processed. Furthermore, data will be securely stored in a password protected cloud storage solution with two-factor authentication. Finally, personally identifiable data will only be stored for a necessary period to complete the project.

# **Section 3: Risk Assessment**

# **Section 4: Confirmation Statements**

I, Anrich Potgieter, confirm that my research study has a potential benefit. I have read the Research Ethics Policy and the relevant sections of the Research Ethics Procedures and will adhere to these in the conduct of this project.

# **References**

‘Blockchain in Banking - 15 Possible Use Cases’ (2022) *The Blockchain Forum*. Available at: https://www.linkedin.com/posts/theblockchainforum\_blockchain-in-banking-activity-6928541204632477696-Qf1p/?utm\_source=linkedin\_share&utm\_medium=member\_desktop\_web (Accessed: 11 May 2022).

European Commission. Directorate General for Informatics. (2017) *New European interoperability framework: promoting seamless services and data flows for European public administrations.* LU: Publications Office. Available at: https://data.europa.eu/doi/10.2799/78681 (Accessed: 11 May 2022).

Hevner, A.R. *et al.* (2004) ‘Design Science in Information Systems Research’, *MIS Quarterly*, 28(1), pp. 75–105. doi:10.2307/25148625.

IBM (2022) ‘Blockchain: Emerging Use Cases for Insurance’. Available at: https://www.the-digital-insurer.com/wp-content/uploads/2019/02/1409-Blockchain-Emerging-Use-Cases-for-Insurance.pdf (Accessed: 11 May 2022).

‘IEEE Standard Computer Dictionary: A Compilation of IEEE Standard Computer Glossaries’ (1991) *IEEE Std 610*, pp. 1–217. doi:10.1109/IEEESTD.1991.106963.

Jabbar, R. *et al.* (2020) ‘Blockchain technology for healthcare: Enhancing shared electronic health record interoperability and integrity’, in *2020 IEEE International Conference on Informatics, IoT, and Enabling Technologies (ICIoT)*. *2020 IEEE International Conference on Informatics, IoT, and Enabling Technologies (ICIoT)*, pp. 310–317. doi:10.1109/ICIoT48696.2020.9089570.

Sein, M.K. *et al.* (2011) ‘Action Design Research’, *MIS Quarterly*, 35(1), pp. 37–56. doi:10.2307/23043488.

Shahaab, A. *et al.* (2021) ‘A Hybrid Blockchain Implementation to Ensure Data Integrity and Interoperability for Public Service Organisations’, in *2021 IEEE International Conference on Blockchain (Blockchain)*. *2021 IEEE International Conference on Blockchain (Blockchain)*, pp. 295–305. doi:10.1109/Blockchain53845.2021.00047.

# **Appendices**

## **Appendix A: Participant Information Sheet**

**Research project title**

A permissioned (Hybrid) blockchain prototype facilitating banking record interoperability.

**Invitation**

You are invited to take part in this research study. You have been chosen to partake in this study due to your unique experience in an industry that is relevant to the context of the research. Please make sure that you read all of the following information about the research, and feel free to contact the researcher with any questions you may have.

**What is the purpose of the research?**

The purpose of the research project is to fulfil the learning outcomes of an MSc Computer Science Dissertation. Furthermore, the research is attempting to explore a gap in knowledge about the application of blockchain technology in baking record interoperability. The study will explore how departments within a bank can interoperate with client data stored in a decentralised manner within a blockchain ecosystem. The use of blockchain technology will ensure that all data is up to date, and changes made to the data will be auditable due to the nature of a blockchain's immutable records.

**Where and when will the research take place?**

Throughout the project's development phase, you will be required to partake in a series of interviews that will include manual testing of a graphical user interface of a blockchain application. There will be two interviews, one hour in length via Zoom week commencing 27 June.

**What will I have to do?**

You will participate in a Zoom meeting with the researcher, where you will be asked a series of questions while engaging with an application's user interface. During this time, you will be required to share your screen and consent to the meeting recording so that the researcher can refer back to your responses throughout the interview.

**What are the possible benefits of taking part?**

Blockchain technology continues to see high levels of adoption in various industries throughout the world. Participating in this study will provide you with a unique opportunity to engage with blockchain technology and its applications in unique use cases like the one outlined in this study.

**What are the possible disadvantages and risks of taking part?**

As this study will require you to be involved in interviews that are one hour in length, these will likely take place in a period that is outside of your usual work hours; as a result, you will have a busier than usual schedule during this time.

**Do I have to take part?**

Your participation in this study is voluntary, and you are free to withdraw from the study at any time. Please contact the researcher if you wish to withdraw from the study using the contact details below. All data gathered from you will be destroyed per the GDPR directives' right to erasure clause.

**How will my personal data be kept confidential?**

Data will be collected from you throughout the study in the form of emails (Word Documents) and Zoom recordings. All personally identifiable information will be securely stored on a password-protected Google Drive with Two Factor Authentication enabled. The research project is supervised by two supervisors from the University of Essex, and they too will have access to this data. All data collected will be used within the study to draw various conclusions about the research outcomes; however, you will remain anonymous throughout said conclusions. Finally, all stored data will only be stored for a period necessary to complete the dissertation; all data will be purged once complete.

**Will I receive payment for taking part?**

You will not receive any payment for taking part in the research study.

**What will happen if I do not want to continue with the study?**

If you decide to withdraw from the study, please notify the researcher at your nearest convenience using the contact details provided at the end of this document. All data collected to date will be destroyed in accordance with the GDPR directive.

**Who has ethically reviewed the project?**

This research project has been ethically reviewed by both the supervisors who are overseeing this project, in addition to the supervisors, the head of the department reviews all projects quarterly.

**What will happen to the results of the research project?**

The results of this project and the final dissertation will be made available at the following URL: [anrichp/Dissertation (github.com)](https://github.com/anrichp/Dissertation)

**Further information and contact details**

#### Researcher Contact Details

Name: Anrich Potgieter

Email Address: [anrichp@gmail.com](mailto:anrichp@gmail.com)

#### Supervisor contact details

Name: Dr Imtiaz Kahn

Email Address: [imtiaz.khan@kaplan.com](mailto:imtiaz.khan@kaplan.com)

Thank you for taking the time to read this information sheet.

## **Appendix B: Participant Consent Form**

Research title: A permissioned blockchain prototype facilitating banking record interoperability.

Participant number:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | | | | Yes | No |
| 1 | I have read and understood the Participant Information Sheet for the study and have been provided with a copy to keep. | | | |  |  |
| 2 | I have been given the opportunity to ask the researcher questions about this research project. | | | |  |  |
| 3 | I understand that I have the right to withdraw from the research without giving a reason and that all information I have provided will be destroyed. | | | |  |  |
| 4 | I understand that interviews will be recorded to aid transcription and accuracy. | | | |  |  |
| 5 | I understand that my identity will be protected by treating the information I provide anonymously, and it will be used solely by the researcher for the purpose of writing a report on the research project. | | | |  |  |
| 6 | I understand that the information I provide will be kept securely, will not be revealed to any other party, and will be destroyed at the conclusion of the project. | | | |  |  |
| 7 | I understand that if I have any questions or concerns about how this research is being conducted, I can contact the independent person named in the Participant Information Sheet. | | | |  |  |
| I consent to participate in this research interview according to the information and principles described in the information sheet. | | | | | | |
| Signed | |  | Date |  | | |