| **VIETNAM NATIONAL UNIVERSITY, HANOI**  **INTERNATIONAL SCHOOL**    **PROGRAM: FINTECH AND DIGITAL BUSINESS**    **PROJECT II REPORT**  **Leveraging Blockchain for Loyalty Points Management in E-Commerce Platforms**          SUPERVISOR: Pham Duc Tho  STUDENT: Ha Thi Thu Trang  STUDENT ID: 22071127  CLASS: FDB2022-A        ***Hanoi - Year 2025*** |
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# **Preface**

In the context of the rapid growth and increasing competitiveness of e-commerce, loyalty programs play a crucial role in attracting and retaining consumers. By offering reward points that can be redeemed for discounts, gifts, or services, businesses not only encourage customers to return for future purchases but also foster strong, long-term relationships with them.

However, most e-commerce platforms today operate their own isolated reward point systems, leading to fragmentation, lack of interoperability, and difficulties for users in converting or utilizing their points across multiple platforms. Additionally, reward points are often non-transferable and can lose value if customers stop using a specific platform. For businesses, maintaining separate systems results in high management costs, potential security risks, and reduced operational efficiency.

Based on these challenges, this project aims to explore and propose a pilot model utilizing blockchain technology to issue, manage, and facilitate the exchange of reward points across various shopping platforms. With key features such as decentralization, transparency, and immutability, blockchain enables users to seamlessly accumulate, transfer, and redeem reward points across different e-commerce platforms. The study focuses on enhancing the utility of reward points, optimizing user experience, and ensuring transparency, security, and convenience for both businesses and customers.

# **Chapter 1: Introduction**

## **Problem Introduction**

Currently, loyalty programs based on reward point management systems are widely implemented across various e-commerce platforms. However, most of these systems are designed and operated independently, resulting in a lack of interoperability between platforms. Consumers are unable to use reward points from one platform to redeem benefits on another, leading to a less flexible user experience. For businesses, maintaining separate reward point systems incurs management costs, complicates data security control, and limits collaboration with other partners.

## Problem Characteristics

* Existing reward point systems operate in isolation, with no common standard, creating barriers to cross-platform interaction.
* Users cannot convert, transfer, or use reward points across different platforms.
* When customers stop using a platform, their accumulated reward points become worthless.
* Businesses must invest in separate technical infrastructure and operational processes, increasing security vulnerabilities and the risk of fraud.
* Centralized systems allow businesses to arbitrarily adjust reward policies, potentially leading to a lack of transparency and eroding customer trust.

## Problem Relationships

The management of reward points is not only linked to customer experience but also involves security and other related aspects. Storing reward point information in centralized systems increases the risk of user data breaches. Additionally, a lack of transparency in point accumulation and redemption directly affects customer trust. Businesses must independently build and maintain their reward point systems, reducing cost efficiency. The absence of a standardized system also hinders business partnerships and platform collaboration.

## Objectives for Problem Resolution

This project aims to develop and test a blockchain-based reward point management system to effectively address the issues mentioned above. The specific objectives include:

* **Interoperability and integration:** Design a system that enables users to accumulate, transfer, and redeem reward points across multiple e-commerce platforms.
* **Transparency and security:** Leverage blockchain technology to ensure all transactions related to reward points are transparent, immutable, and easily verifiable.
* **Flexible transferability:** Allow users to seamlessly transfer reward points between accounts or platforms quickly and efficiently.
* **Reduced operational costs and improved management efficiency:** Businesses can participate in a shared network rather than building independent systems, minimizing development and maintenance costs.
* **Foundation for cross-platform collaboration:** Propose a unified reward point management framework that encourages partnerships among e-commerce businesses and fosters an interconnected ecosystem.

# Chapter 2: Theoretical Foundation

## Related Literature

To establish a solid theoretical foundation for this research, I have reviewed and synthesized relevant literature. The data collection process focuses on the following topics:

* Overview of loyalty programs.
* Reward point management systems on e-commerce platforms.
* Blockchain technology and its applications in finance and data management.
* Models for applying blockchain in reward point management systems.
* Studies, whitepapers, and practical reports on blockchain integration in the e-commerce sector.

## Sources of Literature Search

The process of collecting research materials is based on various sources to ensure comprehensiveness and up-to-date information. The main sources include:

* **Academic journals and conference proceedings**: Relevant papers retrieved from Google Scholar, IEEE Xplore, and ResearchGate.
* **Online articles and technology reports**: Insights from industry sources discussing blockchain adoption in loyalty programs.

## Methodology for Literature Search and Compilation

The process of searching and compiling literature is carried out through the following steps:

* **Identify keywords**: The main keywords include "blockchain-based loyalty programs", "blockchain in e-commerce", "decentralized loyalty points", "smart contract for loyalty management", "customer rewards and blockchain", etc.
* **Search in scientific databases**: Use platforms such as Google Scholar, IEEE Xplore, ResearchGate, and Semantic Scholar to collect relevant research papers.
* **Skim and evaluate the literature**: Filter the literature based on relevance to the research topic, the credibility of the source, and the publication year (priority is given to materials from 2018 onwards).
* **Categorize and synthesize**: The literature is categorized into groups such as blockchain theory, applications in e-commerce, loyalty point management models, and challenges and opportunities of blockchain in this field.

## Search Results and Document Compilation

From the search process, approximately 30 relevant documents have been compiled, including:

* **Scientific articles**: 18 articles from Business
* **Reports from research organizations**: 12 documents

These materials have been compiled to create a theoretical foundation and provide practical evidence for research, helping to analyze and evaluate the applications of blockchain in reward point management and loyalty programs in e-commerce.

## Analysis of Relevant Research on the Topic

Research on the application of blockchain technology in customer loyalty programs has highlighted several important areas and factors:

* **Blockchain in Loyalty Point Management**:
* Many studies (e.g., Boucher, 2020; Lee & Kim, 2023) have shown that blockchain can address issues such as transparency and security in loyalty programs.
* Studies such as Gupta and Kumar (2021) focus on using smart contracts to automate loyalty point management processes, reducing costs and enhancing customer trust.
* **Blockchain and Transparency**:
* Some studies (e.g., Hader & El Mhamedi, 2020) suggest that blockchain improves transparency in loyalty programs due to its immutable nature. This helps increase customer trust in these systems.
* Similarly, research by Antoniadis et al. (2019) demonstrates that blockchain helps brands maintain the integrity of data related to loyalty programs.
* **Models and the Future of Loyalty Programs**:
* Research by Singh and Gupta (2022) outlines a model for blockchain-based loyalty programs, particularly the benefits of exchanging loyalty points across different platforms.
* Studies from research organizations like Deloitte (2018) and IBM (2021) highlight the rapid growth of blockchain in various industries and e-commerce, as well as the potential of blockchain to innovate and reshape current loyalty models.

## Analysis of Advantages of Related Studies

* **High Transparency and Security**: The studies consistently show that blockchain enhances security and transparency in loyalty program transactions. Its immutability ensures that customer data and transactions cannot be altered, thereby fostering trust in loyalty systems (Hader & El Mhamedi, 2020).
* **Data Integrity**: Blockchain ensures that loyalty points cannot be tampered with or forged, which makes loyalty programs more reliable. Research by Gupta and Kumar (2021) and Antoniadis et al. (2019) highlights this as one of the most crucial factors in improving loyalty programs.
* **Cost Reduction in Management**: Many studies indicate that blockchain can reduce the costs associated with managing loyalty programs, primarily through the automation provided by smart contracts and reducing the need for third-party intermediaries (Gupta & Kumar, 2021).
* **Scalability and Flexibility**: Another advantage is blockchain’s scalability and flexibility, allowing loyalty programs to easily integrate and interact with other platforms, as noted in studies by Singh and Gupta (2022).

## Analysis of Limitations of Related Studies

* **Challenges in Implementation**: One of the major limitations of the studies is the challenge of implementing blockchain in real-world scenarios. Although blockchain can improve transparency and security, its deployment in the e-commerce environment faces difficulties, especially for small businesses or organizations not yet ready to invest in new technologies (Thompson & Patel, 2021).
* **High Initial Investment Costs**: Studies from Deloitte (2018) and IBM (2021) indicate that implementing blockchain can require a large upfront investment, particularly for private blockchain systems, which may impose a financial burden on smaller companies.
* **Lack of Standards and Interoperability**: Another limitation is the absence of common standards for the implementation and use of blockchain in loyalty programs, as pointed out by Antoniadis et al. (2019). This can lead to incompatibility between different blockchain systems, reducing the effectiveness of these programs.
* **Regulatory and Legal Issues**: Some studies also mention that implementing blockchain in loyalty programs may face regulatory and legal challenges. Issues regarding consumer privacy when using this technology, especially in countries with strict data protection regulations, present significant challenges (Lee & Kim, 2023).
* **Lack of Empirical Studies**: While theoretical and modeling studies are strong, there is a lack of empirical research and real-world experiments regarding the implementation of blockchain in loyalty programs. This means that there is insufficient practical evidence to validate the long-term benefits of blockchain in these systems (Jones & Robinson, 2020).

1. **Work plan**

| Week 1 | - Research an overview of traditional loyalty point systems and their limitations.  - Study blockchain technology and its potential applications. |
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| Week 2 | - Survey blockchain-based loyalty point models.  - Define system requirements for the proposed model. |
| Week 3 | - Design ERC-20 token for loyalty points.  - Design smart contract workflows.  - Design user wallet functions. |
| Week 4 | - Develop smart contracts using Solidity.  - Test smart contracts on Ethereum testnet. |
| Week 5 | - Integrate MetaMask wallet.  - Build a simple frontend interface.  - Connect frontend with smart contracts. |
| Week 6 | - Run demo of issuing, transferring, and redeeming loyalty points.  - Complete final report. |

1. **Expected results**

This research is expected to develop a prototype of a blockchain-based loyalty points management system with basic functionalities such as issuing, accumulating, transferring, and redeeming loyalty points. Users will be able to easily utilize their points across different wallets without platform barriers. The system will ensure transparency and security through the use of ERC-20 standard smart contracts, minimizing fraud and protecting user interests. Additionally, this solution will help e-commerce businesses reduce the operational costs of managing loyalty programs compared to traditional models.