BLOCKCHAIN FOR CUSTOMER LOYALTY PROGRAMS

OVERVIEW:

Customer loyalty programs are pivotal for businesses aiming to foster customer engagement and retention. However, traditional loyalty programs often suffer from inefficiencies such as low redemption rates, high account inactivity, and limited interoperability. Blockchain technology presents a transformative solution to these challenges by offering benefits like reduced costs, increased transparency, enhanced security, and improved efficiency. This paper explores the potential of blockchain in revolutionizing customer loyalty programs, focusing on its key benefits and use cases. By leveraging blockchain, businesses can create open, interoperable loyalty ecosystems that provide customers with greater control over their rewards and facilitate seamless redemption across multiple programs. Case studies of successful blockchain-based loyalty programs in the hospitality industry illustrate the practical applications and benefits of this technology. Additionally, the paper discusses the future prospects of blockchain in reshaping the loyalty landscape and provides insights into its implementation through open-source Loyalty Blockchain APIs.

In today's fiercely competitive business landscape, customer loyalty programs have emerged as vital tools for enhancing customer engagement, fostering brand loyalty, and driving sustainable business growth. However, traditional loyalty programs often suffer from inefficiencies and limitations, including fragmented management systems, low redemption rates, high operational costs, and security vulnerabilities. These challenges hinder the effectiveness of loyalty initiatives and compromise the customer experience.

Blockchain technology presents a transformative solution to address the shortcomings of traditional loyalty programs. By leveraging its decentralized, immutable ledger and smart contract capabilities, blockchain offers a novel approach to loyalty program management, enabling seamless interoperability, enhanced security, increased transparency, and improved efficiency. Blockchain-based loyalty programs facilitate the creation of open, interoperable ecosystems wherein customers can seamlessly accrue, exchange, and redeem rewards across a diverse network of partners and vendors.

In the context of the hospitality industry, blockchain-based loyalty programs have gained traction as a means to differentiate brands, streamline operations, and deliver enhanced value propositions to guests. Case studies of leading hospitality brands illustrate the tangible benefits and success stories of implementing blockchain technology in loyalty initiatives.

Looking ahead, the future of blockchain in the loyalty world holds immense promise and potential. As businesses increasingly recognize the value proposition of blockchain-based loyalty solutions, we anticipate a paradigm shift towards more transparent, customer-centric loyalty ecosystems. With continued innovation and adoption, blockchain stands poised to reshape the loyalty landscape, driving greater customer engagement, satisfaction, and loyalty in the digital age.

Keywords: Blockchain, Customer Loyalty Programs, Rewards, Interoperability, Transparency, Security, Efficiency, Hospitality Industry.

TECHNIQUES OF THE PAST:

Customer loyalty programs have long been integral to businesses across various industries, serving as powerful mechanisms to foster brand loyalty, incentivize repeat purchases, and drive revenue growth. However, traditional loyalty programs have encountered challenges ranging from inefficiencies to lack of transparency and limited interoperability. In recent years, scholars and practitioners have increasingly turned their focus toward blockchain technology as a potential solution to these challenges. Blockchain offers a decentralized, immutable ledger and cryptographic security features that can enhance the transparency and security of loyalty program operations. By leveraging blockchain, businesses can create transparent and tamper-proof systems for recording and tracking loyalty transactions, addressing concerns related to data integrity, fraud prevention, and customer privacy. Additionally, blockchain facilitates interoperability and integration within loyalty ecosystems, overcoming the siloed nature of traditional programs. Through decentralized infrastructure, blockchain enables seamless transfer and utilization of rewards across different platforms and brands, fostering open, interconnected loyalty networks where customers can earn and redeem rewards across a diverse ecosystem of partners and vendors. Moreover, blockchain-based loyalty programs hold economic implications such as cost reduction and efficiency gains. By automating reward processes through smart contracts, blockchain streamlines program operations, lowers administrative overheads, and improves overall efficiency. Studies demonstrate the potential for blockchain-based loyalty

programs to lower transaction costs, increase program ROI, and enhance the value proposition for both businesses and customers.

Despite the transformative potential of blockchain technology in revolutionizing customer loyalty programs, implementation and adoption present practical challenges. Scalability, regulatory compliance, and user adoption emerge as critical considerations for successful deployment. While blockchain offers promising solutions, businesses must navigate technical complexities and regulatory frameworks to ensure compliance and mitigate risks. Furthermore, user adoption hinges on developing intuitive interfaces and seamless experiences that encourage participation. Robust governance frameworks and industry standards are essential to foster trust and facilitate widespread adoption. As the field of blockchain-based loyalty programs continues to evolve, further research and experimentation are warranted to address these challenges and unlock the full potential of the technology. By advancing understanding and innovation in blockchain applications, businesses can create more transparent, secure, and customer-centric loyalty ecosystems, driving enhanced engagement, satisfaction, and loyalty in the digital age.

To evaluate its potential in addressing trust issues related to energy supply and consumption, we aimed to answer two key research questions:

RQ1: How can blockchain technology improve institution-based trust and mitigate distrust in electricity suppliers?

RQ2: How can a blockchain-based customer loyalty program be developed to foster trust?

To address these inquiries, we adopted a Design Science Research (DSR) approach (Gregor & Hevner, 2013). Employing DSR enabled us to identify design requirements for enhancing institution-based trust and reducing institution-based distrust. Additionally, it facilitated our exploration of designing a customer loyalty program leveraging blockchain technology. Our methodology commenced with an extensive literature review (Webster & Watson, 2002), followed by a workshop with an electricity supplier and preliminary interviews with experts to establish design objectives and requirements. Subsequently, we devised Nexo Energy, a conceptual architecture for a blockchain-based customer loyalty program. Through an iterative process, we refined our artifact via workshops with electricity supplier personnel, comprehensive customer testing, and interviews with both stakeholders (refer to Table A1). Upon concluding the refinement and evaluation phases, we derived a preliminary design theory comprising four key design principles (Gregor & Hevner, 2013). This design theory constitutes a valuable contribution to blockchain research by elucidating a specific mechanism through which blockchain can address ambivalence by fostering institution-based trust and mitigating institution-based distrust. In a broader context, it advances the exploration of how innovative technologies can be leveraged to cultivate consumer trust (Abbas et al., 2020, Cheng et al., 2021, Jeon et al., 2021).

Currently, global efforts toward climate protection and various national sustainability policies are accelerating the transition from finite resources to Renewable Energy Sources (RES) (Ante et al., 2021, Dorfleitner et al., 2021). While RES play a pivotal role in achieving sustainability objectives, their intermittent and volatile nature presents not only numerous organizational and technical hurdles but also a host of regulatory challenges (Andoni et al., 2019, Baumgarte et al., 2020). Moreover, the increasing prominence of RES presents a specific dilemma for the traditional business models of electricity suppliers (Ahl et al., 2020, Hua et al., 2020) as they are now tasked with meeting their customers' growing demand for green electricity (Bogensperger et al., 2018, Luke et al., 2018).

In response, electricity suppliers commonly utilize Green Electricity Tariffs (GETs) (MacPherson & Lange, 2013). However, the adoption of GETs presents two additional challenges. Firstly, GETs are subject to intricate electricity market regulations (Andoni et al., 2019, MacDonald and Eyre, 2018), and their implementation is both cumbersome and expensive (Bergaentzlé et al., 2019), resulting in GETs often being more costly than conventional electricity tariffs (Fang et al., 2021, MacDonald and Eyre, 2018). Secondly, GETs typically rely on "guarantee of origin" certificates (Abad & Dodds, 2020) because many electricity suppliers lack direct access to the requisite amount of RES needed to fulfill their customers' contracted units of green electricity. To meet the quota, they purchase these certificates from other RES suppliers (Hamburger, 2019, Raadal et al., 2012). Although guarantee of origin certificates serve as a legitimate measure to promote the distribution of RES, customers often feel misled by them—whether due to suspicions of excessive charges for green energy or because they do not receive the expected type of green electricity (Ambrose, 2021, Guo et al., 2014, Mezger et

al., 2020). This dissatisfaction is often exacerbated by negative publicity stemming from instances of double-spending (Castellanos et al., 2017, Hamburger, 2019).

Such dissatisfaction can significantly diminish customer satisfaction and ultimately result in a decline in customer loyalty. Customer satisfaction is commonly regarded as a critical precursor to customer loyalty and is grounded in perceived service qualities (Berry et al., 1988, Culiberg, 2010). One key quality is reliability, defined as the "ability to perform the promised service dependably and accurately" (Muzahid & Noorjahan, 2009, p.26). This notion of reliability closely aligns with the conventional definition of customer satisfaction, characterized as "a feeling [arising] from a process of evaluation of what has been received against what was expected" (Muzahid & Noorjahan, 2009, p.27). It is noteworthy that certain expectations regarding GETs may have been overly optimistic and could stem from the general public's limited comprehension of the intricate processes involved in electricity generation, transmission, and distribution. Nonetheless, it remains a distinct issue that electricity suppliers have often failed to deliver the promised services (Bang et al., 2000, MacPherson and Lange, 2013, Wüstenhagen et al., 2007). This failure (Moody et al., 2017) to provide green electricity has fueled widespread doubt (Kramer, 1999) regarding the electricity supplier's capability to enhance its services in the future, leading to two unfortunate outcomes. Firstly, customer satisfaction has declined (Martínez & Rodríguez del Bosque, 2013). Secondly, customer trust has eroded, and customer distrust has emerged as a significant issue (Kramer, 1999, McKnight et al., 2017, Moody et al., 2017).

DESIGNING A BLOCKCHAIN-BASED CUSTOMER LOYALTY PROGRAMME USING DESIGN SCIENCE RESEARCH METHOD:

Loyalty programs serve as vital marketing tools for businesses aiming to enhance customer engagement and retention. These programs, backed by enterprises, offer incentives like rewards and discounts to attract and retain customers. Yet, the lack of compatibility among loyalty programs from different organizations can hinder customers' ability to fully utilize their loyalty points. In this research, we proposed a blockchain-based platform using the design science research (DSR) method to address the limitations of traditional loyalty programs. Through smart contracts, this design allows organizations to incorporate all necessary features for their specific loyalty programs in line with their policies. The platform we designed offers a decentralized, transparent, and secure environment for the exchange of loyalty tokens between organizations and customers. Through expert opinion methodology, we explored the technical aspects and implementation of this blockchain-based loyalty program platform, along with its potential impact on customer experience. Our findings suggest that the proposed platform can enhance the interoperability of loyalty programs by introducing a universal token, thereby creating more value for both businesses and customers. This research contributes to the fields of loyalty programs and blockchain technology by proposing a platform that empowers businesses to develop more efficient, data-driven loyalty strategies, ultimately providing customers with enhanced value for their loyalty points.

The emergence of various computer technologies and networks has brought about rapid and substantial changes across all fields. One common experience for individuals is engaging with loyalty programs offered by businesses providing services or products. These programs are designed to retain customers and increase their spending within the organization [1]. In recent times, many organizations have started collecting customer data to observe and analyze their behavior [2]. By studying this data, organizations aim to create loyalty programs that not only satisfy existing customers but also attract new ones.

Loyalty programs encompass personalized customer marketing and communication systems, offering customers tangible rewards like discounts or gifts, as well as intangible benefits such as personalized services or information [3], [4]. Customers often participate in multiple loyalty programs from different organizations, each using various methods like physical coupons, digital coupons, or specialized mobile apps to provide and manage services. However, the lack of interoperability among these programs means customers struggle to fully utilize the value of their loyalty points, as each organization has its own system and rewards. Moreover, privacy concerns may discourage customers from sharing personal information with every loyalty program [5].

Blockchain technology, a distributed database comprising encrypted blocks of asset transactions, holds promise in addressing these challenges in loyalty programs. By encoding the terms of loyalty programs in a smart contract, blockchain allows organizations to specify the exact rewards and profits to be distributed to customers without relying on trust, ensuring transparency. These contracts are executed autonomously and manage the transactions independently [6], [7].

Facilitating the exchange of benefits between internal and external customers through a suitable blockchain platform involves the creation of tokens. Tokens serve as incentives for customers participating in a loyalty program and are stored securely on the blockchain, representing specific assets like currencies or products. This blockchain platform provides a secure environment for token exchange between different organizations, subject to mutual agreement. By utilizing tokens, integration and collective benefits from all loyalty programs become possible. Tokens aren't restricted to purchases alone but can encompass the entirety of customer interaction with the brand or retailer, thereby integrating digital marketing [8].

Blockchain offers an integrated and trustless platform capable of controlling the transfer and management of customer assets within any organization through the use of tokens [9]. It serves as the foundation for standardizing the types of rewards across organizations [10]. Additionally, organizations can facilitate the transfer of points between them by mutual agreement and through a common platform, reducing the management and maintenance costs of loyalty programs while offering more valuable options to customers. This approach can enhance customer satisfaction levels; for instance, several hotels and airlines allow customers to utilize their points on the same platform using a unified method [11].

However, there are notable drawbacks to implementing blockchain in this context, including structural complexity and costs. Additionally, due to the immutable nature of blockchain, rectifying errors can be extremely challenging or expensive. Some of these advantages and disadvantages are outlined in Table 1.

Table 1. The opportunities and limitations of blockchain-based loyalty programmes

Opportunities	Limitations
Transparency and Security: Blockchain technology provides a tamper-proof and transparent record of transactions, ensuring that loyalty points cannot be fraudulently altered or stolen.	**Technical Complexity**: Implementing blockchain technology can be technically complex and may require specialised expertise, increasing the costs and potential for errors.
Increased Efficiency: Blockchain technology can automate loyalty program processes, such as point issuance, redemption, and transfer, reducing administrative costs and improving customer experience.	**Lack of Standardisation**: As blockchain is a relatively new technology, there is a lack of standardisation, which can create interoperability issues and make it difficult to integrate with existing systems.
Enhanced Customer Loyalty: The use of blockchain technology can provide customers with a greater sense of trust and loyalty towards a brand, knowing that their loyalty points are secure and transparent.	**Technical Limitations**: Blockchain technology is still evolving and has limitations, such as the difficulty of modifying existing transactions and the risk of smart contract vulnerabilities.
Lower Costs: Blockchain can reduce the costs associated with loyalty programme administration, since it eliminates the need for intermediaries and reduces operational costs.	**Limited Scalability:** The current limitations of blockchain technology, such as transaction speed and storage capacity, may make it difficult to scale loyalty programmes with large customer bases.

METHODOLOGY:

Selecting the appropriate research model is crucial for ensuring the validity of the research and for conveying this validity to the audience. Introducing the research model also lays the groundwork for future research endeavors. In this study, the methodology employed is the approach of design science research [12], a method commonly used in information technology to create and evaluate artifacts or solve practical problems. Here, we utilized this methodology to explore how blockchain technology can enhance the transfer of loyalty points among customers participating in various loyalty programs [12, 13, 14].

Using this method, we identified challenges related to loyalty points transfer and devised technological solutions to address these issues. These solutions were then evaluated by gathering insights from a panel of experts [15]. The findings obtained from this evaluation process can be utilized to refine existing designs or develop new solutions.

2.1 DESIGN SCIENCE RESEARCH METHODOLOGY

Design science research operates as a problem-solving paradigm aimed at advancing human knowledge through the creation of innovative artifacts [14]. Employing the DSR approach, our efforts will yield both a tangible product and a practical perspective on the identified problem. Figure 1 outlines the steps and processes inherent in the design science research method [14].

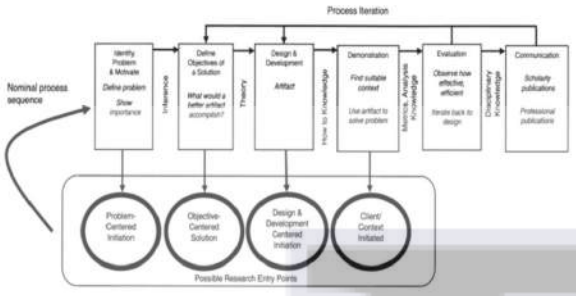

Figure 1. DSR process.

2.1.1 PROBLEM IDENTIFICATION AND MOTIVATIONS

The initial step in the design process involves defining the specific research problem and justifying the need for a solution. In this study, our problem revolves around the absence of a secure and trustless method for granting, utilizing, and exchanging points acquired through customer loyalty programs among customers and organizations. Establishing a secure and efficient platform for transferring benefits enhances the effectiveness of these loyalty programs, thereby potentially increasing their productivity.

The primary objective of customer loyalty programs is to boost customer engagement with the organization and to ensure customer satisfaction, encouraging them to allocate a larger share of their spending to the organization's products or services [16]. Various psychological techniques are employed to attract customers, ultimately resulting in favorable outcomes for organizations [17, 18, 19, 20, 21, 22, 23, 24]. In our study, we focus on the status-based mechanism [20], which examines how customers perceive the value of gifts and discounts [21]. By utilizing this method, we identify the problem and the motivation for developing an artifact to enhance the potential of loyalty programs.

2.1.2 NECESSARY FACTORS FOR SOLVING THE PROBLEM

Goals can be derived from defining the problem and exploring potential solutions. These objectives can take the form of quantitative or qualitative goals, inferred from the problem statement. In this section, we aim to select a blockchain platform that aligns with the needs of both customers and organizations [25]. Subsequently, we implement a smart contract within this platform to encompass the rules of loyalty programs. In the following step, we generate tokens and transfer them to a wallet to facilitate seamless transfer and provide evidence of the artifact's execution.

• Blockchain platform:
Blockchain platforms come in various types, with some lacking support for smart contracts and thus not meeting our selection criteria. Others may impose high fees without offering significant advantages, citing reasons such as technical limitations, lack of support, or limited popularity. Our design opts for the Binance Smart Chain platform, which provides cost-effective smart contract functionality to users.

• Wallet:
To effectively manage tokens generated for the organization and transfer them to users who have earned a certain amount, it's essential to store these tokens in a wallet under the organization's supervision. This allows the organization to transfer tokens in accordance with the regulations of the loyalty program. The automated transfer of digital currencies between customers and organizations necessitates the use of a digital wallet. Additionally, measures such as converting tokens to fiat currency or facilitating offline transfers fall under the regulatory purview and can be implemented based on organizational consensus.

• Unique token:
The unique token serves as an intangible reward provided by organizations to users who engage with their services or purchase their products. Users accumulate points by adhering to the rules outlined in the customer loyalty program. These tokens are transferable within the platform, enabling customers to exchange them and utilize them for various benefits within the loyalty program.

• Smart contract:
A smart contract consists of logical rules encoded in a cryptographic script that can be embedded within the blockchain [26], [27]. Once deployed on the designated blockchain platform, these rules become immutable and enforceable. Organizational considerations such as token transferability, creation, and burning can be incorporated into these contracts. Solidity, a programming language akin to JavaScript, is well-suited for constructing decentralized applications and is commonly employed for writing smart contracts [9].

2.1.3 DESIGN AND DEVELOPMENT

In this phase, a Design Science Research (DSR) artifact, referred to as a chirol, encompasses any object that embodies our research contribution. This entails identifying the intended functionality and design of the artifact. We took on the task of identifying various scenarios for our tokens and devising the execution mechanism within the network. The core components of the network include the token and different user categories. As depicted in Table 2, there are three types of users fulfilling distinct roles. These roles consist of the partner, who distributes loyalty points to members of the loyalty program, the member, who earns points from purchases and redeems them, and the manager, who oversees the affairs of the partners [11].

Table 2. User stories for the rewards points system

US_{01}	As a partner, I assign rewards points to members to encourage their loyalty as clients
US_{02}	As a member, I pay with the accumulated points to save money and enjoy the programme benefits
US_{03}	As a member, I see the balance of my points to know how many I have
US_{04}	As a member, I see a report of transactions
US_{05}	As a member, I approve the points charges, to be sure that other people do not spend them
US_{06}	As an administrator, I manage partners' data (registrations, cancellations, and changes) in the system and I see all the members.

Various transactions and user scenarios can occur within this network (refer to Table 3 [11]). After reviewing the users' narratives, we identified the essential regulations that must be incorporated into the smart contract. These rules govern the transfer, allocation, and expenditure of tokens. While these rules could be inferred from studying existing loyalty programs, we emphasized a scientific approach to this endeavor. Therefore, we utilized the Remix website as an online platform for writing the smart contract, which is based on the Solidity coding language. The final version of the smart contract code is displayed in Code 1.

The smart contract is designed to be applicable for all transactions, with organizations adopting this mechanism based on their preferences. For instance, an organization may consider each loyalty point as a token, or they may decide that ten points are equivalent to a single token. If an organization selects a specific policy for the conversion rate of points to tokens, this ratio must be adhered to by its partner organizations. Organizations are required to engage in consultation and mutually agree on this ratio before reaching a final decision. To avoid potential mathematical complexities in the future, it is recommended that each point be considered equal to one token, as it facilitates the determination of the desired number of tokens.

Table 3. User stories

	Given	When	Then
TC_{01}	M1 has 1 point and P1 has 9999 points	P1 rewards M1	M1 has 2 points and P1 has 9998 points
TC_{02}	M' has 0 points and P1 has 9999 points	P1 rewards M'	M' has 0 points and P1 has 9999 points
TC_{03}	M1 has 1 point and P1 has 0 points	P1 rewards M1	M1 has 1 point, and P1 has 0 points and recieves a message warning that it does not have enough points
TC_{04}	M1 has 10 points and P1 has 0 points	M1 pays 1 point to P1	M1 has 9 points and P1 has 1 point
TC_{05}	M1 has 0 points and P1 has 0 points	M1 pays 1 point to P1	M1 has 0 points, and P1 has 0 points and recieves a message warning that it does not have enough points
TC_{06}	M1 has 10 points	M1 asks for his balance	M1 is notified that he has 10 points
TC_{07}	M1 has 10 points, and P1 has 10 points and recieves a message warning that it is collecting from a wrong member	P1 collects rewards given to M2	M1 has 10 points and P1 has 10 points
TC_{08}	M1 has 10 points and P1 has 10 points	P1 collects 1 point given to M1 and M1 provides his PIN	M1 has 9 points and P1 has 11 points
TC_{09}	There are three partners	Administrator inserts partner X with the number 1234567890	There are four partners
TC_{10}	There are three partners	Administrator inserts partner X with the number 12345	There are three partners

Once the smart contract was set up, the next step involved transferring the created tokens to the wallet of the organization benefiting from this blockchain, so they could distribute them among their members. For this purpose, we utilized the user-friendly and cost-effective Metamask wallet for our operations. Furthermore, we utilized the Binance virtual test network to assess the efficiency of the smart contract, as detailed in subsequent sections.

Code 1. Smart contract.

2.1.4 PRODUCT DISPLAY

This phase involves employing the artifact in experiments, simulations, case studies, proofs, or other pertinent activities. Our final product is a blockchain platform integrated with a smart contract that regulates the loyalty program. The provisions embedded within this smart contract are tailored to meet the specific requirements of loyalty programs. This blockchain platform has the capability to allocate tokens to customers, receive tokens from other customers, and facilitate token transfers between two customers or among customers and organizations.

2.1.5 EVALUATION

Evaluation involves assessing the effectiveness of the artifact in resolving the problem by comparing the intended solution with the observed outcomes of the artifact's implementation. This process can encompass diverse evaluation methodologies that align with the problem domain and the nature of the artifact. Subsequent to this phase, the decision to revise the artifact's efficacy by revisiting the third step or to proceed with communication and defer any potential enhancements for future endeavors is determined.

To evaluate the implemented blockchain, we conducted various network operations on the Binance virtual test network to evaluate its functionality. In the following step, we aimed to assess the practicality of the artifact and identify any potential obstacles in its implementation by seeking expert opinions.

2.1.6 COMMUNICATIONS

Here, all aspects of the problem and the designed artifact were communicated to the stakeholders. Depending on the research objectives and the audience, appropriate forms of communication could be employed, including professional channels.

Finally, it's important to note that the design science research approach methodology involves a back-and-forth behavior. The outcomes reported in each section are the cumulative result of the entire process and not solely the consequence of a single stage. Each stage contributes to the final result and represents a crucial step toward achieving the desired objectives. Therefore, it is the combined effort and progress made throughout all stages that lead to the final outcome.

2.2 EXPERT OPINION METHODOLOGY

This method is utilized to make predictions or estimates when there is insufficient information available to conduct statistical procedures [13]. It operates innovatively and aims to address ambiguous or unresolved problems. Knol et al. describe this method in seven steps [28]:

2.2.1 DETERMINING UNCERTAINTIES (IDENTIFYING VARIABLE VALUES)

In this section, we discussed the significance of obtaining expert opinions and how they can aid in evaluating the feasibility and identifying potential challenges in implementing the proposed solution. Challenges addressed here include the required infrastructures for implementing and examining the blockchain platform, technician training needs, and technical updates.

2.2.2 SCOPE AND FORMAT OF EXTRACTION

Here, we developed a questionnaire with a general format of questions. Various factors such as time and cost were considered to determine the appropriate method of gathering expert opinions, which included interviews, questionnaires, face-to-face or telephone conversations, and opinion summarization.

This study utilized interviews with multiple experts from diverse fields and incorporated a selection of their opinions. An eight-question survey was compiled, administered both in-person and online, covering topics such as software, hardware, human resources, and future-proofing.

2.2.3 IDENTIFICATION AND SELECTION OF EXPERTS

In the expert opinion method, it's crucial to define the criteria for identifying individuals who can be considered experts. An expert is a key person who:

- Possesses significant knowledge of the problem area.
- Holds a background in the discussed field.
- Is recognized (e.g., among colleagues) and competent in solving the problem.
- Is familiar with assessing possibilities.

Additionally, an expert's opinion should evolve over time as they receive new information, and their opinions should be valid, transparent, science-based, and justifiable. However, there are also criteria for recognizing an expert:
- Tangible evidence of expertise (e.g., degree, publications, position).
- Fame or recognition in the field.
- Availability and willingness to participate.
- Understanding of the general problem area.
- Neutrality in viewpoint.
- Lack of economic or personal stake in potential findings.

2.2.4 DESIGN OF EXTRACTION MANUALS
The questions should follow a specific format and aim towards a conclusion for the main purpose. These questions were structured to elicit statistical, probabilistic, and qualitative estimates.

2.2.5 PREPARATION OF THE EXTRACTION SESSION
Meetings were conducted in person, over the phone, or online, depending on the individual's availability and schedule.

2.2.6 RELYING ON THE OPINION OR JUDGMENT OF AN EXPERT
To utilize the opinions of experts, it was essential to reach a consensus on those opinions, especially when multiple experts were involved.

2.2.7 SUMMARY, AGGREGATION, AND REPORTING OF RESULTS
Finally, the collected answers were aggregated based on a scoring system, and the results were summarized and reported.

3. RESULTS
A customer journey map was created to depict the processes that both customers and organizations undergo in this system. A customer journey map is a visual representation of the steps, activities, and situations a customer experiences in order to achieve a specific goal, including their needs and emotions. The design processes were executed with the aim of maximizing automation while minimizing human involvement. Figure 2 illustrates the journey map, which considers user experiences alongside the chronological steps in the system from smart contract execution until the tokens are transferred to the user's wallet.

3.1 EVALUATION OF TRANSACTIONS
After implementing the smart contract, it is crucial to transfer the tokens generated by the contract to a designated account, such as the account of the organization that initiated the creation of these tokens. The Remix website facilitates the interactive deployment of the smart contract code.

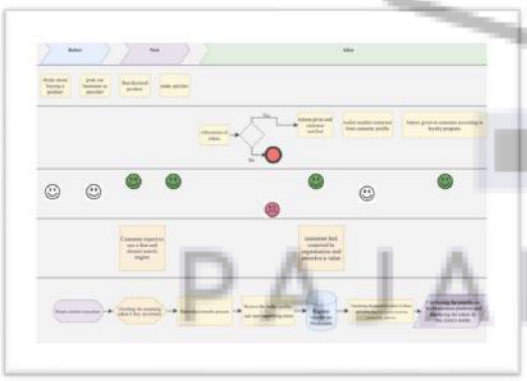

Figure 2. Customer journey map.

To transfer tokens from the deployed smart contract, we interacted with the blockchain using Remix. Then, we utilized the "Deploy and run transactions" menu and inputted the address of the desired Metamask wallet along with the number of tokens we intended to transfer. The Metamask prompt automatically opened for confirmation. Once the transaction was confirmed, the tokens were transferred to the receiver’s wallet.

To verify the completion of transactions on the Binance blockchain platform, we utilized the "BSC Scan" website. The results are depicted in Figure 3.

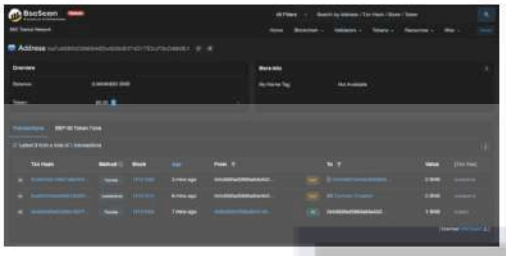

Figure 3. Token journey.

By choosing our token (TKN), we will be transferred to the information page of that token as shown in Figure 4.

Figure 4. Proof of execution.

All information regarding the wallet address, methods, and time of the transfer shown in Figure 4 confirms the execution within the blockchain.

3.2 EVALUATION USING EXPERT OPINION

We formulated a questionnaire to gather feedback from experts regarding the implementation of the project and potential challenges. The questionnaire also provided experts with the opportunity to offer suggestions for improvement. The primary rationale for soliciting expert opinions is to mitigate the high costs associated with implementing projects in organizations, the extended time required for large-scale project troubleshooting, and the heightened risk of customer information loss for the organization. Some of the questions and expert opinions are provided in Table 4.

According to the opinions of respected experts, implementing this project is feasible, but challenges such as internal resistance and advertising costs must be carefully addressed.

Regarding the software aspect, experts generally agree that the system can operate effectively with trained technicians. However, some experts suggest adopting a mechanism for organizations currently employing traditional loyalty programs, allowing their customers to transfer their points to the new blockchain-based platform.

Table 4. Expert opinions questionaire

Expert	Expertise Areas	Question 1: How do you rate the artifact deployabiliy (1–10)?	Question 2: How do you evaluate the operational and training costs for deployment?	Question 3: How do you conclude with the advantages and disadvantages of the design?	Question 4: What are other considerable aspects and criterias?
1	Sales management	7	High	Advantages outweigh disadvantages	Measuring customer affinity beforehand
2	Data science/ eCommerce consulting	4	High	Advantages outweigh disadvantages	Investigating precise costs and long-term goals of cooperation
3	Financial management/ Customer loyalty programme design	8	High	Advantages outweigh disadvantages	Investigating customer prevalances and needed infrastructures
4	Social networks management/ Full stack developer	9	Very high	Advantages outweigh disadvantages	Evaluating clear regulations in terms of contracts and interoperability of programmes

According to the questionnaire, experts have confirmed the usefulness of the artifact for customers and have observed a high potential for increasing customer satisfaction and wallet share due to the enhanced interaction with the organization.

4. CONCLUSION

After conducting an extensive literature review, the decision was made to explore blockchain technology to harness its potential benefits in customer loyalty programs. Using the Design Science Research (DSR) approach and expert opinions, we developed a model with defined conditions, which involved collecting user stories and scenarios to identify network usage patterns. This was followed by the creation of a smart contract to meet the identified needs and deploying it on the Binance Smart Chain platform. The created artifact was then tested, and its efficiency and effectiveness were confirmed through successful transactions. Additionally, we sought the opinions of experts in related fields through an expert opinion approach. Their feedback on the system's efficacy, potential challenges, and opportunities for commercial implementation was collected and summarized.

Our research indicates that blockchain technology offers valuable services that can enhance customer satisfaction, such as token-based point transfers, interoperability, and the elimination of the need for paper coupons. The primary objective of such benefits is to capture a larger portion of customers' wallets, which aligns with the primary goal of loyalty programs. This research aimed to enhance the productivity of loyalty programs by leveraging blockchain technology.

Based on our research findings, it appears that replacing traditional loyalty systems with blockchain-based platforms is less complicated than previously believed. Complex organizational structures and financial barriers have previously hindered the implementation of this technology. Nevertheless, our proposed platform and smart contract implementation require minimal costs in terms of hardware. Furthermore, increased transparency in wallet transactions may encourage customers to utilize their loyalty points.

During the course of our study, we encountered several limitations, including the bureaucratic structures inherent in organizations, which currently impede the widespread adoption of this method. Additionally, the high costs associated with its implementation, adaptation, and lack of cooperativity of organizations compelled us to limit our optimization efforts after the communication phase of the design science research approach.

In conclusion, loyalty programs based on blockchain technology have exhibited advantages for both users and organizations. The adoption of this platform allows organizations to collaborate and implement measures to enhance customer satisfaction. Furthermore, the transparency offered by blockchain technology can foster trust and confidence among users, leading to the expansion of economic relationships through the creation of a standardized token and its distribution in accordance with predefined guidelines. Consequently, conducting large-scale implementation would yield collateral benefits, such as the acquisition of significant data regarding customer behavior, and optimize the overall customer experience. Therefore, further research focusing on the implementation and communication phases of the design process is necessary.

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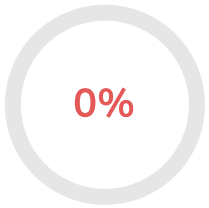

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Customer loyalty programs are pivotal for businesses aiming to foster customer engagement and retention. However, traditional loyalty programs often suffer from inefficiencies such as low redemption rates, high account inactivity, and limited interoperability. Blockchain technology presents a transformative solution to these challenges by offering benefits like reduced costs, increased transparency, enhanced security, and improved efficiency. This paper explores the potential of blockchain in revolutionizing customer loyalty programs, focusing on its key benefits and use cases. By leveraging blockchain, businesses can create open, interoperable loyalty ecosystems that provide customers with greater control over their rewards and facilitate seamless redemption across multiple programs. Case studies of successful blockchain-based loyalty programs in the hospitality industry illustrate the practical applications and benefits of this technology. Additionally, the paper discusses the future prospects of blockchain in reshaping the loyalty landscape and provides insights into its implementation through open-source Loyalty Blockchain APIs.

In today's fiercely competitive business landscape, customer loyalty programs have emerged as vital tools for enhancing customer engagement, fostering brand loyalty, and driving sustainable business growth. However, traditional loyalty programs often suffer from inefficiencies and limitations, including fragmented management systems, low redemption rates, high operational costs, and security vulnerabilities. These challenges hinder the effectiveness of loyalty initiatives and compromise the customer experience.

Blockchain technology presents a transformative solution to address the shortcomings of traditional loyalty programs. By leveraging its decentralized, immutable ledger and smart contract capabilities, blockchain offers a novel approach to loyalty program management, enabling seamless interoperability, enhanced security, increased transparency, and improved efficiency. Blockchain-based loyalty programs facilitate the creation of open, interoperable ecosystems wherein customers can seamlessly accrue, exchange, and redeem rewards across a diverse network of partners and vendors.

In the context of the hospitality industry, blockchain-based loyalty programs have gained traction as a means to differentiate brands, streamline operations, and deliver enhanced value propositions to guests. Case studies of leading hospitality brands illustrate the tangible benefits and success stories of implementing blockchain technology in loyalty initiatives.

Looking ahead, the future of blockchain in the loyalty world holds immense promise and potential. As businesses increasingly recognize the value proposition of blockchain-based loyalty solutions, we anticipate a paradigm shift towards more transparent, customer-centric loyalty ecosystems. With continued innovation and adoption, blockchain stands poised to reshape the loyalty landscape, driving greater customer engagement, satisfaction, and loyalty in the digital age.

METHODOLOGY:

Selecting the appropriate research model is crucial for ensuring the validity of the research and for conveying this validity to the audience. Introducing the research model also lays the groundwork for future research endeavors. In this study, the methodology employed is the approach of design science

research [12], a method commonly used in information technology to create and evaluate artifacts or solve practical problems. Here, we utilized this methodology to explore how blockchain technology can enhance the transfer of loyalty points among customers participating in various loyalty programs [12, 13, 14].

Using this method, we identified challenges related to loyalty points transfer and devised technological solutions to address these issues. These solutions were then evaluated by gathering insights from a panel of experts [15]. The findings obtained from this evaluation process can be utilized to refine existing designs or develop new solutions.

2.1 DESIGN SCIENCE RESEARCH METHODOLOGY

Design science research operates as a problem-solving paradigm aimed at advancing human knowledge through the creation of innovative artifacts [14]. Employing the DSR approach, our efforts will yield both a tangible product and a practical perspective on the identified problem. Figure 1 outlines the steps and processes inherent in the design science research method [14].

2.1.1 PROBLEM IDENTIFICATION AND MOTIVATIONS

The initial step in the design process involves defining the specific research problem and justifying the need for a solution. In this study, our problem revolves around the absence of a secure and trustless method for granting, utilizing, and exchanging points acquired through customer loyalty programs among customers and organizations. Establishing a secure and efficient platform for transferring benefits enhances the effectiveness of these loyalty programs, thereby potentially increasing their productivity.

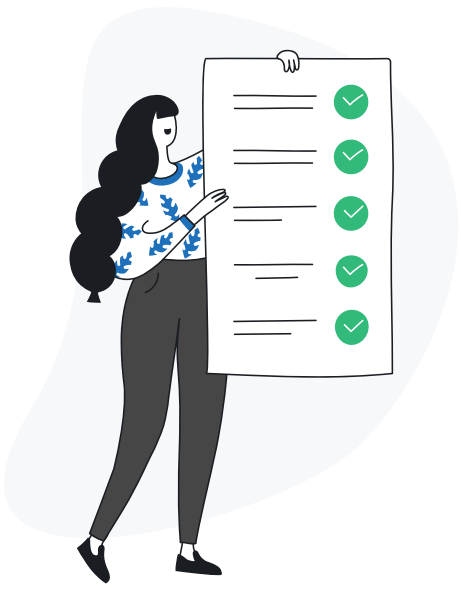
The primary objective of customer loyalty programs is to boost customer engagement with the organization and to ensure customer satisfaction, encouraging them to allocate a larger share of their spending to the organization's products or services [16]. Various psychological techniques are employed to attract customers, ultimately resulting in favorable outcomes for organizations [17, 18, 19, 20, 21, 22, 23, 24]. In our study, we focus on the status-based mechanism [20], which examines how customers perceive the value of gifts and discounts [21]. By utilizing this method, we identify the problem and the motivation for developing an artifact to enhance the potential of loyalty programs.

2.1.2 NECESSARY FACTORS FOR SOLVING THE PROBLEM

Goals can be derived from defining the problem and exploring potential solutions. These objectives can take the form of quantitative or qualitative goals, inferred from the problem statement. In this section, we aim to select a blockchain platform that aligns with the needs of both customers and organizations [25]. Subsequently, we implement a smart contract within this platform to encompass the rules of loyalty programs. In the following step, we generate tokens and transfer them to a wallet to facilitate seamless transfer and provide evidence of the artifact's execution.

- Blockchain platform:

Blockchain platforms come in various types, with some lacking support for smart contracts and thus not meeting our selection criteria. Others may impose high fees without offering significant advantages, citing reasons such as technical limitations, lack of support, or limited popularity. Our design opts for the Binance Smart Chain platform, which provides cost-effective smart contract functionality to users.



PAJAMA PADHAI

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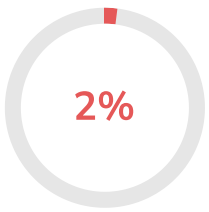

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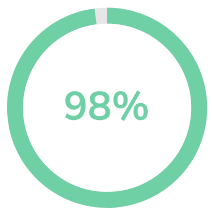

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Total Characters:	**6604**
Plagiarized Sentences:	**1**
Unique Sentences:	**49 (98%)**

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2.1.3 DESIGN AND DEVELOPMENT

In this phase, a Design Science Research (DSR) artifact, referred to as a chirol, encompasses any object that embodies our research contribution. This entails identifying the intended functionality and design of the artifact. We took on the task of identifying various scenarios for our tokens and devising the execution mechanism within the network. The core components of the network include the token and different user categories. As depicted in Table 2, there are three types of users fulfilling distinct roles. These roles consist of the partner, who distributes loyalty points to members of the loyalty program, the member, who earns points from purchases and redeems them, and the manager, who oversees the affairs of the partners [11].

Various transactions and user scenarios can occur within this network (refer to Table 3 [11]). After reviewing the users' narratives, we identified the essential regulations that must be incorporated into the smart contract. These rules govern the transfer, allocation, and expenditure of tokens. While these rules could be inferred from studying existing loyalty programs, we emphasized a scientific approach to this endeavor. Therefore, we utilized the Remix website as an online platform for writing the smart contract, which is based on the Solidity coding language. The final version of the smart contract code is displayed in Code 1.

The smart contract is designed to be applicable for all transactions, with organizations adopting this mechanism based on their preferences. For instance, an organization may consider each loyalty point as a token, or they may decide that ten points are equivalent to a single token. If an organization selects a specific policy for the conversion rate of points to tokens, this ratio must be adhered to by its partner organizations. Organizations are required to engage in consultation and mutually agree on this ratio before reaching a final decision. To avoid potential mathematical complexities in the future, it is recommended that each point be considered equal to one token, as it facilitates the determination of the desired number of tokens.

Once the smart contract was set up, the next step involved transferring the created tokens to the wallet of the organization benefiting from this blockchain, so they could distribute them among their members. For this purpose, we utilized the user-friendly and cost-effective Metamask wallet for our operations. Furthermore, we utilized the Binance virtual test network to assess the efficiency of the smart contract, as detailed in subsequent sections.

2.1.4 PRODUCT DISPLAY

This phase involves employing the artifact in experiments, simulations, case studies, proofs, or other pertinent activities. Our final product is a blockchain platform integrated with a smart contract that regulates the loyalty program. The provisions embedded within this smart contract are tailored to meet

the specific requirements of loyalty programs. This blockchain platform has the capability to allocate tokens to customers, receive tokens from other customers, and facilitate token transfers between two customers or among customers and organizations.

2.1.5 EVALUATION

Evaluation involves assessing the effectiveness of the artifact in resolving the problem by comparing the intended solution with the observed outcomes of the artifact's implementation. This process can encompass diverse evaluation methodologies that align with the problem domain and the nature of the artifact. Subsequent to this phase, the decision to revise the artifact's efficacy by revisiting the third step or to proceed with communication and defer any potential enhancements for future endeavors is determined.

To evaluate the implemented blockchain, we conducted various network operations on the Binance virtual test network to evaluate its functionality. In the following step, we aimed to assess the practicality of the artifact and identify any potential obstacles in its implementation by seeking expert opinions.

2.1.6 COMMUNICATIONS

Here, all aspects of the problem and the designed artifact were communicated to the stakeholders. Depending on the research objectives and the audience, appropriate forms of communication could be employed, including professional channels.

Finally, it's important to note that the design science research approach methodology involves a back-and-forth behavior. The outcomes reported in each section are the cumulative result of the entire process and not solely the consequence of a single stage. Each stage contributes to the final result and represents a crucial step toward achieving the desired objectives. Therefore, it is the combined effort and progress made throughout all stages that lead to the final outcome.

2.2 EXPERT OPINION METHODOLOGY

This method is utilized to make predictions or estimates when there is insufficient information available to conduct statistical procedures [13]. It operates innovatively and aims to address ambiguous or unresolved problems. Knol et al. describe this method in seven steps [28]:

2.2.1 DETERMINING UNCERTAINTIES (IDENTIFYING VARIABLE VALUES)

In this section, we discussed the significance of obtaining expert opinions and how they can aid in evaluating the feasibility and identifying potential challenges in implementing the proposed solution. Challenges addressed here include the required infrastructures for implementing and examining the blockchain platform, technician training needs, and technical updates.

2.2.2 SCOPE AND FORMAT OF EXTRACTION

Here, we developed a questionnaire with a general format of questions. Various factors such as time and cost were considered to determine the appropriate method of gathering expert opinions, which included interviews, questionnaires, face-to-face or telephone conversations, and opinion summarization.

This study utilized interviews with multiple experts from diverse fields and incorporated a selection of their opinions. An eight-question survey was compiled, administered both in-person and online, covering topics such as software, hardware, human resources, and future-proofing.

2.2.3 IDENTIFICATION AND SELECTION OF EXPERTS

In the expert opinion method, it's crucial to define the criteria for identifying individuals who can be considered experts. An expert is a key person who:

- Possesses significant knowledge of the problem area.

- Holds a background in the discussed field.
- Is recognized (e.g., among colleagues) and competent in solving the problem.
- Is familiar with assessing possibilities.

How to elicit opinions from experts - Revasia

An expert is a key person who: ▫ has important knowledge about the field of interest;. ▫ has a background in the field of interest;. ▫ is recognized (such ...

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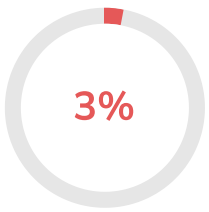

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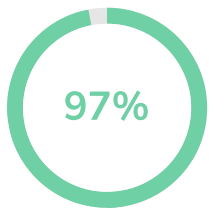

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Plagiarized Sentences:	**0.81**
Unique Sentences:	**26.19 (97%)**

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2.2.4 DESIGN OF EXTRACTION MANUALS

The questions should follow a specific format and aim towards a conclusion for the main purpose. These questions were structured to elicit statistical, probabilistic, and qualitative estimates.

2.2.5 PREPARATION OF THE EXTRACTION SESSION

Meetings were conducted in person, over the phone, or online, depending on the individual's availability and schedule.

2.2.6 RELYING ON THE OPINION OR JUDGMENT OF AN EXPERT

To utilize the opinions of experts, it was essential to reach a consensus on those opinions, especially when multiple experts were involved.

2.2.7 SUMMARY, AGGREGATION, AND REPORTING OF RESULTS

Finally, the collected answers were aggregated based on a scoring system, and the results were summarized and reported.

3. RESULTS

A customer journey map was created to depict the processes that both customers and organizations undergo in this system. A customer journey map is a visual representation of the steps, activities, and situations a customer experiences in order to achieve a specific goal, including their needs and emotions. The design processes were executed with the aim of maximizing automation while minimizing human involvement. Figure 2 illustrates the journey map, which considers user experiences alongside the chronological steps in the system from smart contract execution until the tokens are transferred to the user's wallet.

3.1 EVALUATION OF TRANSACTIONS

After implementing the smart contract, it is crucial to transfer the tokens generated by the contract to a designated account, such as the account of the organization that initiated the creation of these tokens. The Remix website facilitates the interactive deployment of the smart contract code.

To transfer tokens from the deployed smart contract, we interacted with the blockchain using Remix. Then, we utilized the "Deploy and run transactions" menu and inputted the address of the desired Metamask wallet along with the number of tokens we intended to transfer. The Metamask prompt automatically opened for confirmation. Once the transaction was confirmed, the tokens were transferred to the receiver’s wallet.

To verify the completion of transactions on the Binance blockchain platform, we utilized the "BSC Scan" website. The results are depicted in Figure 3.

All information regarding the wallet address, methods, and time of the transfer shown in Figure 4 confirms the execution within the blockchain.

3.2 EVALUATION USING EXPERT OPINION

We formulated a questionnaire to gather feedback from experts regarding the implementation of the project and potential challenges. The questionnaire also provided experts with the opportunity to offer suggestions for improvement. The primary rationale for soliciting expert opinions is to mitigate the high costs associated with implementing projects in organizations, the extended time required for large-scale project troubleshooting, and the heightened risk of customer information loss for the organization. Some of the questions and expert opinions are provided in Table 4.

According to the opinions of respected experts, implementing this project is feasible, but challenges such as internal resistance and advertising costs must be carefully addressed.

Regarding the software aspect, experts generally agree that the system can operate effectively with trained technicians. However, some experts suggest adopting a mechanism for organizations currently employing traditional loyalty programs, allowing their customers to transfer their points to the new blockchain-based platform.

According to the questionnaire, experts have confirmed the usefulness of the artifact for customers and have observed a high potential for increasing customer satisfaction and wallet share due to the enhanced interaction with the organization.

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Unique Sentences:	**20 (100%)**

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4. CONCLUSION

After conducting an extensive literature review, the decision was made to explore blockchain technology to harness its potential benefits in customer loyalty programs. Using the Design Science Research (DSR) approach and expert opinions, we developed a model with defined conditions, which involved collecting user stories and scenarios to identify network usage patterns. This was followed by the creation of a smart contract to meet the identified needs and deploying it on the Binance Smart Chain platform. The created artifact was then tested, and its efficiency and effectiveness were confirmed through successful transactions. Additionally, we sought the opinions of experts in related fields through an expert opinion approach. Their feedback on the system's efficacy, potential challenges, and opportunities for commercial implementation was collected and summarized.

Our research indicates that blockchain technology offers valuable services that can enhance customer satisfaction, such as token-based point transfers, interoperability, and the elimination of the need for paper coupons. The primary objective of such benefits is to capture a larger portion of customers' wallets, which aligns with the primary goal of loyalty programs. This research aimed to enhance the productivity of loyalty programs by leveraging blockchain technology.

Based on our research findings, it appears that replacing traditional loyalty systems with blockchain-based platforms is less complicated than previously believed. Complex organizational structures and financial barriers have previously hindered the implementation of this technology. Nevertheless, our proposed platform and smart contract implementation require minimal costs in terms of hardware. Furthermore, increased transparency in wallet transactions may encourage customers to utilize their loyalty points.

During the course of our study, we encountered several limitations, including the bureaucratic structures inherent in organizations, which currently impede the widespread adoption of this method. Additionally, the high costs associated with its implementation, adaptation, and lack of cooperativity of organizations compelled us to limit our optimization efforts after the communication phase of the design science research approach.

In conclusion, loyalty programs based on blockchain technology have exhibited advantages for both users and organizations. The adoption of this platform allows organizations to collaborate and implement measures to enhance customer satisfaction. Furthermore, the transparency offered by blockchain technology can foster trust and confidence among users, leading to the expansion of economic relationships through the creation of a standardized token and its distribution in accordance with predefined guidelines. Consequently, conducting large-scale implementation would yield collateral benefits, such as the acquisition of significant data regarding customer behavior, and optimize the overall customer experience. Therefore, further research focusing on the implementation and communication phases of the design process is necessary.

No Plagiarism Found