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Designing a Blockchain-Based Customer Loyalty Programme using Design Science Research Method

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Abstract
Loyalty programmes are crucial marketing tools for businesses to increase customer engagement and retention. These programmes, sponsored by enterprises, offer rewards, discounts, and other incentives to attract and retain customers. However, the lack of interoperability among loyalty programmes of different organisations can limit the customer's ability to maximise the value of their loyalty points. In this study, we proposed the design and implementation of a blockchain-based platform using the design science research (DSR) method as a candidate solution to overcome the limitations of conventional loyalty programmes. Using smart contracts, the design enables organisations to embed all necessary attributes for their desired customer loyalty programmes in accordance with their policies. The designed platform provides a decentralised, transparent, and secure environment for the exchange of loyalty tokens between various organisations and customers. Using expert opinion methodology, we discussed the technical considerations and implementation of the blockchain-based loyalty programme platform, as well as its potential impact on the customer experience. Our findings suggest that the proposed platform can improve the interoperability of loyalty programmes using a universal token that creates more value for businesses and customers. The research contributes to the field of loyalty programmes and blockchain technology by proposing a platform that enable businesses to develop more effective and data-driven loyalty strategies, while providing customers with better value for their loyalty points.

Keywords: *Blockchain Technology, Loyalty Programme, Marketing, Design Science Research*

JEL Classifications: *L14, M31*

1. Introduction

The advent of diverse computer technologies and networks has resulted in significant and expeditious transformations across all domains. Among the common practices experienced by individuals in their lifetime is the utilisation of loyalty programmes by organisations providing services or products. Such programmes aim to retain customers within the organisation and enhance their share of wallet [1].

In recent years, numerous organisations have begun to accumulate customer data to monitor and analyse their behaviour [2]. By studying this data, organisations try to design a loyalty programme to keep current customers satisfied and attract new customers.

Loyalty programmes include integrated systems of personalised customer marketing and marketing communications, offering tangible (such as discounts or gifts) or intangible (such as personalised service or information) rewards to the customer [3], [4].

Customers may be members of multiple loyalty programmes from various organisations that use disparate methods to provide and manage services, such as physical coupons, digital coupons, or specialised mobile applications. The absence of interoperability among loyalty programmes of various organisations leads to a situation where consumers face difficulty in effectively utilising the value of their loyalty points, given that each organisation offers its own system and rewards. Additionally, privacy concerns may dissuade customers from sharing personal information with every loyalty programme [5].

Blockchain technology is a distributed database comprising encrypted blocks of asset transactions that are sequentially ordered, digitally signed, and governed by a consensus model [6]. The technology's potential in addressing these loyalty programme challenges is noteworthy. By embedding the terms of loyalty programmes in a smart contract, blockchain enables organisations to determine the precise reward and profit amounts to be disbursed to their customers, without the need for trust, in a transparent manner. This contract is executed independently and is used to manage the transaction [7].

Providing a suitable blockchain platform for the exchange of these privileges between internal and external customers is possible by creating a token. Tokens are a form of incentive given to customers for participating in a loyalty programme. These tokens are stored on the blockchain and represent specific assets, such as currencies or products.

The blockchain platform offers a secure environment for the exchange of tokens between various organisations after mutual agreement. By employing tokens, integration and collective

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benefits of all loyalty programmes become feasible. Tokens are not limited to purchases but can also encompass the overall customer interaction with the brand or retailer, resulting in the integration of digital marketing [8].

By providing an integrated and trustless platform, blockchain can control the transfer and manage the number of customer assets in any organisation with the help of tokens in its platform [9]. Blockchain provides the basis for unifying the type of awards between organisations [10].

Furthermore, organisations can provide the possibility of transferring their points with each other by agreeing between themselves and using a common platform, so that both the management and maintenance costs of their loyalty programmes are reduced and providing more valuable options to customers themselves should also provide ways to improve their level of satisfaction. For example, several hotels and airlines offer their points to their customers on the same platform using the same method [11].

As of now, the main disadvantages of using blockchain in this scope are the implementation of the structure and costs. Besides, due to the nature of blockchain, correcting a mistake is rather impossible or very costly. Some of these advantages and disadvantages are given 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.

In this article, we will explore the design and implementation of a blockchain-based platform for loyalty programmes via a design science research approach. We aim to explore blockchain potential to solve mentioned problems in loyalty programmes. Throughout this article, we discuss the benefits of using blockchain for loyalty programmes, the technical considerations in designing such a platform, gaining insights from experts, and the potential impact on the overall customer experience. By the end of this article, readers will have a better understanding of if blockchain technology can transform the loyalty programme landscape and create more value for both businesses and customers.

2. Methodology

Choosing the appropriate research model in the research process is vital in explaining its validity to the audience. Also, the introduction of the research model facilitates and expands future research. The methodology used in this study is the approach of design science research [12] as a research method used in information technology to develop and evaluate artefacts or practical problems. In this case, we utilised this methodology to leverage blockchain opportunities to optimise loyal points transfer among customers of various loyalty programmes [12, 13, 14].

In this method, we identified loyal points transfer problems and developed a technology solution to address these problems. The solutions developed are evaluated through gaining knowledge from a list of experts [15], and the findings are able to be used to refine the design or develop new solutions.

2.1 Design science research methodology

Design science research is a problem-solving paradigm that seeks to enhance human knowledge by creating innovative artefacts [14]. Using the DSR approach, the result of our work will be a product and a pragmatic view of the identified problem. Figure 1 illustrates the steps and processes underlying the design science research method [14].

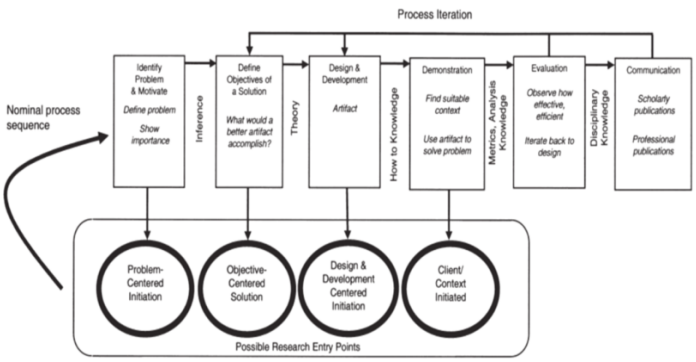

Figure 1. DSR process.

We benefited from six steps below in the design science research approach.

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2.1.1 Problem identification and motivations

The first step in the design is to define the specific research problem and justify the value of a solution. In this study, our problem is the lack of a safe and trustless method to grant, use, and exchange points obtained through customer loyalty programmes to customers and among organisations. Providing a safe and efficient platform for transferring privileges increases the efficiency of these loyalty programmes. As a result, productivity in loyal programmes would increase.

The purpose of customer loyalty programmes is to increase customer engagement with the organisation and to satisfy customers to allocate more significant portion of their wallet to the services or products of the organisations [16]. For that matter, there are many psychological methods which attract customers, leading to profitable outcomes for organisations [17, 18, 19, 20, 21, 22, 23, 24]. The key psychological method employed in our study is the status-based mechanism [20], which examines the perceived value by the customer through gifts and discounts [21]. By using the mentioned method, we identified problem and motivation for creating an artefact to enhance loyalty programme potentials.

2.1.2 Necessary factors for solving the problem

We can deduce goals by defining the problem and investigating solution possibilities. These objectives can be quantitative or qualitative and inferred from the problem specification. In this section, we select our blockchain platform according to the customer and organisation needs [25] and implement a smart contract that covers the rules of loyalty programmes through this platform. In the next step, we create tokens and transfer them to a wallet for easy transfer and proof of executing the artefact.

- Blockchain platform

Blockchain platforms vary in type, with some lacking smart contract support and being excluded from our selection. Others charge high fees without offering a competitive advantage, citing technical reasons, support, or popularity. Our design employs the Binance Smart Chain platform, which offers cost-effective smart contract functionality to users.

- Wallet

In order to store tokens generated for the organisation and transfer tokens to users who have received a certain amount of them, it is necessary to store the tokens in a wallet under the supervision of the organisation so that the organisation can transfer them according to loyalty programme regulations. Automated transfer of digital currencies among customers and organisations necessitates the use of a digital wallet. The conversion of tokens to fiat currency or their offline transfer are regulatory measures that are employable and fall under the purview of organisational consensus.

- Unique token

The unique token is an intangible reward offered by organisations to users who use their service or purchase their product. Users earn points by adhering to the rules of the customer loyalty programme. The tokens are transferable within the platform, allowing customers to exchange them and use them for various benefits in the loyalty programme.

- Smart contract

A smart contract is a set of logical rules in the form of a cryptographic script that can be embedded within the blockchain [26], [27]. Upon implementation on the desired blockchain platform, the rules will become immutable and binding. Organisational considerations such as token transferability, creation, and burning may be incorporated into these contracts. Solidity, a programming language similar to JavaScript, is well-suited for building decentralised applications and is utilised for contract writing [9].

2.1.3 Design and development

In this phase, a DSR chrolo refers to any object that incorporates our research contribution. This involves identifying the intended functionality and design of the artefact.

we undertook the task of identifying various scenarios for our tokens and devising the execution mechanism within the network. The fundamental elements of the network comprise the token and the users' categories. As illustrated in Table 2, there are types of users in three different roles. These roles include the partner as a person who gives loyalty points to members of this loyalty programme, a member who receives points from their purchases and spends those points, and a manager who supervises the partners' affairs [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 stories can occur within this network (see Table 3 [11]).

Upon reviewing the users' narratives, we identified the essential regulations that must be integrated into the smart contract. These rules pertain to the transfer, allocation, and expenditure of tokens. Although these rules could be inferred from studying existing loyalty programmes, we emphasised a scientific approach to this endeavour. So, we used the Remix website to write the smart contract to provide an online solidity-based coding platform. The final version of the smart contract code is shown in code 1.

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The smart contract is assumed applicable for all transactions. Organisations adopt this mechanism based on their preferences. For instance, the organisation may consider each loyalty point as a token, or they may consider ten points equivalent to a single token. In case an organisation selects a specific policy for the conversion rate of points to tokens, it must be adhered to by its partner organisations. The organisations are required to engage in consultation and mutually agree on this ratio before making a final decision. To avoid potential mathematical complications in the future, it is recommended that each point be deemed equal to one token, as it allows for easy 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

After setting up the smart contract, it was necessary to place the created tokens in the wallet of the organisation benefiting from this blockchain to distribute them among its members. We utilised the user-friendly and cost-effective Metamask wallet for our operations. Additionally, we employed the Binance virtual test network to evaluate the efficiency of the smart contract, as elaborated in subsequent sections.

```
pragma solidity ^0.8.2;

contract Token {
    mapping(address => uint) public balances;
    mapping(address => mapping(address => uint)) public allowance;
    uint public totalSupply = 21000000 * 10 ** 18;
    string public name = "My Token";
    string public symbol = "TKE";
    uint public decimals = 18;

    event Transfer(address indexed from, address indexed to, uint value);
    event Approval(address indexed owner, address indexed spender, uint value);

    constructor(){
        balances[msg.sender] = totalSupply;
    }

    function balanceOf(address owner) public view returns(uint) {
        return balances[owner];
    }

    function transfer(address to, uint value) public returns(bool) {
        require(balanceOf(msg.sender) >= value,'balance too low');
        balances[to] += value;
        balances[msg.sender] -= value;
        emit  Transfer(msg.sender, to, value);
        return true;
    }

    function transferFrom(address from, address to, uint value) public returns(bool) {
        require(balanceOf(from) >= value, 'balance too low');
        require(allowance[from][msg.sender] >= value, 'allowance too low');
        balances[to] += value;
        balances[from] -= value;
        emit Transfer(from, to, value);
        return true;
    }

    function approve(address spender, uint value) public returns(bool){
        allowance[msg.sender][spender] = value;
        emit Approval(msg.sender, spender, value);
        return true;
    }
}
```

Code 1. Smart contract.

2.1.4 Product display

This phase entails utilising the artefact in experiments, simulations, case studies, proofs, or other relevant activities. Our final product is a blockchain platform integrated with a smart contract that governs the loyalty programme. The provisions encoded within this smart contract are customised to cater to the requirements of loyalty programmes. 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 organisations.

2.1.5 Evaluation

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

To evaluate the implemented blockchain, we executed various network operations on the Binance virtual test network to assess

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its functionality. In the next step, we aimed to assess the practicality of the artefact and identify any potential obstacles in its implementation by soliciting expert opinions.

2.1.6 Communications

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

Finally, it should be noted that the design science research approach methodology has a back-and-forth behaviour. It is important to note that 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 towards 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 employed to make predictions or estimates when there is inadequate information available to conduct statistical procedures [13]. This method operates innovatively and endeavours to solve obscure 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 have discussed the importance of obtaining expert opinions and how it can help us in evaluating the feasibility and identifying potential challenges in implementing the proposed solution. Challenges addressed here include 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 created a questionnaire in a general format of questions. Various factors such as time and cost were taken into account to determine the appropriate method of gathering expert opinions, including interviews, questionnaires, face-to-face or telephone conversations, and opinion summarisation.

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

2.2.3 Identification and selection of experts

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

- has significant knowledge of the problem area
- has a background in the discussed field
- is known (e.g., among colleagues) and competent in solving the problem
- is familiar with the assessment of possibilities.

Additionally, the expert's opinion should change over time as the expert receives new information and also the expert's opinions should be valid, transparent, science-based, and justifiable. Nevertheless, there are also criteria to recognise an expert:

- Tangible evidence of expertise (e.g., degree, publications, position)
- The fame
- Availability and willingness to participate
- Understanding the general problem area
- Neutrality
- Having no economic or personal stake in potential findings

2.2.4 Design of extraction manuals

The questions should have had a specific format and move towards a conclusion for the main purpose. These questions were in the form of statistical, probabilistic, and qualitative estimates.

2.2.5 Preparation of the extraction session

The meetings were held in person, by phone, or online depending on the person's time and availability.

2.2.6 Relying on the opinion or judgment of an expert

In order to use the opinions of experts, it was necessary to reach a consensus on those opinions if we have used several experts.

2.2.7 Summary, aggregation, and reporting of results

Finally, the collected answers were aggregated based on a scoring system.

3. Results

A customer journey map was created to illustrate the processes that customers and organisations undergo in this system. A customer journey map is a visual representation of the steps, activities, and situations a customer goes through to achieve a specific goal, including customer needs and emotions. The design processes were carried out so that the maximum level of automation follows the minimum level of human involvement. Figure 2 illustrates the journey map. As illustrated, the map considers the user experiences along with the chronological steps in system from the smart contract execution until the tokens have transferred to user's wallet.

3.1 Evaluation of transactions

Once the smart contract is implemented, it is essential to transfer the tokens generated by the contract to a designated account, such as the account of the organisation that initiated the creation of these tokens. The Remix site facilitates the interactive deployment of the smart contract code.

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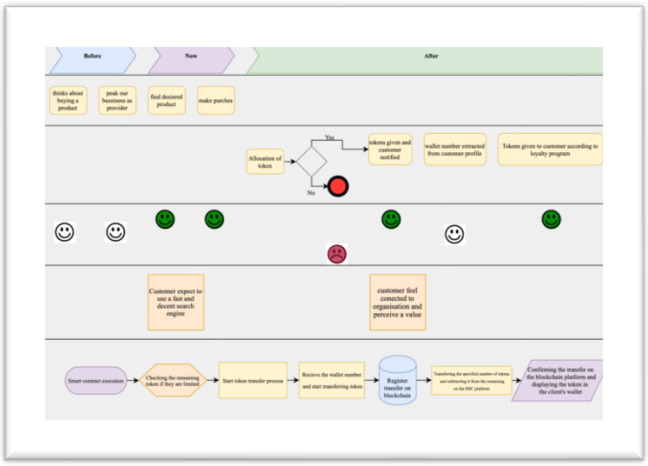

Figure 2. Customer journey map.

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

To check the completion of the Binance blockchain platform transactions, we used the "BSC Scan" website. The results are shown in Figure 3.

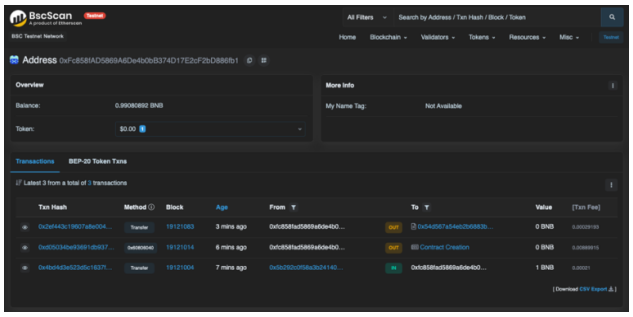

Figure 3. Token journey.

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

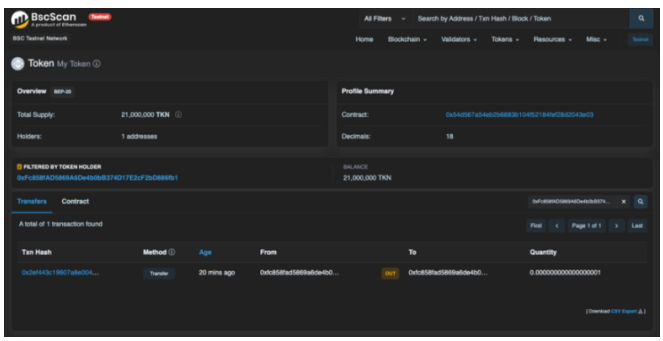

Figure 4. Proof of execution.

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 created a questionnaire to obtain feedback from experts regarding the implementation of the project and potential challenges. The questionnaire also allowed experts to provide suggestions for improvement. The primary rationale for using expert opinions is to mitigate the high costs of implementing projects in organisations, the prolonged time required for large-scale project troubleshooting, and the increased risk of customer information loss for the organisation. Some of the questions and expert opinions are given in Table 4.

According to the opinion of respected experts, implementing this project is possible but facing challenges, like internal resistance and advertising costs, must be carefully addressed.

Regarding the software aspect, the experts generally agree that the system can work effectively with trained technicians. However, some experts suggest that a mechanism should be adopted for organisations that currently use traditional loyalty programmes, 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 deployability (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 artefact for customers and observed a high

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potential for increasing customer satisfaction and wallet share due to the increase in interaction with the organisation.

4. Conclusion

After an extensive literature review, the decision was made to explore blockchain technology to utilise their potential benefits in customer loyalty programmes. Using the DSR approach and expert opinions, we developed a model with defined conditions which involved collecting user stories and scenarios to identify network usage patterns, followed by writing a smart contract to meet the identified needs and deploying it on the Binance Smart Chain platform. The created artefact 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 summarised.

Our research indicates that blockchain technology offers valuable services that can enhance customer satisfaction, such as token-based point transfers, interoperability, and eliminating 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 programmes. This research aimed to enhance the productivity of loyalty programmes 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 organisational structures and financial barriers have previously hindered the implementation of this technology. Nevertheless, our proposed platform and smart contract implementation need minimal costs in the case of hardware. Furthermore, increased transparency in wallet transactions may encourage customers to utilise their loyalty points.

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

In conclusion, loyalty programmes based on blockchain technology have exhibited advantages for both users and organisations. The adoption of this platform allows organisations 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 standardised 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 behaviour, and optimise the overall customer experience. Therefore, further research focusing on the implementation and communication phases of the design process is necessary.

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None declared.

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Author's contribution:
The authors designed and coordinated this research and prepared the manuscript in its entirety.

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References

[1] A. Boukis, "Exploring the implications of blockchain technology for brand–consumer relationships: A future research agenda," *J. Prod. Brand. Manag.*, vol. 29, no. 3, pp. 307–320, Apr. 2020, doi: 10.1108/JPBM-03-2018-1780.

[2] P. Leonora, "New technologies in marketing as competitive advantage" [Online]. Available: http://hdl.handle.net/10419/183838www.econstor.eu

[3] Y. Chen, T. Mandler, and L. Meyer-Waarden, "Three decades of research on loyalty Programmes: A literature review and future research agenda," *J. Bus. Res.*, vol. 124. Elsevier Inc., pp. 179–197, Jan. 01, 2021. doi: 10.1016/j.jbusres.2020.11.057.

[4] N. J. F. Bombaij and M. G. Dekimpe, "When do loyalty programmes work? The moderating role of design, retailer-strategy, and country characteristics," *Int. J. Res. Mark.,* vol. 37, no. 1, pp. 175–195, Mar. 2020, doi: 10.1016/j.ijresmar.2019.07.003.

[5] O. Sonmezturk, T. Ayav, and Y. M. Erten, "Loyalty programme using blockchain," in *Proc. - 2020 IEEE Int. Conf. Blockchain, Blockchain 2020*, Nov. 2020, pp. 509–516, doi: 10.1109/Blockchain50366.2020.00074.

[6] K. Sultan, U. Ruhi, and R. Lakhani, "Conceptualizing blockchains: Characteristics & applications," in *Proc. 11th IADIS Int. Conf. Inf. Syst.*, Apr. 2018, pp. 49–57.

[7] S. Bülbül and G. Ince, "Blockchain-based framework for customer loyalty programme," in *Proc. 3rd Int. Conf. Comput. Sci. Eng. (UBMK),* Sep. 2018, pp. 342–346.

[8] I. Antoniadis, S. Kontsas, and K. Spinthiropoulos, "Blockchain applications in marketing," 2019. [Online]. Available: https://www.researchgate.net/publication /337439697

[9] M. Agrawal, D. Amin, R. Gala, and H. Dalvi, "Blockchain-based universal loyalty platform," in *Proc. Int.*

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Conf. Adv. Comput. Commun. Control (ICAC3), Dec. 2019, pp. 1–6.

[10] A. Rejeb, J. G. Keogh, and H. Treiblmaier, "How blockchain technology can benefit marketing: Six pending research areas," *Front. Blockchain*, vol. 3, Feb. 2020, doi: 10.3389/fbloc.2020.00003.

[11] L. J. Dominguez Perez, L. Ibarra, G. F. Alejandro, A. Rumayor, and C. Lara-Alvarez, "A loyalty programme based on waves blockchain and mobile phone interactions," *Knowl. Eng. Rev.*, 2020, doi: 10.1017/S0269888920000181.

[12] R. Henver, T. March, J. Park, and S. Ram, "Design science in information systems research," *MIS Quart.*, vol. 28, no. 1, pp. 75–105, Mar. 2004.

[13] A. C. K. Wiedlea, "Expert elicitation for risk assessment," 2008, doi: https://doi.org/10.1002/9780470061596.risk0490.

[14] J. vom Brocke, A. Hevner, and A. Maedche, "Introduction to design science research," pp. 1–13, 2020, doi: 10.1007/978-3-030-46781-4_1.

[15] T. Bedford, J. Quigley, and L. Walls, "Expert elicitation for reliable system design," *Stat. Sci.*, vol. 21, no. 4, pp. 428–450, 2006. doi: 10.1214/088342306000000510.

[16] M. Chaudhuri, C. M. Voorhees, and J. M. Beck, "The effects of loyalty Programme introduction and design on short- and long-term sales and gross profits," *J. Acad. Mark. Sci.*, vol. 47, no. 4, pp. 640–658, Jul. 2019, doi: 10.1007/s11747-019-00652-y.

[17] F. G. Gilal, J. Zhang, J. Paul, and N. G. Gilal, "The role of self-determination theory in marketing science: An integrative review and agenda for research," *Eur. Manag. J.*, vol. 37, no. 1, pp. 29–44, Feb. 2019, doi: 10.1016/j.emj.2018.10.004.

[18] R. M. Ryan and E. L. Deci, "Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being," Am. Psychol., vol. 55, no. 1, p. 68, 2000.

[19] K. Kim and S. J. (Grace) Ahn, "The role of gamification in enhancing intrinsic motivation to use a loyalty programme," *J. Interact. Mark.*, vol. 40. Elsevier Inc., pp. 41–51, Nov. 01, 2017, doi: 10.1016/j.intmar.2017.07.001.

[20] L. Sajtos and Y. S. Chong, "Boasting and aspiring, as status-reinforcing mechanisms in status-based loyalty Programmes," *Psychol. Mark.*, vol. 35, no. 9, pp. 640–651, Sep. 2018, doi: 10.1002/mar.21112.

[21] A. Akhmedova, F. Marimon, and M. Mas-Machuca, "Winning strategies for customer loyalty in the sharing economy: A mixed-methods study," *J. Bus. Res.*, vol. 112, pp. 33–44, May 2020, doi: 10.1016/j.jbusres.2020.02.046.

[22] H. Tajfel and J. C. Turner, "The social identity theory of intergroup behavior," in Political Psychology. Psychology Press, 2004, pp. 276–293.

[23] D. Kahneman and A. Tversky, "Prospect theory: An analysis of decision under risk," in *Choices, Values, and Frames*, Cambridge: Cambridge University Press, 2019, pp. 17–43. doi: 10.1017/CBO9780511803475.003.

[24] L. Festinger, "A theory of social comparison processes," doi: 10.1177/001872675400700202.

[25] A. Schweizer, G. Fridgen, and A. Rieger, "A solution in search of a problem: A method for the development of blockchain use cases digital transformation of incumbent organisations view project artefacts for blockchain projects view project," 2018. [Online]. Available: https://www.researchgate.net/publication/324603293

[26] A. Vacca, A. Di Sorbo, C. A. Visaggio, and G. Canfora, "A systematic literature review of blockchain and smart contract development: Techniques, tools, and open challenges," *J. Syst. Softw.*, vol. 174, Apr. 2021, doi: 10.1016/j.jss.2020.110891.

[27] M. Marchesi, L. Marchesi, and R. Tonelli, "An agile software engineering method to design blockchain applications," pp. 1–8, 2018, doi: 10.1145/3290621.3290627.

[28] A. B. Knol, P. Slottje, J. P. Van Der Sluijs, and E. Lebret, "The use of expert elicitation in environmental health impact assessment: A seven step procedure," *Environ. Health*, vol. 9, no. 1, 2010, doi: 10.1186/1476-069X-9-19.

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