Andaman Token: A Feasibility Study of Blockchain Adoption in the Tourism Industry

Warodom Werapun, Nattawat Songsom, Tanakan Khongfai, Ayuth Intrapradit, Jakapan Suaboot

College of Computing, Prince of Songkla University, Kathu, Phuket 83120, Thailand

{warodom.w, s6430621005, s6330613005, ayuth.i, jakapan.su}@phuket.psu.ac.th

***Abstract*— This paper investigates investment costs and challenges of implementing digital money in the tourism industry. Electronic cash offers financial transparency and transaction efficiency by eliminating the reliance on physical cash via a voucher system. Also, it enables travelers to make instant payments for bookings, accommodations, and services through digital platforms, thus simplifying cross-border transactions. However, recent difficulties encountered by Russian tourists in Thailand highlight the negative impact of restricted financial transactions on tourism revenue, underscoring the need for further examination and solutions. Embracing digital money enhances customer experiences, streamlines financial operations, and paves the way for a connected and cashless future of travel. Additionally, this research explores the properties and considerations surrounding the implementation of the Andaman token in blockchain-based platforms, including technical-operational costs and user understanding. It contributes to a deeper understanding of utilizing vouchers in different contexts and evaluating the potential of blockchain solutions for the tourism industry.**

Keywords*— *Andaman Token, Cryptocurrency, Tourism, Hotel, smart contract, blockchain

I. INTRODUCTION

Digital money has emerged as a transformative force in tourism, revolutionizing how travelers carry out transactions with service providers. In this context, digital money refers to electronic forms of currency (e.g., credit cards, cryptocurrency) that enable seamless and secure financial transactions within the tourism ecosystem. It eliminates the need for physical cash, offering convenience, efficiency, and enhanced financial transparency. Cybercash allows travelers to make instant payments for bookings, accommodations, and services through various digital payment platforms, reducing reliance on traditional banking systems. Moreover, it facilitates cross-border transactions, eliminating the hassles of currency exchange and associated fees. Therefore, adopting digital cash could enhance customer experiences, streamline financial operations, and pave the way for a more connected and cashless future of travel.

According to the reports [1][2], on Mar 4, 2022, Russian banks were banned from SWIFT. Russian travelers in Thailand faced difficulties with financial transactions and travel. Many Russian tourists preferred to pay for goods and services using credit cards, including accommodations and meals. However, hotels and restaurants were encountering problems because tourists could not use credit cards. After all, the fund from Russia was blocked. Some visitors expressed a desire to return home but could not do so due to the absence of cash. The issue has been confirmed by the Tourism Authority of Thailand (TAT) Deputy Governor. The ban on financial transactions with major Russian banks has affected the ability of tourists to pay for hotel rooms and services, make international money transfers, and so on. As a result, the number of Russian travelers in Thailand has significantly declined, impacting the industry's revenue.

Cryptocurrencies offer a compelling solution when cash or credit cards cannot be used, providing seamless and secure transactions. By utilizing cryptocurrencies such as Bitcoin or Ethereum, one can overcome the limitations of traditional payment methods and enjoy instant, decentralized payments. These digital currencies enable borderless transactions, eliminating the need for currency exchange and making them convenient for online purchases and cross-border scenarios. With cryptocurrencies, one retains control over their funds, ensuring privacy and reducing the risk of fraud. Crypto wallets provide secure storage while promoting innovation and financial inclusivity. As more businesses embrace cryptocurrencies, a world of possibilities is unlocked, fostering a decentralized financial ecosystem for efficient transactions, even in unfamiliar environments where cash or credit cards may not suffice. Moreover, businesses could effortlessly implement their business logic/models on the digital payment platform using distributed programs known as smart contracts on the blockchain network.

Although digital cash is not legally accepted as a means of payment in some countries, including Thailand, merchants circumvent this restriction by selling travel vouchers for digital money instead. In this paper, we propose the Andaman token ERC-20, which is designed to be a replacement for paper-based and electronic-based coupons. The main contribution of this work is not only a demonstration of the Andaman token platform implementation in reality but also the analyses of using cryptocurrency compared to paper-based or electronic-based vouchers in Phuket. Our study analyzes operational costs, practicability and benefits of the blockchain-based platform compared to traditional solutions.

The remainder of this paper is organized as follows. Section II presents the background and discusses related work. Section III describes our proposed system. The experiment result is demonstrated in Section IV. Finally, we conclude our work in Section V.

II. Related Work

A. Cryptocurrencies

A cryptocurrency is a form of digital or virtual asset that uses cryptography for secure financial transactions, especially blockchain technology, which serves as a decentralized ledger to record and verify transactions. Bitcoin [3] was invented by Satoshi Nakamoto in 2008; it became a pioneering decentralized digital currency that functions without a central authority. One gain numerous advantages from using cryptocurrencies for payments or investments. While Bitcoin is widely recognized as the first and most influential cryptocurrency, Ethereum revolutionized blockchain technology with its programmability and ecosystem for decentralized applications (DApps), e.g., using smart contracts. Moreover, Ethereum has its native cryptocurrency called Ether (ETH), which is used to fuel transactions and incentivize participants on the network.

Smart contracts are distributed and self-executing contracts that contain terms of agreements written in programming code. These contracts automatically execute and enforce the agreement upon terms without intermediaries or third-party involvement. Smart contracts stored and run on the Ethereum blockchain ensure a transaction's transparency, security, and immutability [5].

Solidity is Ethereum's programming language that defines the smart contract. It allows developers to program contract functionality, conditions, and actions to be automatically executed when conditions are met. Once a smart contract is deployed on the Ethereum network, it becomes a part of the blockchain and can interact with other contracts when it receives user transactions. Several previous works employed smart contracts on Ethereum blockchain applications, e.g., student activity credits [4] and review systems [5][6].

A voucher is used in agricultural applications. Tende et al. [7] propose to use the Hyperledger Fabric blockchain network to store and distribute digital subsidy vouchers to farmers. The blockchain network's features, including hashing and digital signatures, offer digital voucher integrity and prevent potential misuse. Also, it ensures trust in the system. Another instance is the E-voucher system by Akbar and Munir [8], which addresses the issue of distributing social assistance [8].

B. Blockchain applications in tourism

The emergence of smart tourism (i.e., technology and data-driven) has gained significant attention in recent years. Kontogianni and Alepis [9] expand the smart tourism world by introducing Artificial Intelligence, Blockchain, and Cyber tourism as additional concepts. Meanwhile, Blockchain technology is being investigated for its potential benefits for destination management organizations (DMO); hence blockchain is revolutionizing the tourism industry [10].

Medical tourism has gained attention worldwide in recent years, with the emergence of many Asian medical destinations except China. The medical tourism industry lags behind its Asian counterparts. To address this, Chinese researchers [11] leverage blockchain technology to drive technological advancements, create innovative medical tourism offerings, and strengthen its position in the international market. These strategies would enhance the competitiveness of China's medical tourism industry in the digital era and expand its reach on the global stage. BATDIV [12] is a tourism data insertion and visualization solution that employs BigchainDB, a permissioned blockchain with JavaScript code for backend and frontend infrastructure. BLOBIM (Blockchain-Based Integrated Model) [13] ensures trust, eliminates third-party intervention, and addresses challenges in the tourism sector. It enables accurate contact tracing and supports the development of the future tourism industry.

III. Proposed Solution

This section presents the Andaman Token System, consisting of the business model, stakeholders, and system architecture.

A. The business model

We assume this project can negotiate discounts from hotels, including restaurants, spas, and tour operators, at least 10% more discounts than Online Travel Agency (OTA). This price gap will be used to make decisions in project management. Note that the E-voucher also holds other benefits for the token holders. For instance, the traveler can use the voucher to pay for a hotel or other travel services. We examine the discount value of all services that adapt Andaman tokens (Utility Tokens). We also assume that the tokens are ready to be sold to tourers who wish to buy them in advance to receive a discount on various services.

For instance, a project negotiates a 30% service fee discount from three hotels. The total value of the fee is 250,000 USD, and the project creates ready-to-use tokens worth 250,000 USD (250,000 Andaman tokens at 1 USD per token). The system sells Andaman tokens to travelers (i.e., customers) for purchasing services in hotels where the project discounts are stipulated under the agreement disclosed to token buyers. Here, different periods offer different discounts. For example, during the low season, Andaman tokens could provide a full 30% discount from the regular price. During the high season, on the other hand, the Andaman token could offer only 20% discount from the normal selling price, then 10% margin will be reserved for the project's operating costs.

B. Stakeholders and Andaman token

Fig. 1 illustrates relationships between stakeholders and Andaman tokens. Here, stakeholders consist of a provider, a hotel, and a customer, detailed as follows:

(i). **Provider**: A provider, who operates the system, mints Andaman tokens in the initial phase according to price reduction provided by hotels. These tokens are ready to be sold to customers as vouchers at a discount price. The hotel can reimburse fiat currency back from the provider once the customers claim their tokens for services at the hotels. The provider is responsible for demolishing the used tokens.

(ii). **Hotel**: A hotel staff is responsible for validating customers' vouchers (e.g., when they check-in or use services). Also, they will exchange tokens with the provider to turn the vouchers into fiat currency.

(iii). **Customer**: A customer (i.e., tourer) utilizes the system for various scenarios, including purchasing Andaman tokens, monitoring the balance of their tokens, and using the tokens to purchase vouchers, making payments with hotel reservations, or obtaining discounts from booking hotels.

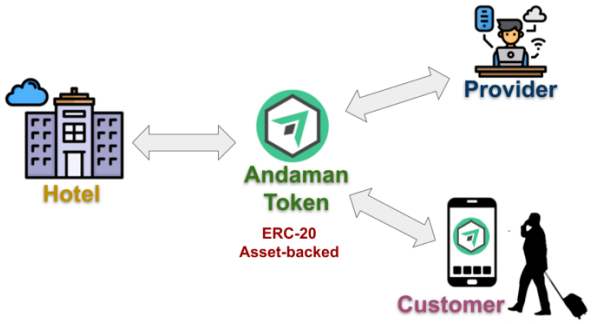

Fig. 1. The high-level view among stakeholders and the Andaman token

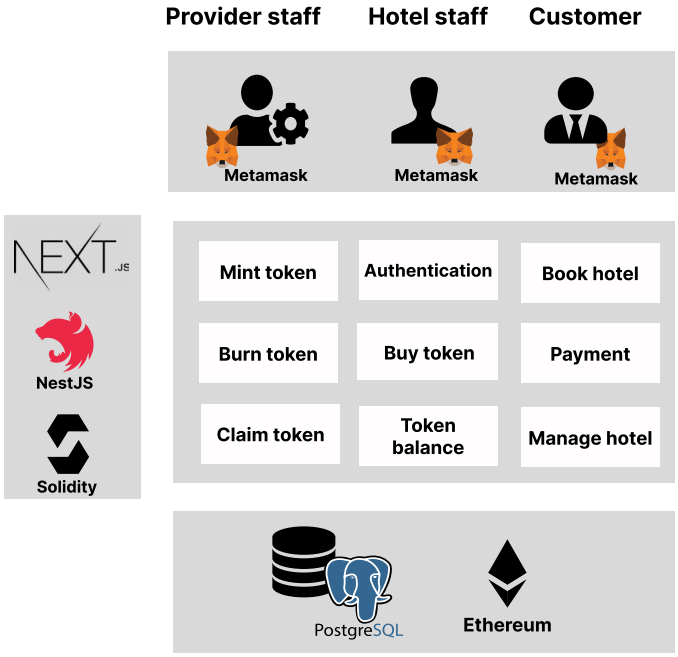

Fig. 2. The Andaman token system components

C. System Architecture

The Andaman token system components are explained in Fig. 2. The system composes of three following layers:

(i). **User layer**: This layer contains a provider, hotels, and customers. All users must have a crypto wallet (e.g., Metamask).

(ii). **Frontend, Backend, and Functions layer**: This layer includes Frontend, Backend, and Smart contract. *Nextjs* is used to develop the frontend, which interacts with all users. *Nestjs* is used for implementing the backend server and managing REST API calls. *Solidity* is used to implement smart contracts as well as generate tokens.

(iii). **Blockchain and database layer**: All users' information is kept in a centralized database (i.e., PostgreSQL) except payment transactions relating to Andaman tokens in the Ethereum blockchain.

We construct a user-friendly and responsive website, as shown in Fig. 3. The current page shows the screenshot of the hotel booking page. Here, the customer only needs a crypto wallet to sign up, log on, navigate and make a payment for services on the platform[a].

[a] https://andaman-token.vercel.app/

Fig. 3. The Andaman token system screenshot

IV. Experimental Results and Analysis

This section describes the experimental environment, analyses technical operation cost and platform benefits, and compares our proposed approach against alternative solutions.

A. Experimental environment

The system was developed on the *Goerli TestNet* [14], and the Ethereum node was used through the *Alchemy* service [15] to access the blockchain network with *Web3JS* [16] library for proof of concept and testing all functions of the implemented system. However, when the system was deployed in a production environment, the choice of a blockchain network became a vital tradeoff between cost and the number of blockchain users. Our smart contract was Ethereum-based and can be deployed on any EVM-compatible chain. Due to the limited budget, we simulated deploying our smart contract on Ethereum MainNet (MNT), Binance Smart Chain (BSC), and Polygon Chain (POL) to compare technical operation costs, especially for transaction fees.

B. Technical Operation Cost

The *paper-based voucher* had a cost of 0.05 USD per piece, depending on the number of printed vouchers and their quality. E-voucher had a fixed cost (i.e., a server operating cost). Typically, the server cost for running a droplet on a virtual cloud provider (e.g., Digital Ocean) is 10 USD per month, and a payment gateway fee was estimated from 3-5% of the transaction amount.

Table I shows that the Andaman token requires the same expenses as traditional E-voucher with additional costs (i.e., blockchain transaction fees). Specifically, users must pay a

transaction fee when they perform any activity that is recorded as transactions on the blockchain (e.g., buy token). A transaction fee is calculated according to equation (1) below,

$$transaction\ fee = gas\_price \times gas\_used, \quad (1)$$

where a *transaction fee* is the *gas_price* times *gas_used* for each transaction. Here, the gas price may be fluctuated depending on how many users are doing transactions, how fast we need, and which blockchain network is used. For instance, on the Ethereum Mainnet, transaction fees can vary from 3 – 20 USD per transaction.

Table I: Andaman token cost for stakeholders

Cost	Provider	Hotel	Customer
Transaction fee - buy token			/
Transaction fee - book room			/
Transaction fee - claim token		/	
Transaction fee - burn token	/		
Hardware wallet			/
Smart contract security audit	/		

Table I also explains the cost for each stakeholder in detail. Transaction fees and other additional costs such as web server hosting, a payment gateway fee, and a hardware wallet for some customers are considered significant barriers; therefore, this difficulty hinders businesses from adopting blockchain-based currency. Moreover, a qualified blockchain developer usually demands a high salary and is difficult to recruit. Since blockchain offers immutable property, if there is any bug or issue relating to the smart contract, it is very challenging or nearly impossible to modify a previous version of a deployed smart contract. This is an important reason why we need a qualified blockchain developer with smart contract security auditing before launching the system to production. The *Technical Operation Cost* is shown in equation (3), where SC (equation (2)) is the total cost from web hosting, payment gateway fee, hardware wallet, and smart contract security audit, whereas *n* from *transaction_fee* denotes all blockchain transactions.

$$SC = WH + PGW + HW + Audit \quad (2)$$

$$Technical\ Operation\ Cost = \sum_{i=0}^{n} transaction\_fee_i + \mathrm{SC} \quad (3)$$

Here, the transaction fee is the main factor that makes technical operation costs expensive. Although we may reduce transaction fees by grouping many small transactions and executing them as a batch, this method is complicated and may not be able to perform in any situation.

C. Technical Operation Cost Comparison

This section compares the paper voucher, E-voucher, and Andaman token on different blockchain networks. The cost of each voucher-based method for 10,000 customers per month is compared in Fig 4. It is clear that the paper voucher requires the lowest cost because it utilizes only printed papers. E-voucher incurs higher cost compared to the paper voucher due to a fixed cost from the centralized web hosting service and payment gateway fees. Still, it is significantly less expensive than the Andaman token method. Note that the transaction fee data is collected and simulated on Ethereum MainNet (MNT), Binance Smart Chain (BSC), and Polygon (POL) [17], which know as demanding high operation costs. Fortunately, the transaction fee of the Andaman token is distributed to several stakeholders, i.e., customers, the hotel staff, and the service provider. This is a cost that one or another of the stakeholders must bear regardless indeed.

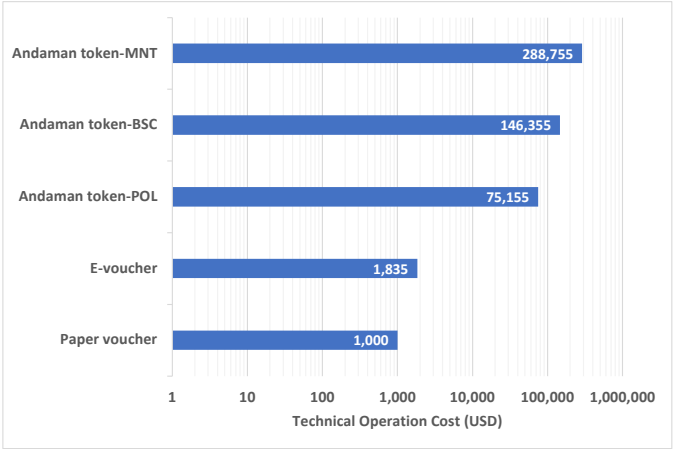

Fig. 4. Technical operation cost for 10,000 customers

D. Platform benefit comparisons

We analyzed the advantages and disadvantages of each method, as depicted in Table II. The paper-based voucher offers simplicity, as it does not require an e-wallet or an online account, is easy to use, and has no maintenance fee for web hosting. However, when considering other properties, each alternative has its own pros and cons, as follows.

Table II: Platform comparison

Properties	Paper based voucher	E-voucher	Andaman token (all networks)
Simple to use and understand	+	0	--
Require account or wallet	+	-	--
Initial setup cost	+	-	--
Maintenance fee	0	-	--
Transaction transparency	0	+	++
Ownership transferring	0	+	++
Trading channel	0	+	++
Tokenization	-	0	+

Simple to use and understand, a customer can use the paper-based voucher without any electronic devices, while an E-voucher and Andaman token do need.

Require account or wallet, E-voucher usually requires an email account (e.g., email) to validate the ownership. Andaman token is more complex than the E-voucher. It requires I only a user

account but also a crypto wallet. On the other hand, a hardware crypto wallet is more secure, even if it is not very user-friendly and poses customers additional costs. Even though ERC-4337 (i.e., an Ethereum standard achieves account abstraction) will ease wallet usage, the product under ERC-4337 is still under development and research.

Initial setup cost is the cost to mint (i.e., create) new vouchers. The paper-based voucher demands only a design and printing of the hard copy. E-voucher needs design, web hosting, payment gateway fee, and supporting system. Andaman token requires all the need for E-voucher, plus the cost of hiring blockchain developers – whose wage is greater than typical programmers. Moreover, smart contract auditing and legal compliance are even more expensive.

Maintenance fee includes the expense for annual web hosting and the salary for technicians who maintain the services and provide technical support. Here, Andaman token maintenance is the same as E-voucher, with additional transaction fees.

Transaction transparency is one of the vital blockchain features (i.e., immutable transactions). All stakeholders are able to verify and track transactions. This property is especially required when trust cannot be guaranteed. This property could prevent other privacy issues as well.

Ownership transferring is how to change a voucher's owner from one individual to another. The paper-based voucher is not in digital form and can be transferred physically via face-to-face interaction or by using a postal service. Meanwhile, E-voucher and the Andaman token need an electronic device to transfer online, which is more accessible than the paper-based voucher.

Trading channel is a means to buy and sell for the purpose of speculation. The Andaman token has advantages over the competitors in aspects of ownership transferring and trading channel because it is a token-based method. Moreover, the digital token can be listed in decentralized exchanges and easily swapped with other tokens globally.

Tokenization is the way to fractionalize the benefits, for example, splitting a voucher to pay for three hotel rooms. In this case, it is nearly impossible to do with the paper-based or E-voucher, particularly when a voucher cannot be tokenized and is usually not refundable.

To sum up this comparison, the Andaman token is an excellent choice when transaction transparency, ownership transferring, trading channel, and tokenization are concerns. However, it requires more technical-operational costs and user technological skills. Nevertheless, the technical operation cost of the Andaman token varies significantly depending on the blockchain network handling transactions. For instance, using a private blockchain network such as Hyperledger is cheaper than the public one. The lower transaction fee is a trade-off between the operational cost and the trustworthiness of decentralization. The more expensive the blockchain network, the more dependable it is. On the other hand, E-voucher is a middle-ground solution between the paper-based voucher and the Andaman token. It allows for ownership transfer and trading through online platforms while compromising maintenance fees, setting up costs, and usability.

E. Discussion

The Andaman token has the highest technical operation costs compared to other alternatives. Instead of creating the Andaman token by using other tokens, the experimental results will be similar, as they continue to share comparable technical costs. However, the disadvantages of using the token are exchanged with the benefits of tokenization and ownership transfer mentioned earlier. The Andaman token enables connectivity with other global services, such as the ability to apply loyalty programs of spas and fitness centers and seamless payment without the need for currency exchange. These benefits of adopting a blockchain platform become a competitive advantage to the business. With the growing blockchain innovation, more and more people are intrigued by its potential and seek to incorporate it into various domains.

However, blockchain is a rather slow and expensive database, unsuitable for many scenarios, as indicated in the analysis. Especially in Thailand, the financial service is very well organized. Thai people can use mobile banking to transfer digital money without a fee. Token as a means of payment will face a tough challenge in fighting with the existing service. Conversely, many countries have issues or concerns about their own currency. In this context, cryptocurrency offers several profits, as discussed in this paper. Some obstacles businesses might find challenging are government regulations and technical difficulty issues.

This paper sheds light on several important aspects, including investment costs and assumptions related to the application of blockchain-based platforms. Nonetheless, state policy and compliance are also significant concerns and go far beyond the scope of this paper.

V. Conclusion

This paper presents the Andaman token platform and feasibility analysis of implementing this scheme compared to other alternatives, namely E-voucher and paper-based voucher. The main contribution of this paper is not only the design and implementation of the Andaman token system but also the analysis of key properties, including technical operation costs and assumptions, surrounding the implementation of a blockchain-based platform. Despite the higher implementation cost, the digital token approach offers global connectivity to various services, loyalty program applications, and seamless cross-border payments. These benefits make the blockchain-based platform a compelling option. Nevertheless, the complex nature of implementing blockchain technology remains a significant barrier for small businesses to invest in this technology.

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