A Systematic Review of Blockchain-based Loyalty Programs

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Abstract

Customer loyalty programs, the incentive structures designed to reward and retain customers for purchases and other activities, have struggled to maximize their intended goals. Academics and industry practitioners have advocated for the use of blockchain technology as a vehicle to revolutionize loyalty programs. Despite this hype, we have yet to see an examination of existing blockchain-based loyalty solutions. This paper identifies, reviews, and classifies tokenized loyalty solutions.

Using a web-scraping method, we systematically retrieved 9,642 tokens listed on the coinmarketcap.com website. Multiple applications of inclusion/exclusion criteria resulted in 21 active loyalty programs based on blockchain, which we evaluated in depth. Our findings confirm that the domain is nascent yet more actualized than previous research has suggested. This analysis fills a much-needed role in the blockchain-loyalty literature by providing an industry lens into the realities of blockchain as a loyalty solution.

Keywords: Blockchain, loyalty program, customer relationship management, CRM.

1. Introduction

Customer loyalty programs are economic incentive structures used to reward customers for purchases or other forms of allegiance. Securing repeat sales from customers is a hallmark of relationship marketing (RM), which is the theoretical underpinning of customer relationship management (CRM) (Peppers, Rogers, & Dorf, 1999; Ryals & Payne, 2001). As a result, loyalty program management can be considered a critical component of organizational CRM initiatives. Gartner, Inc. views CRM through the five dimensions of sales, marketing, customer service, digital commerce, and cross-CRM, and places loyalty management as a component of the marketing dimension (Thompson, 2021).

Research on CRM remains highly relevant as these popular enterprise systems, which grew in market share 13% from 2019-2020 to $69.3 billion, have eclipsed enterprise resource planning (ERP) and supply chain management (SCM) systems and now represent the largest market of the major enterprise systems (Poulter, Dharmasthira, & Gupta, 2021). CRM is increasingly explored in the context of emergent technologies like blockchain, an innovation underpinning the Web3 and Web4 paradigms (Kinnett & Steinbach, 2021). Blockchain has been noted as particularly important in the context of customer loyalty programs. This attention is driven by both academics (Wang, Luo, Hua, & Wang, 2019) and industry practitioners (Fromhart & Therattil, 2016) both recommending blockchain as a vehicle through which loyalty programs can be optimized or even transformed. Such advocates purport that some of blockchain's inherent characteristics, such as immutability of transactions, the ability to exchange blockchain-based currency in a decentralized marketplace, and the buyer-seller trust that can be inculcated through the use of blockchain's consensus protocols collectively make blockchain the ideal vehicle through which loyalty programs can be reinvented.

Existing literature has yet fully to explore the realities of blockchain loyalty programs. One scoping review of blockchain applications states that none of the studies they review has discussed marketing at all, let alone loyalty programs (Li, Marier-Bienvenue, Perron-Brault, Wang, & Paré, 2018). Another systematic review on blockchain-based applications (Casino, Dasaklis, & Patsakis, 2019) does not even highlight the absence of marketing applications such as loyalty programs. Stallone et al. (2021) argue to be the first paper that investigated blockchain applications in the marketing area (Stallone, Wetzels, & Klaas, 2021). Even though they were the first to conduct a systematic literature review in the marketing domain, they relied on initial coin offering (ICO) websites to collect marketing companies and cluster them into different domains. Our paper differs in two ways: we focus on loyalty programs' current applications, and we analyze each of these applications based on a quantitative analysis of their tokens. Salviotti et al. (2018) recognized the importance of using a systematic method to review public token listings (e.g., Coinmarketcap) to uncover

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the status quo of actual blockchain applications, but their paper does not focus on loyalty programs (Salviotti, de Rossi, & Abbatemarco, 2018). Although Antoniadis et al. (2019) explored blockchain's characteristics and their potential to enhance loyalty programs, they did not systematically review current applications in the domain (Antoniadis, Kontsas, & Spinthiropoulos, 2019). Our goals for this paper are thus to systematically review existing blockchain-based tokens and identify & classify those related to loyalty programs. These goals allow us to articulate the following research questions. ***RQ1****: What is the status quo of blockchain-based loyalty programs?* ***RQ2****: How can these initiatives be classified?*

Our paper encompasses a systematic review of publicly listed loyalty projects' tokens, which expands existing understanding of blockchain as an infrastructure for loyalty programs. The rest of the paper is structured as follows. First, we discuss the prevalent literature on blockchain and loyalty programs. Next, we outline our research method. Following the method, we present our results and a discussion. We conclude with limitations and recommendations for future work in this domain.

2. Background

2.1. Loyalty Programs

Customer loyalty programs are "coordinated, membership-based marketing activities designed to enhance closer, more cooperative relationships among pre-identified customers toward specific products offered by the program sponsor" (Lacey & Sneath, 2006 p. 459). Loyalty programs can be classified in six main categories, namely, punch cards, points collection cards, tiered, fee-based, cash back, non-monetary rewards, and coalition loyalty programs (Agrawal et al., 2018). Loyalty programs entail two primary goals: the maximization of customer purchases – an offensive goal – and the strengthening of bonds between customers and an organization – a defensive goal (Uncles, Dowling, & Hammond, 2003). Although they represent the customer-focus embodied in the CRM movement, loyalty programs have displayed limited effectiveness in facilitating relational outcomes (Lacey, 2009) and are plagued by customer dissatisfaction (Brashear-Alejandro, Kang, & Groza, 2016).

Deloitte suggests in a recent report that blockchain's characteristics make it the ideal solution to address known issues in loyalty programs, including "account inactivity; low redemption rates; time delays; high transaction and system management and customer acquisition costs; and low client retention" (Fromhart & Therattil, 2016) pg. 2. A study surrounding a new blockchain program called *Unify Rewards* reported numerous positive rewards from a piloted loyalty program, which rewarded participants with stamps exchangeable for *Ether*, a popular cryptocurrency built on the Ethereum blockchain (Shelper, Lowe, & Kanhere, 2018). Another recent paper, a case study, explore blockchain loyalty solutions in the context of self-determination theory and report that customers will use blockchain solutions to satisfy needs of economy, autonomy, competence and relatedness (Wang, Luo, & Xue, 2018).

2.2. Blockchain

Härdle et al. (2020) summarize the history of blockchain. First, Haber and Stornetta (1999) propose a linear hash chain or blockchain by time-stamping documents using a cryptographic hash to certify when a digital document has been created or changed. By not time-stamping the data itself, the privacy of the content is preserved. Their time-stamping proposal also solves the potential collusion and lack of trust problems by linking hash values together and using digital signatures, uniquely identifying the signer (Haber & Stornetta, 1999). Then, Dwork and Naor (1992) propose a proof-of-work system to combat junk mail. They provide each email with a header containing virtual postage as a single calculation, which the receiver can verify with minimal effort. To prove this postage, a modest CPU time is consumed to calculate the stamp before sending the email. Whereas an individual email could be sent at a very low cost, the intent was to defeat spammers who send millions of emails. Spamming would come at a high price (Dwork & Naor, 1992).

Blockchain is "a digital, distributed transaction ledger, with identical copies maintained on multiple computer systems controlled by different entities" (Schatsky & Muraskin, 2015). In short, each block on the chain contains transactions hashed into a binary tree (a Merkle tree), with the hash of the root (the genesis block) stored alongside it. Each block also contains the previous block's hash, thus guaranteeing integrity, replicability, and determinism – that is, any node replicating all transactions starting from the first block will arrive at the same state as any other node (Antonopoulos, 2014). The first complete application of blockchain technology is Bitcoin (Nakamoto, 2008).

2.2.1. Cryptographic Techniques. Cryptography provides a mechanism for securely encoding the rules of a blockchain in the system itself. It prevents tampering and equivocation and encodes the rules for creating new units of the currency into a mathematical protocol (Narayanan et al., 2016).

A hash function is a one-way mathematical algorithm that takes an input and produces an output, known as the hash or digest. A good hashing algorithm makes it computationally infeasible to find two input values that produce the same hash value (output). This is known as collision resistance (Narayanan et al., 2016). For example, the Secure Hash Algorithm (SHA-256) is one of the most common hashing algorithms. It has a maximum input size of 264-1 bits (more than 2 million terabytes) and an output of 256 bits. This input information will be stored in a very short output, the hash. If just one piece of the input – such as, for example, a blank space or a comma – is changed, then the hash output will be completely different (Härdle, Harvey, & Reule, 2020).

To ensure that no one can change the history of the block, Nakamoto (2008) introduces the idea of "work." Hence, rather than providing SHA-256 output, a special SHA-256 output is needed, where it must start with several zeros known as nonce (Nakamoto, 2008). Thus, the proposed SHA-256 hash must be lower – or equal to – the current target for a block to be added to the Bitcoin blockchain. The algorithm ensures that the difficulty of finding a new block persists, regardless of technological advances or reduction of computing power in case some nodes leave the network. This is achieved by adjusting the number of leading zeros required before the SHA-256 output. In this way, it becomes nearly impossible to alter all blocks' transactions unless a single entity holds 51% of the network computing power.

2.2.2. Consensus Mechanism. Now, transactions are grouped into fixed-size blocks that are added to the existing chain in the process known as mining. Nodes in the network aim to reach a consensus regarding the following block to append utilizing a consensus protocol. Such a protocol is the core of the blockchain, as it ultimately ensures decentralized governance, quorum, performance, authentication, integrity, nonrepudiation, and byzantine fault tolerance (Garriga et al., 2021). If two blocks with contradicting information are broadcasted, the network waits and adds blocks in the longer chain. Thus, a fraudulent node will not outcompete the rest of the nodes in the network.

From game theory, a strategy profile in which all miners add valid blocks to their copies of the Bitcoin blockchain is a Nash equilibrium (Berentsen & Schär, 2018). If a miner believes that all other miners are acting accordingly, then the best response for that miner is to add a valid block candidate to their copy of the Bitcoin blockchain. A deviation is not worthwhile because it is not profitable to work on a version of the blockchain that is not generally accepted (i.e., waste of resources). Having rewards due to finding blocks on a version of the chain that is not accepted by anyone else is worthless. Thus, even though no central authority enforces such a rule, and miners are free to modify their copy of the ledger as they wish, there is still a strong incentive to follow this rule. This self-enforcing rule allows the network to maintain consensus regarding the ownership of all Bitcoin units (Berentsen & Schär, 2018). Valid block candidates can be found only through a trial-and-error procedure, hence the name proof of work.

Table1 shows some examples of consensus mechanisms.

Table 1. Summary of consensus models

Model	How it functions
PoW	A user publishes the next block by being the first to solve a computationally intensive puzzle. E.g., Bitcoin.
PoS	Select validators in proportion to their quantity of holdings in the associated cryptocurrency. E.g., Ethereum
DPOS	Participants vote (using cryptographically signed messages) to elect and revoke the rights of delegates to validate blocks. E.g., Bitshares
PoA	Transactions are validated by approved accounts, known as validators. E.g., Binance Smart Chain.
PBFT	Nodes are sequentially ordered, with one node being the leader and others referred to as backup nodes. All nodes where all honest nodes will agree on the state of the system using a majority rule. E.g., Hyperledger Fabric.

3. Method

3.1. Locating Blockchain-based Loyalty Programs

The authors used a web-scraping method using the cloud.webscraper.io tool to locate blockchain-based loyalty program applications. Coinmarketcap website is considered a reliable source of information for crypto-based companies. Academic research has previously referenced it (e.g., Gkillas & Katsiampa, 2018; Salviotti et al., 2018).

Coinmarketcap is a price-tracking website for cryptoassets. For a crypto project to be listed on coimarketcap, the project's team should submit an online request to list their asset or update one already approved for listing. For a cryptoasset to be considered for the Tracked Listing tier (i.e., market data is tracked), coinmarketcap requires the asset to leverage blockchain technology, have a functional website and block explorer, must be traded publicly on at least one

exchange and finally to provide a representative for future communication.

This study's goal is to identify, collect, and assess applications that explore loyalty programs either in whole or part. We argue that every token-based application would be eager to be listed on coinmarketcap to have the exposure that each crypto project seeks to attract potential investors and traders. Since coinmarketcap requires token developers to provide information about their projects to be listed (e.g., project name, project ticker/symbol, detailed project description, website), this ensures that the description of each listed token-based application represents its true goal since its team wrote it. Therefore, identifying the current token-based loyalty program applications can be achieved by exploring listed applications on coinmarketcap.

3.2. Tokens' Parameters

Coinmarketcap dedicates a page to each listed token that includes different information about the project, such as name, price, market cap, max supply, charts, live data summary, and text description of the cryptoasset. The elements that the authors scraped are the name of the cryptoasset (full name and symbol) and the full texted description on its page. Since these texts are provided by the project's owners aiming to explain the project's goal, they were investigated to search for potential loyalty program applications.

3.3. Identification and Screening

The authors defined multi-phased exclusion and inclusion criteria presented in Figure 1. First, the web-scraping was conducted on March 27th, 2022, collecting 9,642 token-based projects. The authors identified keywords to search the scraped descriptions of these projects. Six keywords were used to investigate the collected projects (n=9,642): *Loyalty*, *Customer Points*, *Mileage*, *Miles*, *Points*, and *Cashback*. A project with any of these keywords is considered a potential loyalty program application. The authors conducted this screening independently utilizing different methods such as performing inquiries using a database management system (Microsoft Access) and a filtering process through MS Excel. Different tools were utilized to increase methodological rigor and to ensure that the same results were obtained using varying approaches. The authors reached the same conclusion, with each author identifying (n=350) token-based applications that include at least one of the six identified keywords.

The second screening phase was conducted by reading the scraped descriptions of these projects (n=350) to assess their relevance to loyalty programs. Again, the authors screened these descriptions independently to ensure consistent identification. Projects that authors had independently identified as loyalty programs, as well as projects that had conflicted opinions, were moved to the next phase. Thus, the second phase of screening resulted in identifying (n=60) projects relevant to this paper's scope.

The third phase of screening was conducted by investigating the whitepapers of these projects (n=60). Reviewing the whitepapers provides concrete evidence that the collected applications are relevant to the loyalty programs domain. This phase identified (n=35) whitepapers that were subject to further investigations.

A token on coinmarketcap can have information about its price but not include other quantitative data such as the amount of circulating supply, market cap, 24-hour volume etc. Thus, a final screening phase was performed to ensure only those projects with complete quantitative data on coinmarketcap were included. This final phase resulted in collecting (n=21) blockchain-based loyalty program applications.

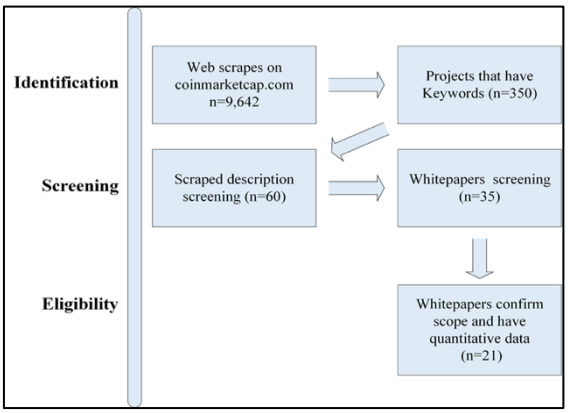

Figure 1. Flowchart of the search strategy

3.4. Evaluation

The evaluation of the collected blockchain-based loyalty program applications (n=21) follows an industry-oriented analysis by collecting the following information about each project: main objectives, blockchain ecosystem, consensus model, country, year established, token max supply, token circulating supply, current price, first listed price, market cap, fully diluted market cap, number of holders, number of transactions, number of transactions in a week, and exchange platforms. By analyzing this information, the authors can clearly and comprehensibly depict the status quo of tokens representing blockchain-based applications in the landscape of loyalty programs. Market-related data was collected on May 31st, 2022.

4. Results

4.1. Main objective, year established and geographic distribution

Table 2 provides a summary of the main objectives of the reviewed applications. The authors clustered these applications based on their domains. Six of the 21 reviewed applications belonged to the finance industry, representing 29%, followed by the hospitality & tourism industry with five applications, 24%. Commerce was the third dominant sector, although there were variations in the type of commerce (e.g., e-commerce, social commerce), with three applications accounting for 14%. The food industry had two projects and the customer loyalty domain, representing 10% each. Advertisements & Marketing, lifestyle, and construction sectors were represented by one application each.

The blockchain-based loyalty programs first appeared in 2017 with two projects (9.5%): Green Power and Travala. The year 2021 had the highest number of established projects, nine, representing 43%: Bole, Bistroo, Crowny, Fado Go, Feed System, Otium Tech, Trip Candy, Vow, and Xtra. On the other hand, 2020 was the least busy year regarding token-based loyalty programs, where only one new project was established, Xion Finance. In 2018 and 2019, six projects were established, distributed as two (9.5%) Mobie Coin and Sessia, and four (19%) ArdCoin, Isiklar, MileVerse and Wirex. As of the current year (2022), three projects have been established, representing (14.3), namely Immortl, Reefer and Travel Care.

The collected blockchain-based loyalty program initiatives varied in origin, yet the UK and Spain took the lead with three projects each. Netherlands, Singapore, and the USA come second with two projects each. The rest of the applications are distributed among various countries such as Bulgaria, Germany, Hong Kong, Indonesia, Korea, Mongolia, Russia, and Vietnam.

4.2. Blockchain ecosystem and consensus model

Figure 2 shows the types of blockchain networks that the reviewed applications utilized. Ethereum and Binance Smart Chain were the most adapted networks representing 37.5% each. Stellar blockchain came second, with 16.7% of the projects employing it. The least two adapted networks were Solana and xDai Chain, representing 4.2% each.

Table 2. Reviewed projects summary

Project	Objective	Industry
ArdCoin	Loyalty program for Ard financial group and its subsidiaries	Finance
Bistroo	Food delivery app which rewards users in crypto	Food
BoleToken	Restaurant that rewards customers with crypto	Food
Crowny	Platform rewards users for consuming ads	Adv. & Marketing
Fado Go	Cross-border shopping platform rewards crypto	E-commerce
Feed System	App connects the hospitality industry.	Hospitality & Tourism
Green Power	Universal loyalty program solution	Customer Loyalty
Immortl	Platform rewards users who live a healthy lifestyle	Lifestyle
Isiklar Coin	Loyalty program for Isiklar Holdings	Construction
MileVerse	Payment system that rewards mileages	Finance
MobieCoin	Payment system	Finance
Otium Tech	Ecosystem for the tourism industry	Hospitality & Tourism
Reefer Token	Buy Cannabis through a digital wallet using crypto	Commerce
Sessia	A social marketplace with rewarding system	Social commerce
Travala	A booking platform that enables crypto payment and rewards users in crypto	Hospitality & Tourism
Travel Care	A booking platform with crypto rewards	Hospitality & Tourism
Trip Candy	A booking platform with crypto rewards	Hospitality & Tourism
Vow	Dec. Payment method offers cashback in crypto	Finance
Wirex	A payment method rewards in crypto	Finance
Xion Finance	Global payments & rewards gateway	Finance
Xtra	A universal loyalty program	Customer Loyalty

Regarding the consensus algorithms, proof of staked authority (PoSA) took the lead appearing in eight projects (38%) (Table 3). Proof of stake (PoS) came second with six projects (28.6%), followed by Stellar consensus protocol (SCP) in 3 projects (14.3%). Delegated proof of stake (DPOS), fast Byzantine fault tolerance (FBFT), proof of stake architecture

(POSDAO), and tower BFT were employed once, representing (4.8%) each.

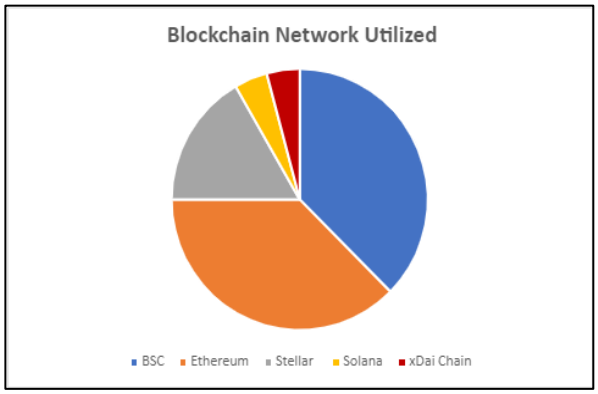

Figure 2. Blockchain networks utilized

Table 3. Consensus models used

Consensus Model	Frequency	%
Delegated Proof of Stake	1	4.8%
Fast Byzantine Fault Tolerance	1	4.8%
Proof of Stake Architecture	1	4.8%
Tower BFT	1	4.8%
Stellar Consensus Protocol	3	14.3%
Proof of Stake	6	28.6%
Proof of Staked Authority	8	38.1%

4.3. Market cap and asset supply

Market cap is calculated based on the multiplication of two elements, the current price of a cryptoasset and the current supply of that cryptoasset available to the public to trade or use (i.e., circulating supply). On the other hand, the fully diluted market cap is the current price of a cryptoasset multiplied by the ever-created (minted) amount of that cryptoasset (i.e., max supply). Table 4 shows that the Vow project had the highest market cap ($78.5 million) while Bole Token had the lowest ($990). The average market cap is $10.5 million, while the standard deviation equals (SD= $19.8 million), indicating a vast variation. Also, Vow, Green Power, Travala, Wirex and Mile Verse accounted for 93% of the total market cap of all applications.

Figure 3 compares the market cap and fully diluted market cap in the reviewed projects. This difference also represents the variation between the amount of circulating supply and the maximum supply of each project. It seems that Bole Token had the lowest percentage of circulating supply (0.03%) which is evident by the massive difference between its market cap and fully diluted market cap. On the other hand, Immortl, Green Power, and Travel Care had the lowest difference in market cap and fully diluted market cap due to the amount of circulating supply they had, 84%, 97%, 98%, and 99%, respectively.

Table 4. Market capitalization

Token	MKT cap	% of Total
Bole	$990.00	0.00%
Fado Go	$60,582.10	0.03%
Xion Finance	$61,124.00	0.03%
Otium Tech	$123,156.00	0.06%
Sessia	$188,685.00	0.09%
Reefer Token	$205,656.00	0.09%
Travel Care	$377,336.00	0.17%
Xtra	$445,753.00	0.20%
Trip Candy	$687,176.00	0.31%
Immortl	$749,886.00	0.34%
Crowny	$826,791.96	0.38%
Bistroo	$871,282.00	0.40%
Feed System	$1,970,148.00	0.90%
Isiklar Coin	$2,122,641.00	0.97%
ArdCoin	$2,456,702.00	1.12%
MobieCoin	$4,682,096.00	2.14%
Mile Verse	$17,769,020.00	8.11%
Wirex	$24,300,500.00	11.10%
Travala	$38,560,715.00	17.61%
Green Power	$43,956,134.00	20.07%
Vow	$78,555,264.50	35.87%
Total	$218,971,638.56	100%

4.4. Price volatility

To evaluate the difference in projects' tokens' prices, the authors compared each token's first listed price to the current price. Sessia's token had the sharpest decrease among all projects (-96%) followed by Bole Token (-94%) and Green Power (-91%). On the contrary, the ArdCoin project represented the highest increase in cryptoassets' prices with a 638% increase, followed by the Vow and Mile Verse with a rise of 220%, and 160%, respectively. In total, only five tokens' prices showed an increase since the first time they were available on exchanges: Isiklar, Travala, MileVerse, Vow and ArdCoin.

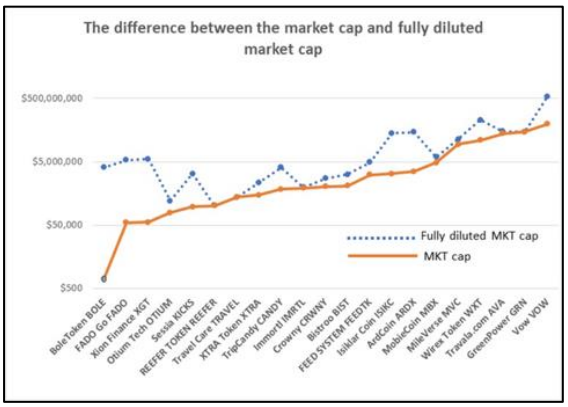

Figure 3. Difference in MKT cap and fully diluted MKT

4.5. Transactions and holders

One characteristic of blockchain technology is the ability to view the number of holders (public addresses) of a specific token on the network and the number of transactions that have taken place on that network. Through blockchain explorer tools (e.g., Etherscan, BSCscan), the authors analyzed the number of holders and transactions of each of the reviewed loyalty program applications. Table 5 provides the descriptive statistics of the overall data of holders and transactions. While the Green Power token had the lowest number of both holders and transactions (9, 292, respectively), it had the highest average of transactions per holder, 32.4. Wirex Token, Mile Verse, Fado Go, Otium, and Bole Token followed with 29, 26, 26, 25, and 24. On the contrary, Travel Care had the lowest average of transactions per holder (2.3), followed by Sessia, Vow, Feed System, and Trip Candy with 2.8, 3.2, 3.3, 4.7, respectively.

Table 5. Transaction and holders' statistics

	Mean	SD	Median	Min	Max
Hs.	3,171	2,764	2,276	9	9,540
Ts.	37,845	48,254	18,839	292	171,175

To assess the recent activities of these projects, the authors collected one-week period transactions covering days from May 24th, 2022, to May 31st, 2022. The analysis showed that the number of transactions across all applications is 11,573, with an average of 551 and a standard deviation of 1,200 transactions per project (Table 6). Crowny application had the highest number of transactions during this period with 5,000 transactions, followed by Wirex Token and Fado Go with 3,008 and 1,451, respectively. On the other hand, feed System, Green Power and Isiklar had zero transactions.

Table 6. One-week period transactions

	Mean	SD	Median	Min	Max
Ts.	551	1,200	115	0	5,000

4.6. Exchanges

In the world of listing cryptoassets, there are two types of exchange platforms, decentralized and centralized. Decentralized exchanges (DEXs) are peer-to-peer marketplaces where traders exchange cryptoassets directly without a central authority acting as an intermediary or custodian. Transactions on DEXs are facilitated by using self-executing agreements written in codes called smart contracts. Centralized exchanges (CEXs), on the other hand, are financial organizations that coordinate the trading of cryptoassets on a large scale that function in a similar way as the stock exchanges. In CEXs, traders are not in full control of their funds.

In the reviewed blockchain-based loyalty programs, the authors analyzed the type of exchanges on which tokens are listed. Regarding the DEXs, nine exchanges were identified, where PancakeSwap exchanges took the lead, with 11 (52%) of the reviewed tokens available on it. It was followed by Uniswap, where it appeared six times (29%). The remaining seven DEXs identified were referenced once each: Serum, DeFi Kingdoms, ViperSwap, EtherDelta, Sushiswap, Trader joe and Honeyswap. Regarding the CEXs, there were various platforms where 18 exchanges were identified, such as Bittrex, Hotbit, Bithumb, Bitglobal etc. The high number of CEXs indicated that there was not a dominating exchange that the reviewed applications had utilized to list their tokens.

5. Discussion

Considering the various blockchain ecosystems, Binance Smart Chain and Ethereum are the preferred choices for the reviewed applications, accounting for 67%. Consequently, the proof of stake (PoS) consensus model and its variants, such as the PoSA, are adopted the most. Although the Ethereum network was launched using the proof of work (PoW) model, it has been gradually moving to PoS, where it should be entirely employed by the end of 2022. PoW was introduced by the first known application of blockchain technology (Bitcoin); however, it has been under criticism due to

scalability and transaction processing speed issues. It is worth noting that all of the reviewed applications except for Green Power relied on building their solutions on top of mature networks such as BSC and Ethereum. Even though they have attempted to develop their ecosystem from scratch, Green Power eventually decided to migrate to Ethereum without providing further details.

Almost half of the reviewed applications are based in Europe, while east Asia countries contribute 24%. Only two projects are based in North America (9.5%). The rest of the projects are scattered all over the world. Traditional loyalty programs are a global phenomenon where businesses in a particular country can have an endless number of them; however, this is not the case for blockchain-based loyalty programs. Companies must invest a lot of resources to adopt this technology due to its complexity. Consequently, they must ensure that their customer bases make up for such investments.

Although a one-size-fits-all solution might reduce the investment cost, this paper shows that only two current projects focus on developing a universal solution for all businesses to adopt: Green Power and Xtra. In a closer look, Green Power has not fully developed this proposal. They aim to require businesses to purchase a license to use their loyalty points management system that enables them to transfer their older loyalty programs to the new system. However, there is no update on the status of this system. Xtra provides a similar solution to Green Power, yet Xtra's white paper fails to explain how this solution functions.

Since last year, there have been 12 token-based applications, representing 57% of all reviewed projects. This indicates a trend in this domain after it experienced some stagnation in 2020 when only one application was established. Looking at the first established projects (Green Power and Travala), we notice that Green Power and Travala account for 38% of the accumulated market cap of all projects. Yet, Green Power has the least number of transactions (292) and holders (9). This might be due to their migration to another ecosystem or to the fact that their reported numbers on coinmarketcap are not accurate. In addition, five applications represent 93% of the total market cap, which can be attributed to different reasons, such as the core business behind the token or the projects' maturity stage. For instance, three of these applications are payment systems where high traffic is expected compared to other applications with a narrowed scope, such as local food delivery companies (e.g., Bistroo). In addition, Travala has more than 2 million properties listed, covering over 90 thousand destinations in 230 countries, indicating its maturity, which is reflected in its share in the total market cap.

Although we have identified 21 blockchain-based loyalty applications, their market cap is a fraction of the total market cap of cryptoassets (0.02%). Not all cryptoassets are comparable in terms of functionality and objectives; nevertheless, this small percentage indicates that this domain is in its infancy. The argument is also supported by the statistics related to the number of transactions and holders of all applications combined. Assuming that each public address is held by a different user, the total number of users currently owning tokens reviewed is only 66,555, a paucity compared to mature programs like the American Airlines AAdvantage program, which is estimated at 67 million members (Chen, Mandler, & Meyer-Waarden, 2021). The recent activities on these projects' public ledgers further affirm this point (average transactions in one-week=551), where there are zero activities on three applications (Feed System, Green Power and Isiklar) while one project has two transactions (Sessia).

Transaction activities and the number of holders are critical aspects of these applications since they contribute to the network effect. Whether tokens' holders are investors, developers, customers, or crypto traders, the more activity each token has on the market, the more the value it creates. For instance, some of the reviewed applications provide other unlisted tokens for rewarding loyalty (e.g., MileVerse), where customers are rewarded with a token with a fixed value pegged against a stable asset (e.g., US dollar). Customers can then redeem these rewards using the utility token linked to the application/project that issued them. Therefore, even if some of the applications do not reward customers with the tokens reviewed, they should attract enough activity around their utility tokens because they represent the value of their applications. From a customer standpoint, as long as these utility tokens hold value in the market, they are more likely to stay associated with these businesses (i.e., applications). This is due to the chance that their loyalty points can grow in value or be liquidated for other assets (e.g., cash, other cryptocurrencies).

In terms of exchanges, we notice that only four CEXs are from the top 20 exchanges according to coinmarketcap ranking, which takes several factors such as web traffic factor, average liquidity, volume, and the confidence that the volume reported by an exchange is legitimate. These four CEXs are Bithumb, LBank, MEXC and Gate.io. Only five (MileVerse, Green Power, Travala, Wirex and Isiklar) out of the 21 projects reviewed have been able to list their tokens on at least one of these four exchanges. This is due to the rigorous process that centralized exchanges enforce for a token to be enlisted on them.

On the other hand, the DEXs are not maintained by a central authority, making them a viable choice for new token-based projects to set a price for their tokens. As the token creators, a project's team must provide the first initial liquidity for their token by pairing their token with another popular token (e.g., BNB, Ether) in a smart contract. By supplying both amounts, the team sets the price for its newly created token that can be traded (e.g., 1 BNB = 14952.3 BIST).

The variable nature of the observed loyalty programs (n=21) suggests companies have many options regarding the depth of their commitment to blockchain. The base level of engagement seems mostly to be practiced by financial services companies, who have developed tokens to be used as substitutes for cashback or existing reward points. Wirex is an example of this model, which rewards customers for using Wirex's credit card or digital wallet. Another model, practiced by holding companies ArdCoin and Isiklar, is based on the strategic position of these companies, where they have a variety of businesses and subsidiaries that could benefit from a unified token-based loyalty program. These examples show simple brand-isolated substitutions of tokens for some other rewards point mechanism. An expanded version of this model is the shared token rewards alliance found in the Immortl token, which is designed to be issued and redeemed at any number of vendors in the fitness & healthy lifestyles industries. Loyalty tokens like Travala, Trip Candy, and Travel Care are similarly designed for a consortium of vendors who issue and accept coins within a network, not unlike fungible mileage found in airline alliances today. More transformative models can be found in the universal loyalty solutions offered by Green Power or Xtra, which seek to be premier intermediaries enabling ecosystems of partners to implement quality loyalty solutions.

There are enough players in the game now that we no longer need to postulate the feasibility of blockchain as a loyalty solution. Instead, research must pivot to examining the emerging blockchain-based loyalty tokens and continue to monitor for the presence of new entrants. Industry will benefit from research identifying pitfalls or blind spots in the market, and studies about the adoption and diffusion of innovations will become increasingly relevant in the domain of blockchain and loyalty programs. Yet major vendors, e.g., United Airlines, Hilton Hotels – are not offering tokens on crypto-exchanges. Deloitte's seminal report outlines a path by which organizations could issue loyalty tokens, which could be linked with smart contracts with defined exchange rates, which would allow individual holders of those tokens to initiate exchanges from digital wallets (Fromhart & Therattil, 2016). Such a model seemingly reverts to the pre-relational marketing paradigm. The presence of highly fungible loyalty points causes each sale to be transactional. If customers can choose to exchange loyalty points for fiat or partner or competitor currency, is a loyalty program rewarding loyalty?

The very affordance of exchangeability might improve customer satisfaction, which could encourage repeat patronage in itself. Shelper et al. (2018) suggest exchangeability "can be offset via quality customer experience design in two ways; firstly, by making it really easy and worthwhile to spend with the merchant, and secondly by allowing the member to transfer other cryptocurrencies into the ecosystem to be easily spent with the merchant" (Shelper et al., 2018) pg. 7. Although organizations may gain accounting benefits from the diminished need to report balance sheet losses or liabilities due to unredeemed loyalty points, these firms would sacrifice a tremendous amount of control by allowing their points to be traded on an open market.

6. Limitations & Conclusion

This paper employed a web-scraping method to facilitate a systematic market analysis of active blockchain tokens relevant to loyalty programs. Despite the rigor of the method, our analysis can be likened to a market analysis performed on traded securities. By targeting our analysis to actively traded tokens, we purposefully exclude potentially worthy projects, which have not yet been fully tokenized and launched on a crypto exchange. This accounts for the absence in our results of blockchain-based loyalty programs discussed in other academic papers, such as *Loyyal* (Agrawal et al., 2018) or *Bubichain* (Wang et al., 2019). Thus, this paper sought not to provide an exhaustive review of every conceivable blockchain-based loyalty program, but rather a market analysis of actively traded loyalty tokens in order to orient the literature toward industry realities. Also, the market data that has been extracted from the coinmarketcap website might not represent the actual state of the reviewed tokens, especially the circulating supply. This is because not all of the reviewed tokens' circulating supply data has been verified by the coinmarketcap team, where projects' teams self-reported their data. They have not requested the coinmarketcap team to verify them.

Despite the plethora of papers espousing the benefits of blockchain as a solution for the woes inherent in most customer loyalty programs, we find relatively few actual loyalty solutions have been deployed via blockchains. Most of these solutions seek to build niche-based ecosystems (e.g., fitness/lifestyle, construction materials, food delivery services, travel) or simply to provide cashback rewards in the form of crypto tokens. Nevertheless, the presence of these

solutions at all suggests a shift in the realities of blockchain-based loyalty solutions, moving away from the purely speculative dimensions often described in the literature to a confirmation that loyalty programs can be operationalized via tokenization. The immaturity of these tokens reinforces the nascency of the domain.

7. References

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