



Gaining Competitive Advantage in Blockchain-Based Platform Economies

Melih Arat

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List of Abbreviations

Abbreviation	Explanation
2FA	Two Factor Authentication
USA	United States of America
ADA	Cardano Token
AERGO	AERGO TOKEN / AERGO Platform
AML	Anti-Money Laundering
AVAX	Avalanche Token
BBN	BayBayNakit (Interbank Card Center Loyalty Program)
BKM	Interbank Card Center
BTC	Bitcoin (Crypto currency)
CAESP	Crypto Asset Exchange Service Providers
CASPs	Crypto Asset Service Provider
CTFC	US Commodity Futures Trading Commission
CTSI	Cartesi Token
DAO	Decentralized Autonomous Organizations
dApps	Decentralized Applications
DCCPA	Digital Commodities Consumer Protection Act
DDoS	Distributed Denial of Service
DeFi	Decentralized Finance
DEX	Decentralized Exchange
DOT	Polkadot Token
DPoS	Delegated Proof of Stake
EPI	Electronic Payment Instruments
ETH	Ethereum Token
FDIC	Federal Deposit Insurance Corporation

FIEA	Financial Instruments and Exchange Act (Japan)
FinCEN	Financial Crimes Enforcement Network
FTX	Futures Exchange
HCC	Horizen Community Council
IP	Intellectual Property
KSM	Kusama Token
KYC	Know Your Customer
MICA	The Markets in Crypto-Assets Regulation
Mt. Gox	Magic: The Gathering Online Exchange
Nasdaq	US National Association of Securities Dealers Automated Quotations
NBA	National Basketball Association
(NFT)	Non-Fungible Token
NPOS	Nominated Proof of Stake
OCC	Office of the Comptroller of the Currency
PoA	Proof of Authority
PoS	Proof of Stake
PoW	Proof of Work
PSA	Public Securities Association (Japan)
RFIA	Responsible Financial Innovation Act
SEC	US Securities and Exchange Commission
SOL	Solana Token
SPK	Capital Markets Board of Turkiye
TBMM	Grand National Assembly of Turkiye
N.D.	No date
TPS	Transaction Per Second
USDC	USD Coin (United States Dollar Coin)
USDT	USD Tether (United States Dollar Tether)
VTHO	VeThor Token
web3	Third Generation of the World Wide Web
ZEN	Horizen Zen Token
zk-SNARKs	Zero Knowledge Succinct Non-Interactive Arguments of Knowledge

Introduction

Blockchain technology is continuously transforming digital economies and giving rise to a new environment for service and value creation called blockchain-based platform economies. These new platforms offer unprecedented opportunities for value creation and exchange by utilizing the decentralization, transparency, and security advantages provided by blockchain technology. Combined with network effects, these platforms pave the way for innovation and growth in the digital marketplace.

As blockchain-based platforms grow in both complexity and popularity, understanding the elements that contribute to the success of these platforms becomes critically important. There is a need to develop a framework to identify the value-adding factors that distinguish these digital ecosystems from others and to evaluate the impact of these factors on platform performance and user outcomes.

In this book, a case study methodology will be employed to identify and explain these value-adding factors that fuel the success of blockchain-based platforms. Through detailed examination of ten blockchain-based platform cases selected with specific criteria, the impact of these factors on platform performance and outcomes will be evaluated. This research has generated the necessary information for stakeholders of blockchain-based platforms to develop their strategies and value propositions by providing critical success insights.

Blockchain-based platforms have emerged as a new transformative force by offering decentralized value creation and exchange opportunities in the digital market. These platforms provide trust, consensus, security, and smart contract capabilities in transactions through blockchain technology (Sultan et al., 2018: 49).

The methodology used in this research can be considered a powerful approach for investigating value-adding factors in blockchain-based platform economies. This method provides the opportunity to examine real-world examples and performances of platform ecosystems. The use of ten selected cases in this study and the comparison of their performances according to various criteria will help generate knowledge about common factors driving the success of these platforms and the conditions under which these factors are most effective.

The purpose of this book is to identify and determine the value-adding factors that contribute to the success of blockchain-based platform economies using case analysis.

Consequently, this research will assist stakeholders in blockchain-based platform economies to optimize their strategies and improve their value propositions, thereby providing them with the opportunity to create more sustainable and effective digital ecosystems.

The emergence of blockchain-based platforms after 2008 has brought revolutionary changes to digital marketplaces (Tapscott & Tapscott, 2016: 1). These changes have enabled decentralized value creation and exchange methods (Zarrin, J. et al., 2021: 2861). However, despite the transformative potential of these ecosystems, there is a need for systematic knowledge about the fundamental value-adding factors that contribute to the success of these ecosystems.

As blockchain-based platform economies become more popular and complex, identifying these value-adding factors is of great importance for optimizing platform performance and user outcomes. Furthermore, as blockchain technology continues to develop and new platform ecosystems emerge, the necessity of a comprehensive framework to evaluate the impact of various factors on platform success is evident.

In this field, which is literally changing day by day along with the technology itself, there is a gap in concrete data and theoretical knowledge regarding the factors contributing to the success of these ecosystems, due to the novelty of the field.

In addition to all these, there is a need for a more systematic approach that can generate concrete knowledge based on real-world examples, particularly regarding platform performances.

Therefore, the problem this book aims to address is the identification of value-adding factors for competitive advantage in blockchain-based platform economies through case analysis.

In this study, a qualitative research technique employing a comparative method has been adopted to provide an in-depth perspective on blockchain-based platform economies. This method was preferred because it allows for detailed examination of complex and technical phenomena in real-life contexts.

According to Arch Woodside (2010: 16), author of *Case Study Research*, the case study method is an inquiry focused on describing, understanding, predicting, and/or controlling an organization, with the main goal being understanding and description. According to Helen Simons, author of *Case Study Research in Practice*, the case study method is appropriate for examples where the boundaries between phenomenon and context are not yet clear when examining a new phenomenon in real-world contexts (Simons, 2009: 18). Robert K. Yin (2018: 39), author of *Case Study Research and Applications*, states that when examining new phenomena, if answers to “how” and “why” questions are sought under conditions where control over behavioral situations cannot be achieved, conducting case studies would be appropriate. Robert E. Stake (1995: 7), author of *The Art of Case Study Research*, suggests that when generating case-based generalizations, attention should be paid to the uniqueness of cases and generalizations should be defined with limited conditions. In this study as well, the conclusions drawn will be limited to the conditions of the examined cases.

The research methodology of this study is based on a qualitative paradigm using a case study approach that allows for a comprehensive examination of blockchain-based platform economies that will reveal similarities and differences. The case study method allows for both focused and contextual analysis to address the complex structure of blockchain applications in various economic sectors for each case.

The research methodology aims to understand and compare by breaking down the fundamental mechanisms, value propositions, and strategic interactions that define the success of these platforms. Each case study constitutes a different example of how blockchain technology is used within a platform economy, providing insights about operational challenges related to usage, user engagement strategies, and economic outcomes.

To enhance the robustness and contextual relevance of findings, the case study methodology will include both within-case analysis and cross-case comparison. This dual approach ensures comprehensive understanding of each platform while also revealing the different, superior, and similar aspects of projects competing in the same field.

The examination of the five highest and five lowest market value platforms within the scope of the research will allow for the development of a theory based on the common and divergent aspects of these platforms.

This qualitative research is structured to capture the richness of the blockchain phenomenon by utilizing various data sources to create a multifaceted perspective. Although this technology and ventures are extremely new, numerous articles about them can be found on the internet due to their registration on the Coinbase cryptocurrency exchange platform; some of these are speculative. To prepare cases using completely accurate and reliable information, the websites of these ventures and their white papers will be used. Sources other than these will be avoided as much as possible, and the white papers and websites, which are the official sources of the platforms, will be utilized. Other sources that are consistent with the information in these platforms' own official white papers and official websites have also been employed.

The objectives of the research are listed below:

- To identify and determine the fundamental value factors that contribute to the success of blockchain-based platform economies in the context of blockchain technology and platform economies.
- To identify and determine the competitiveness elements of Porter's Five Forces Model (1980) in blockchain technology and platform economies.
- To develop a comprehensive framework that will evaluate the impact of these value-adding factors on platform performance and user outcomes through case analysis of numerous blockchain-based platform ecosystems.
- To analyze the performance of selected blockchain-based platform ecosystems using the developed framework and generate knowledge about the conditions under which value-adding factors are most effective.
- To compare the performance of different blockchain-based platforms, identify common and unique value-adding factors, and develop a typology of blockchain-based platform ecosystems according to their fundamental characteristics.
- To evaluate the effects of the identified value-adding factors for platform strategy and management and provide methods for stakeholders

in blockchain-based platform economies to optimize their strategies and improve their value propositions.

- To contribute to the theoretical and empirical literature on platform economies by presenting a comprehensive framework that will evaluate the impact of value-adding factors on the success of blockchain platforms.

The research questions that this book focuses on are listed below:

- What is the value-adding factors that distinguish blockchain-based platform economies from other types of digital ecosystems, and how can these be identified and determined?
- What are the competitiveness elements of Porter's Five Forces Model in blockchain technology and platform economies? What are the competitive constraints and advantages that these force elements bring to blockchain-based platform economies?
- How can a comprehensive framework be developed to evaluate the impact of these value-adding factors on platform performance and user outcomes, and what are the fundamental components of this framework?
- How do the identified value-adding factors contribute to the performance of selected blockchain-based platform ecosystems, and under what conditions are they most effective?
- How can blockchain-based platform ecosystems be compared in terms of their fundamental characteristics and value-adding factors, and what are the effects of these factors on platform strategy and implementation?
- What are the theoretical and practical implications of the identified value-adding factors for the design and management of blockchain-based platform ecosystems, and how can stakeholders in these ecosystems optimize their strategies and value propositions?
- How can the developed framework and typology of blockchain-based platform ecosystems contribute to the literature on platform economies?

The scope of this book is explained below:

- This study will specifically focus on blockchain-based platform economies and more specifically on "smart contract platforms," and will not include other types of digital ecosystems.

- The analysis will be conducted using a case study approach, focusing on selected blockchain-based platform ecosystems.
- The research will utilize various data sources, primarily including founding documents (known as White Papers in blockchain literature), market capitalization, and corporate websites, to provide a comprehensive analysis of value-adding factors in blockchain-based platform economies.
- The framework to be developed will be based on the typology of blockchain-based platform ecosystems and findings obtained from case studies.
- The study will examine a total of ten blockchain projects that use the “smart contract” platform business model: the five with the highest market capitalization and the five with the lowest market capitalization.
- The projects to be evaluated as cases will be selected from Coinbase, an exchange platform located on Nasdaq, which is one of two federally recognized exchange organizations in the United States. The reasons why these selection criteria were preferred will be explained in detail in the relevant section.
- During the research, the selected platforms will be analyzed using their founding documents, market capitalizations, and officially announced data and information.
- This book research will be conducted on platforms registered on the Coinbase exchange platform, which was established in the United States in 2012. Therefore, the study will primarily be based on data between 2012 and 2024 for research purposes.
- Projects that have existed on the Coinbase platform for at least 3 years or more will be examined as cases in the research.

The limitations related to this book are explained below:

- The findings of the study are limited to the specific blockchain-based platform ecosystems analyzed and should not be expected to be generalized to other ecosystems. This is because projects in the blockchain field are technically and marketwise very different from each other and from other digital ecosystems in the blockchain space. For example, Bitcoin is a cryptocurrency, and similarly, Ethereum, which is well-known, is also a cryptocurrency; however, Ethereum is a smart contract platform, and its local currency was created to support its

own operations. In this sense, Ethereum, as a platform, covers a much broader area than Bitcoin, which is solely a currency. All platforms examined in the research are smart contract platforms in the same group as Ethereum. Each has its own cryptocurrency (coin); however, all of these are primarily used for transactions on their own platforms.

- The study will be based on official and publicly available data sources, and speculative news in the media or information and opinions that cannot be verified with institutional sources or the institution's official information will not be used.
- The analyses will primarily focus on the perspectives of founders and the platform and will secondarily focus on the specific perspectives of platform users (developers) with various objectives, smart contract user customers, and other stakeholders.
- The value-adding factors identified in this study, defined within the broad context of blockchain technology and digital ecosystems, may lose their relevance over time. Since technology advances very rapidly, a technological constraint or advantage that exists today may disappear in a short period of time, such as a few years.
- The developed framework and typology of blockchain-based platform ecosystems will be based on a subjective synthesis of case study findings. This subjective synthesis is open to criticism or revision based on different perspectives or data sources.

The importance of this book can be defined under five headings:

The examination of value-adding factors in blockchain-based platform economies through case analysis is important for several reasons:

- First, blockchain-based platform economies represent a rapidly growing and extremely dynamic digital economy segment with significant implications for business, technology, and society. This research can contribute to the development of more effective and sustainable blockchain-based platforms by providing a comprehensive understanding of the fundamental value-adding factors that distinguish these ecosystems from other types of digital ecosystems.
- Second, the development of a framework that evaluates the impact of value-adding factors on platform performance and user outcomes can provide a valuable tool for platform operators and other stakeholders within the blockchain-based platform ecosystem. This framework can

be used to optimize platform strategies, improve user experience, and encourage innovation and growth in these ecosystems.

- Third, the analysis of numerous blockchain-based platform ecosystems through case studies can offer a rich perspective on the unique characteristics and challenges of these ecosystems. This can help develop a more nuanced understanding of the role of blockchain technology in platform economies and how platform operators can utilize this technology to create value for users.
- Fourth, the development of a typology of blockchain-based platform ecosystems according to their fundamental characteristics can provide a valuable tool for policymakers and regulators seeking to understand the diversity and complexity of these ecosystems. This can inform policy decisions and regulatory frameworks that support innovation and growth in the blockchain-based platform ecosystem.
- Finally, this research will contribute to the literature on platform economies and the use of blockchain technology in digital ecosystems. By providing a comprehensive framework that evaluates the impact of value-adding factors on platform success and offering insights into the unique characteristics and challenges of blockchain-based platform ecosystems, it will contribute to future research and theory development in this important and rapidly evolving field.

Platform Economies, Blockchain Technology, and Competition

In the first chapter, platform economies, blockchain technology, and the evaluation of these two phenomena in the context of competition will be conducted. After conducting a literature review of platform economies and blockchain technology, the competitive framework of blockchain-based platform economies will be evaluated using Porter's Five Forces Model.

1.1. Platform Economies and Platform Business Models

Recent technological developments have enabled the emergence of new business models based on digital platforms. Marketplaces such as Airbnb or Uber offer digital platforms that connect previously unmatched demand and supply side participants through innovative ways of creating, delivering, and capturing value (Täuscher & Laudien, 2018: 321). Platform economies and platform business models are related but distinct concepts. A Platform Business Model refers to the business strategy in which a firm or organization provides a digital or physical platform that connects different users, such as buyers and sellers or service providers and consumers (Moazed, 2016). Examples of platform economies include Uber, which connects passengers with drivers, or Airbnb, which connects travelers with hosts. Platforms typically generate revenue by taking a transaction fee or through other monetization methods such as advertising or membership fees. The platform business model creates a network effect where the value of the platform increases as more users join the platform.

According to Xue et al., (2020:1), "Platform economy refers to a phenomenon driven by a series of digital technologies such as Internet, cloud

computing, big data, and Internet of Things, led by numerous platform enterprises that design and implement a complete platform environment for platforms, consumers, and service providers, affecting businesses by reducing transaction costs of organizational rules and services, and achieving a new type of economic integration where resources are highly integrated with traditional industries”.

In simpler terms, the Platform Economy is the economic system that emerges as a result of the widespread adoption of platform business models. In the platform economy, economic and social activities are facilitated and coordinated by platforms, and traditional linear business models are disrupted. This creates new possibilities for the consumption and provision of goods and services. The platform economy includes changes that affect not only individual businesses but also labor markets, regulations, competition, and the overall economy at the macroeconomic level.

According to Schweiger et al. (2016:66), recent technological advances have enabled the emergence of new business models based on digital platforms; marketplaces such as Airbnb or Uber offer such digital platforms that connect previously unmatched demand and supply side participants through innovative forms of value creation, delivery, and capture.

In short, the platform business model is a business strategy adopted by independent enterprises, while the platform economy is a larger economic system that encompasses and results from the widespread adoption of such business models.

After making this distinction, it can be said that platform economies are reshaping the economic landscape of the 21st century. Essentially, these economies are digital platforms that facilitate the exchange of goods, services, or social inputs; these platforms enable value-creating interactions among users (Korhonen et al., 2017: 17). These modern digital economic systems are revolutionizing business models across various sectors, creating a dynamic and diverse global marketplace.

To understand how the Platform Business Model differs significantly from traditional business models, we can examine examples:

- The operations of Twitter, formerly known as Twitter and now known as X, present an ideal example of the Platform Business Model. On Twitter, users both produce and consume content. However, Twitter as a company neither produces nor consumes this content; instead, it provides a platform that serves as a bridge between content producers and content consumers.

- The popular accommodation platform Airbnb's business is also built on the Platform Business Model. On Airbnb, people stay in others' homes while traveling and, if they wish, can also host other travelers by offering accommodation services as hosts themselves. Airbnb brings together hosts and travelers as a marketplace for accommodation services.
- Uber's business is also a manifestation of the Platform Business Model. Uber provides a marketplace and platform that brings together vehicle owners and drivers who want to offer transportation services with individuals who need urban transportation. Uber's digital interface allows any individual to transform their private vehicle into a transportation service resource, while enabling another individual who wants to travel from point A to point B to reserve the nearest available vehicle.

As indicated by the examples given above, the Platform Business Model functions as a marketplace and creates a space for users to come together. A platform is a worthless structure without users; value is provided by users offering content and participating. Businesses operating on the Platform Business Model create an empty box that constitutes an infrastructure that content/service producers and consumers can use. When Twitter was first established, it initially offered a 140-character empty space to those who wanted to share content. Similarly, Facebook provided a multi-purpose empty box where users could share text, photos, videos, and documents. While Instagram offers an empty canvas for visual content, WhatsApp provides a platform for users to instantly share written, audio, or visual content. With rare exceptions, none of these companies inject their own content into these spaces or try to sell their content. The role of businesses using the Platform Business Model is not to sell content, goods, or services, but to provide a marketplace where these can be exchanged by users.

Except for rare examples, businesses using the Platform Business Model do not compete with their users. One of the rare examples is the well-known businessman Elon Musk, who purchased Twitter; he also produces content on his platform called X and, as an international businessman, is in a sense competing with other platform content producers. However, even this competition is not as the accepted leader of the community of billions of users on the platform, but as the competition of a powerful businessman on the platform. Airbnb does not aim to compete with users on its platform by opening a hotel or resort to rival users on the platform. Uber does not deploy its own cars with salaried drivers to compete with drivers on its platform.

The purpose of the Platform Business Model is to serve as many users as possible with an infrastructure that will enable easy exchange of services. Therefore, value creation on platforms is based on content developed by users (Subramanian, Mitra & Ransbotham, 2021: 805). This platform business model differs significantly from traditional business models that revolve around the producer-seller-consumer axis.

In the Platform Business Model, users take on both producer and consumer roles. As seen in the examples of Twitter, Facebook, and Instagram, users both create and consume content. As observed with Uber and Airbnb, users can be both customers and service providers if they wish. Thus, in the Platform Business Model, consumer and service provider roles can be switched quickly and easily.

Establishing a Platform Business Model means creating an online marketplace around a specific topic. This marketplace can cover a wide range of areas such as urban transportation (Uber), visual sharing (Instagram), restaurant reviews, and sharing of all kinds of retail establishments (Yelp).

1.1.1. Definition of Platform Business Model

The emergence of Internet technology has led to the birth of an innovative business model known as the “Platform Business Model.” This model is not limited to the United States. Since the commercial infrastructure of developing countries is not as established and complete as that of advanced countries, the industries of these countries (such as Alibaba in China, etc.) have emerged around the internet (Moazed & Johnson, 2016: 20).

The platform economy is an economic system that uses digital platforms as the primary tool to facilitate interactions between producers and consumers. These platforms act as intermediaries or marketplaces that create communities and marketplaces where participants can transact directly with each other. The scope of such transactions can include everything from physical goods and services to digital content and even intangible values such as social recognition or influence. As Moazed and Johnson state, platform economies depart from the traditional linear business model paradigm where goods or services are produced by a single organization and then consumed by end users (Moazed & Johnson, 2016: 26). Instead, it operates on a multi-sided model where the platform does not own the means of production but fosters an environment where independent sellers, service providers, or content creators can meet with potential buyers or consumers. The Platform Business Model creates a marketplace that connects various stakeholders-developers, producers,

customers, and users-to each other, facilitating the exchange of content, products, and services.

This business model thrives in a distinctly adaptable environment that encourages users to create and consume content, services, and additional values. Cusumano et al. (2019:16), emphasized that this model not only encourages interaction but also facilitates collaborative innovation: platforms create synergy between individuals and organizations, producing non-linear increases in otherwise untapped value and innovation opportunities.

Thus, the platform model creates a dynamic space for interaction and value creation, regardless of participants' roles as producers, consumers, or platform providers. Reillier & Reillier (2017: 26) emphasized the inherent value creation potential of the platform business model's user matching feature: it creates significant value by including, matching, connecting, and enabling transactions between two or more customer groups.

One of the critical factors underlying the success of a platform company within this model is the development and continuous optimization of an algorithm that can match users effectively and efficiently. Evans and Schmalensee (2016: 4) drew a metaphorical parallel by comparing the platform business model to a shopping mall: essentially, the platform functions as a shopping mall with buyers and stores as its users. Today, platforms have the potential to facilitate global trade and service exchange.

1.1.3. The Importance and Growth of Platform Economies

Platform economies have rapidly gained importance and scaled with the expansion of the internet and digital technologies. They have provided new opportunities for innovation, competition, and customer interaction, leading to their adoption across a wide range of sectors from retail and transportation to entertainment and education.

As previously mentioned, companies like Amazon, Uber, Airbnb, and Alibaba constitute evidence of the power and magnitude of the platform economy. Platform economies have disrupted traditional markets and created substantial economic value by leveraging the capabilities of the internet and mobile technologies. The growth rate in the spread of sharing systems in platform economies shows that these economies pose a serious threat to some established industries (Kathan et al., 2016: 664).

Despite emerging only a short time ago, about a decade, the Gig economy in the context of platforms has entered many sectors (Vallas & Schor, 2020). The proliferation of platform economies has reshaped labor markets, leading

to the emergence of a phenomenon now known as the Gig economy. The ‘Gig economy’ is used to describe labor markets where independent contracts are carried out through, on, or via digital platforms (Woodcock & Graham, 2019: 10). This term refers to a labor market where short-term contracts or freelance work are prevalent, as opposed to permanent jobs. In this structure, independent contractors, freelancers, or self-employed individuals typically provide services on demand through digital platforms.

For example, ride-sharing applications like Uber and Lyft or delivery services like DoorDash and Instacart connect freelance drivers with consumers who need their services. Similarly, platforms like Upwork and Fiverr connect freelance professionals in areas such as graphic design, writing, and programming with businesses and individuals seeking their expertise. These new work arrangements have brought significant flexibility for workers. These platforms have offered users who prefer the supplier role the freedom to choose when, where, and how often they work, and have provided the opportunity to diversify income sources by working on multiple platforms alongside traditional jobs. Platform-based work has become particularly advantageous for individuals who want to establish work-life balance, seek additional income, or desire independence and autonomy in their work (Rasheed et al., 2022: 82). From the consumer’s perspective, the Gig economy provides comfort and efficiency. Services are typically accessible at all hours of the day and with just a few taps on a smartphone. This situation has led to a change in consumer expectations and demands as consumers have become accustomed to the speed and accessibility offered by the Gig economy.

1.1.4. Theoretical Framework of Platform Business Model

The theoretical framework of the Platform Business Model has been significantly influenced by several fundamental studies, among which Surowiecki’s “The Wisdom of Crowds” (2005: XIV) stands out prominently. In his book, Surowiecki explains that collective decisions made by large and diverse groups can often be superior to decisions made by individuals or even experts. For example, the most popular song is chosen not by an experienced music magazine editor, but by the independent decisions of billions of viewers on platforms like YouTube. Surowiecki articulated the idea that the collective wisdom potential harbored by billions of people in selecting the most popular song could outweigh the expertise of an experienced music editor. An example of this phenomenon can be seen in how YouTube phenomenon Enes Batur’s videos (Boom Social: Enes Batur, 2024) attract more subscribers than famous artist Tarkan’s videos (Boom Social, Tarkan, 2024). The emergence of YouTube

phenomena has been made possible by gaining the approval of crowds, not music or art critics.

Another important work that details how the collective wisdom of crowds can surpass a company's R&D department or senior executives is Jeff Howe's "Crowdsourcing" (2009: 146-176). In the context of this book, the most attractive game for the Apple Store is expected to emerge not from Apple's own internal development team, but from the competitive contest of thousands of independent game developers. The greatest feature of platforms is their ability to provide a very large quantity, very diverse, geographically almost everywhere supply against demand. This depends on a specific supply being provided by crowds and independently acting individuals.

Charles Leadbeater's thought-provoking book "We-Think" (2010: 8) forms another cornerstone of the theoretical framework for social media platforms like X. It argues that content producers on X or blogs can influence a broader audience than professional columnists thanks to the democratizing nature of the platform. In other words, ordinary members of the platform can engage in interactions that surpass the fame of well-known individuals. While various titles are required to become a columnist for a traditional newspaper, an email address or a phone number is sufficient to join a social media platform.

Chris Anderson in his book named "The Long Tail" (2007: 15-27) describes an interesting paradigm shift where the positions of major brands, best-selling authors, and famous personalities are gradually being replaced by the contributions of ordinary individuals on platforms. For example, Wattpad is a social storytelling platform where users write and publish stories, and readers can read these stories for free. On the Wattpad platform, a young writer who is completely unknown and has no name in the field of literature can bring readers a book that is read more than that of a famous writer. Again, this phenomenon is made possible thanks to the platform economy.

Taking the discussion one step further, Chris Anderson in his book named "Free" (2010: 14-25), which followed his previously referenced book "The Long Tail," pointed to the transformation of seemingly free services into successful platforms. Particularly, the fact that something or the offered value is free creates an element of attraction for that platform, increasing the number of users. The increase in the number of users also raises the value of the platform, making it even more attractive.

Finally, platform business models also align with ecological trends. Rachel Botsman and Roo Rodgers' book "What's Mine is Yours" (2010: 21-36) provides a compelling explanation of the sharing economy. The concept of

the sharing economy essentially forms the foundation of platform-based businesses like Uber and Airbnb.

The common feature of all these works is that the content, products, and services produced by independent individuals forming large groups, and the demand created by these individuals, create meaningful and integrated value with a unique economy.

1.1.5. Comparison of Traditional Business Models with Platform Business Models

In the digital age, the difference between Traditional Linear Business Models and Platform Business Models is becoming increasingly distinct. Traditional business models typically involve a linear process of production, sales, and purchasing, and in these models, companies act as the main producer/supplier/service provider. In contrast, platform business models function as intermediaries, creating a marketplace that connects various users according to their objectives. The following analysis and accompanying table 1 present a detailed comparison of these two different business models across various aspects such as the company's role, value creation, revenue generation, competitive advantage, and applications in various industries. This analysis helps comprehensively understand the changes in global business strategies with technological advancements and the rise of digital platforms.

The companies in the sector examples given for the Platform Business Model in Table 1 are quite remarkable. Businesses using the Platform Business Model have almost all been established within the last twenty years and have transformed into the world's largest companies in their respective fields. Companies that evaluate the Platform Business Model based on internet technologies have taken market shares from businesses that continue to operate with traditional business models. Companies like Amazon, which do not have their own physical stores, are causing store chains like Sears, one of America's largest retailers, to gradually withdraw from the market over time (Tincq, 2016) (Berg & Knights, 2021: 2).

Table 1. Comparison of Traditional Business Model and Platform Business Model

Criterion	Traditional/Linear Business Model	Platform Business Model
Role of the Company (Producer)	Producer (Linear producer-seller-buyer relationship)	Intermediary and marketplace (Providing infrastructure for users to interact)
Value Creation Method	Creating value through product and service features that benefit consumers	Creating value by enabling user transactions (e.g., lodging services, transportation, etc.)
Revenue Generation Method	Charging for product features	Advertising (e.g., Facebook, X(Twitter), Instagram), transaction fees (e.g., Uber, AirBnB), platform membership fees (e.g., Creative Market)
Core Competitive Advantage	Product features and pricing	Platform usability, supply and user base volume
Examples		
Industry	Traditional Companies	Platform Companies
Food	Burger King, McDonald's	YemekSepeti, DoorDash, GrubHub, UberEats
Accommodation & Travel	Hilton, Turkish Airlines, Lufthansa, Travel Agencies, Thomas Cook (bankrupt)	AirBnB, Expedia, Booking.com
Content	Ana Britannica, Lonely Planet	Wikipedia, WikiTravel, Medium
News	CNN, Reuters	X(Twitter), Snapchat, Tumblr, Facebook, Facebook Live, Periscope
Education	Nişantaşı, Boğaziçi, Harvard Universities	Udemy, Coursera
Tutoring	Mathematics and Science Prep Courses	Khan Academy
Classified Contact Info	Yellow Pages	Craigslist, Google, Zillow
Commerce & Retail	Walmart, Carrefour	Amazon, AliExpress, Hepsiburada, eBay
Video Entertainment	TV Channels	YouTube, Dailymotion, Vimeo
Car Rental	Avis, Hertz, National, Sixt	Turo
Music	Sony Music	Spotify

Source: Adapted from the Comparative of Different Types of Business Table in Zhao et al., 2024.

Based on Table 1 the differences between Traditional Linear Business Models and Platform Business Models have been analyzed by the author of this book below:

1. Company's Role:

- *Traditional Business Model:* The company acts as a producer in a linear producer-seller-buyer relationship. For example, Burger King and McDonald's produce food and sell it directly to consumers.
- *Platform Business Model:* The company serves as an intermediary and marketplace that provides infrastructure for users to interact according to their objectives. For example, UberEats serves as an intermediary platform where customers can order food from various restaurants.

2. Value Creation Method:

- *Traditional Business Model:* Value is created through the features of products and services that provide benefits to consumers. For example, Hilton creates value for its guests by offering comfortable accommodation and premium services.
- *Platform Business Model:* Value is created by enabling users to conduct transactions (buying/selling such as accommodation services, transportation services). For example, Airbnb allows hosts to rent their spaces to travelers.

3. Revenue Generation Method:

- *Traditional Business Model:* Revenue is obtained by charging for product features. For example, car rental companies like Avis and Hertz charge customers based on the type of vehicle to be rented and the rental duration.
- *Platform Business Model:* Revenue is typically obtained from advertisements on the marketplace (Facebook, Twitter, Instagram), commission per transaction (Uber, Airbnb), or platform membership fees (Creative Market). For example, Turo generates revenue by taking a commission for each car rental transaction made through its platform.

4. Core Competitive Advantage:

- *Traditional Business Model:* Competitive advantage lies in product features and pricing. For example, Sony Music competes based on the quality and variety of the music it produces and sells.

- *Platform Business Model*: Competitive advantage lies in the platform's usability, supply, and customer volume. For example, Spotify attracts a large customer volume by offering a user-friendly platform and an extensive music library.

1.1.6. The Role of Technology in Platform Economies

The emergence and expansion of platform economies has been made possible by advances in digital technologies. Particularly, IoT and cloud computing are complementary technologies, and cloud computing serves as the central point for data storage and management in IoT systems (Nikita, 2023). Technologies such as cloud computing, big data analytics, mobile applications, the Internet of Things (IoT), and artificial intelligence play a critical role in the operation and success of platform economies.

Access to information and services by numerous users in platform economies is made possible through cloud computing. Cloud computing is a computing method in which highly scalable information technology-related capabilities are provided to multiple external customers as 'services' using internet technologies (Stanoevska-Slabeva & Wozniak, 2009: 47). A simple example of cloud computing is web-based email: An internet email provider using cloud computing technology provides access by offering server space; thanks to this service, a web-based email user simply enters a web address into a browser and provides user information to access an account (Lewis, 2010: 1).

Cloud computing provides the necessary infrastructure to handle the scale and complexity of platform operations. In an era where instant and continuous connectivity is expected, cloud computing offers scalability, flexibility, and cost efficiency. By moving platform functionality to the cloud, businesses can process massive transaction and data volumes in real-time, seamlessly connect users worldwide, and rapidly scale up or down to meet fluctuating demand. Additionally, the operational agility of cloud computing enables platforms to rapidly update their services and gain competitive advantage in today's fast-paced digital economy.

One of the technologies and methods supporting platform economies is Big Data Analytics. Big Data Analytics is a methodology that supports high-speed data acquisition, storage, and analysis thanks to recent technological developments; data sources have expanded beyond traditional enterprise databases to include emails, mobile device outputs, and data generated by various sensors (Zakir et al., 2015). Big data analytics helps platforms effectively match supply and demand, personalize user experiences, and

improve decision-making processes by providing insights into user behaviors. With the ability to process and analyze massive amounts of structured and unstructured data, platforms can extract meaningful patterns and trends related to user behaviors, preferences, and consumption patterns. This data-driven approach facilitates real-time matching of supply and demand, predicting customer needs before they emerge, and customizing experiences for individual users, thereby increasing user engagement and loyalty. Additionally, this understanding strengthens the strategic decision-making process and provides information about product development, marketing strategies, and operational improvements.

Platform economies are a mixture of software, hardware, operations, and networks (Kenney & Zysman, 2016: 61). Without hardware technologies, there is no possibility of conducting transactions in platform economies. More than sixty-five percent of internet users access the internet using mobile technologies (Kovalenko et al., 2020: 103). Mobile technologies expand access to platform services, offering convenience and mobility. With the prevalence of smartphones and other mobile devices, users can access platform services anytime, anywhere. This not only expands the potential user base but also improves the user experience by providing instant, location-independent access to services. Whether making a travel reservation, ordering food, shopping for clothes, or watching a movie, mobile technologies make these services easily accessible at users' fingertips, supporting the growth and adoption of platform economies.

According to Martin Kenney and John Zysman (2016: 61), algorithms and cloud computing form the foundations of the platform economy. Artificial intelligence (AI) and machine learning (ML) have increased the efficiency of these platforms by strengthening recommendation programs made to customers, facilitating pricing decisions, and enabling automation of various processes. AI algorithms learn from historical data and patterns, personalizing user experience by making accurate predictions and recommendations to users. For example, they enable recommendation engines that suggest products, services, or content based on users' past behaviors and preferences to perform their jobs better. In pricing, AI can dynamically adjust prices based on demand, supply, and other market factors, optimizing profitability and efficiency. Additionally, AI and machine learning enable automation of repetitive tasks and processes, allowing human resources to be freed up for more strategic and creative tasks. All of these contribute to the success and competitiveness of platform economies by increasing productivity and operational efficiency.

The Internet of Things (IoT) is currently a technology concept that is fundamentally transforming and redefining almost all markets and industries (Lucero, 2016). The Internet of Things (IoT) plays a critical role in data collection, shopping, and analysis operations across various sectors as an indispensable tool for platform economies. By integrating sensors and technologies into physical objects, IoT provides seamless interaction between digital and physical worlds, offering the necessary infrastructure for efficient operation of platform economies. These IoT connections facilitate the collection of large amounts of data about consumer behaviors and operational processes, while also providing significant improvement opportunities in tracking goods and vehicles in motion (Tadejko, 2015). These capabilities result in businesses within platform economies gaining detailed information about logistics and supply chain, optimizing delivery routes, reducing operational costs, and increasing overall service reliability. Analyses based on collected data further increase operational efficiency and customer satisfaction by supporting processes such as better decision-making, trend forecasting, and pattern recognition.

The technologies and methods mentioned above serve as the cornerstones of platform economies. The interaction between platform economies and the mentioned technologies is a fundamental feature of the modern digital economy, and technological developments in this field will continue to profoundly shape the economic future.

1.1.7. Types of Platform Economy

Platform economies are mostly based on digital platforms and provide a virtual space that brings together different types of users, enabling transactions to occur between them. Different types of platform economies will be examined in the following sections. This classification has been prepared based on the book “Modern Monopolies” (Moazed & Johnson, 2016: 34).

1.1.7.1 Service Marketplace Platforms

Service Marketplace platforms are online platforms where various professional services are bought and sold between freelancers and clients (Moazed & Johnson, 2016: 49). Platforms like Upwork or Fiverr bring together experts in many fields such as software development, graphic design, and copywriting with individuals or companies that need these services. Users list their projects, receive bids, and start working with the most suitable service provider. These platforms create significant opportunities for freelancers by offering flexible working hours and access to a broad client network.

1.1.7.2. Product Marketplace Platforms

Product Marketplace platforms are online platforms where users can buy and sell various physical products (Keenan, 2023). Platforms like Amazon and eBay offer a wide range of products from electronics to clothing, from household items to antiques. Sellers can reach a broad audience by listing their products, while buyers have the opportunity to compare products from different sellers and purchase at the most suitable price. These platforms provide a preferred shopping environment for both buyers and sellers with their ease of use and secure payment systems.

1.1.7.3. Payment Platforms

Payment Platforms are digital tools that enable users to securely transfer money when making online purchases or paying bills (PayPal Editorial Staff, 2023). Platforms like PayPal and Stripe allow both individuals and businesses to easily make payments and collect receivables between different currencies. These systems have become an indispensable part of online commerce with their user-friendly interfaces and robust security measures.

1.1.7.4. Investment Platforms

Investment Platforms are online tools that facilitate individuals and institutions to invest through various financial instruments, such as stocks, bonds, or lending. Platforms like AngelList and LendingClub allow investors to provide capital to startups or finance individual loans (Tamplin, 2023). Through Investment Platforms, users can access financial markets more easily and diversify their portfolios. These platforms help users discover, evaluate, and manage investment opportunities, thereby providing a modern and interactive way to achieve their financial goals.

1.1.7.5. Social Network Platforms

Social Network Platforms are online platforms that allow users to connect with friends, message, and share content (Carr & Hayes, 2015:46). Platforms like Facebook and LinkedIn offer extensive opportunities for expanding personal and professional networks. Users can create profiles, share updates, join groups, and interact on these platforms. These social networks have become an important tool for both social and professional interaction, enabling users to create communities based on their interests and exchange information.

1.1.7.6. Communications Platforms

Communication Platforms are digital platforms that enable users to communicate directly and instantly in various formats such as text, voice, and video messages (Nouwens, Griggio & Mackay, 2017: 727). Applications like WhatsApp and Telegram allow users to message one-on-one or in groups, share files, and even make voice or video calls. These platforms provide convenience and speed in daily communication, enabling millions of people worldwide to stay connected with each other.

1.1.7.7. Social Gaming Platforms

Social Gaming Platforms are digital platforms where users can interact with each other through various games. Platforms like Steam allow players to purchase, subscribe to, download games, and interact with in-game communities (Zanescu, 2021: 34). Users can create friend lists, establish groups, and play multiplayer games to compete or collaborate with other players worldwide. These platforms enrich social interaction and gaming experience by offering players an extensive game library.

1.1.7.8. Content Platforms

Content Platforms are online platforms where users can share various types of content and consumers can access and enjoy watching, reading, or listening to this content. Content platforms are subject to such extensive consumption that, for example, billions of hours of video are watched monthly on YouTube, a content platform (DeLisa, 2015: 1275). Platforms like YouTube and Medium offer the opportunity to reach a broad audience for content in different formats such as videos, articles, and blog posts. Users can create, publish their own content on these platforms and interact with a wide audience, which encourages information sharing and creative expression.

1.1.7.9. Development Platforms

Development Platforms are online tools that facilitate software developers to collaborate on projects, share code, and manage software development processes. Platforms like GitHub provide developers with the opportunity to manage and develop their projects more effectively through features that support code storage, version control, and teamwork (Zagalsky et al., 2015:1906). These platforms support software development projects across a wide range, from open-source projects to large-scale commercial applications.

1.1.8. Platform Economies by Number of Sides

When examining the literature, it is observed that platform economies are categorized according to the number of sides that constitute these economies. Below, platform economies are listed and explained according to these numbers of sides.

1.1.8.1. One-sided Platform Economies

A one-sided platform is a digital platform that offers a service to a community of target users. A user connects to the platform through a user commitment agreement via registration and/or subscription (Derave et al., 2021: 417-431). For example, DropBox, a file storage and access platform, is an example of one-sided platform economies.

1.1.8.2. Two-sided Platform Economies

Two-sided platforms are platforms where consumers and third-party producers can interact by providing access to the same space (Hagiu, 2009: 1011-1043). For both sides, the value of platform access is higher when there are more members on the other side. Two-sided platforms are characterized by the interaction of two different user groups that are mutually interdependent. Essentially functioning as intermediaries, these platforms effectively facilitate direct participation between two sides, fostering mutual value creation. Payment card systems like Visa and MasterCard are examples of two-sided platforms. In these payment systems, one side of the user base consists of cardholders (individuals or organizations) seeking an effective, secure, and universally accepted payment methodology. The other side consists of merchants who aim to increase sales by offering various payment alternatives to their customers. The platform serves both sides: providing a universally accepted and secure payment instrument for cardholders while ensuring seamless processing of these payments for merchants.

The network effect, which shows a significant increase in the platform's value as the number of users on both sides increases, is vital for the function and success of two-sided platforms. In the context of two-sided platforms, the network effect means that as more cardholders adopt the platform, more merchants are encouraged to facilitate this payment method, which in turn attracts a larger number of cardholders. This dynamic creates a positive cycle that increases the overall utility and attractiveness of the platform for all users. Successful two-sided platforms typically include unique features designed to attract and retain users. In payment card systems, these features may include security measures such as fraud protection for cardholders and advanced

transaction management tools for merchants. In summary, two-sided platforms are at the intersection of technological innovation and network dynamics. By enabling direct interactions between different user groups, they promote growth and contribute to value creation through the maintenance of network effects.

1.1.8.3. Multi-Sided Platform Economies

Multi-sided platforms represent an evolution of the two-sided platform model and exhibit interaction features with more than two different user groups. Multi-sided platform markets have two or more different customer groups that businesses must have and retain to be successful (Evans, 2003: 2). These types of platforms serve as an embodiment of complex, interactive ecosystems that address the different needs and preferences of multiple user categories.

Multi-sided platforms are defined as networks that bring together two or more different types of users and facilitate transactions between them (Zhao et al., 2020: 2).

The network effect, which is a feature of multi-sided platforms mentioned in the previous section, intensifies as it accommodates the increasing diversity of platform user types. This effect creates a wave of value increase across the platform's user base; value for one group increases with the entry of another group, leading to an increasing cycle of mutual benefit.

A shopping mall is an example of a multi-sided platform. This model involves a three-way interaction between shoppers, retailers, and advertisers. Shoppers are offered various goods and services in one location, retailers are provided access to a pool of potential customers, and advertisers are given the opportunity to reach a broad audience. Each user group creates indirect value for others by participating in the platform.

The increase in the number of shoppers enables more retailers and advertisers to be attracted to the shopping mall. More retailers offer more options to shoppers and create more advertising space, thus attracting more advertisers. Similarly, the presence of more advertisers can attract a larger crowd of shoppers. This is a classic manifestation of the network effect in multi-sided platforms. To fully realize the potential of multi-sided platforms, strategic management of interactions between various user groups is vital. Since value creation is interconnected, balancing the needs and benefits of each user group becomes a central task.

The platform must be designed and managed to seamlessly facilitate transactions and interactions between users, thereby maximizing overall network value. Innovative features, effective communication channels, and efficient governance mechanisms play key roles in improving user experience and ensuring sustainable growth of multi-sided platforms.

With their broad user bases and multi-layered interactions, multi-sided platforms offer a complex but dynamic business model. The interaction of various user groups and the network effects that encourage platform growth emphasize the importance of strategic management and continuous innovation in the digital economy.

1.1.9. Blockchain Smart Contract Platforms

Although it will be discussed in detail later, it would be appropriate to explain the relationship between the Platform Business Models mentioned so far and the Blockchain Smart Contract Platforms, which are the main research topic of this book.

Smart contracts allow a flow of value based on specific terms and conditions; they are like real-world contracts except that they are completely digital. Smart contracts, being digital, consist of a small programming code stored within the blockchain. There are different blockchain platforms that can be used to develop smart contracts (Macrinici et al., 2018: 2337-2354).

Smart contracts are simple programs that are executed when predetermined conditions are met and stored on a blockchain; they are typically used to automate the execution of an agreement, so all participants can be immediately certain of the agreement's outcome without any intermediary involvement or time loss; they can also automate a workflow, triggering the next action when conditions are met (IBM Smart Contracts, 2024).

To address it very briefly, when a blockchain project offers smart contracts as a service, these tools become two-sided contracts that each user can customize according to their needs. These contract mechanisms are completely worthless without users. When users use these contracts for their own purposes and fill in the content of the contracts, the blockchain project and smart contract platform become valuable. When the number of users increases and smart contracts are filled according to user purposes, the blockchain project gains value.

In summary, blockchain smart contract platforms encompass the defining characteristics of platform business models: they serve as intermediaries that

facilitate and simplify transactions between different parties, create value by developing a multi-sided ecosystem, and grow through strong network effects.

1.2. Blockchain History and Concepts

Blockchain technology has both a complex and technical history that includes many pioneering and conceptual developments, and this history encompasses a process that has reached its current form.

1.2.1. The Origins of Blockchain: Early Developments and Concepts Leading to Blockchain

The origins of blockchain technology date back decades and include the following series of developments and concepts that eventually led to its current form (Willson, 2021) (Icaew, 2024).

- **Merkle Trees (1979):** An important precursor to blockchain is the concept of Merkle trees introduced by Ralph Merkle. This provided a data structure to efficiently verify data records in a large dataset, and this principle became an integral part of blockchain technology. In the Bitcoin White Paper, the Merkle tree is mentioned to describe a method that provides efficiency related to records (Nakamoto, 2008: 5).
- **David Chaum's Work (1982):** David Chaum, in his doctoral thesis, described a system for "establishing and maintaining secure, trustworthy digital systems among groups with mutual suspicion" (<https://evervault.com/papers/chaum>). Chaum dedicated his entire career to this field by developing new cryptographic algorithms to protect sensitive information. He is now recognized as both "the father of cryptocurrency" and "the pioneer of online privacy" (Kendall, 2023).
- **Stuart Haber and W. Scott Stornetta's Contributions (1991):** They proposed methods for time-stamping digital documents in a way that would prevent tampering (Haber & Stornetta, 1991). This concept formed the foundation for the development of blockchain.
- **Progress Toward Proof of Work (PoW) (1997):** Cynthia Dwork and Moni Naor, and later Adam Back with Hashcash (Back, 1997), contributed to the PoW concept that became critical in the implementation of blockchain in Bitcoin mining (Bitcoin Magazine, 2018).
- **Stefan Konst's Work (2000):** Stefan Konst introduced the concept of cryptographically secured chains in his article "Secure Log Files Based on Cryptographically Concatenated Entries." His model, which showed that entries in the chain could be traced from the Genesis

block and thus authenticity could be proven, formed the foundation of today's blockchain models (Konst, 2000: 25-46).

- Nick Szabo's Bit Gold (2005): Although Nick Szabo's Bit gold project was never implemented, Szabo's initiative is generally considered a precursor to Satoshi Nakamoto's bitcoin protocol. Bit gold combines various elements from cryptography and mining to achieve decentralization, including time-stamped blocks that are stored in a title registry and generated using Proof of Work (PoW) sequences (Szabo, 2005). The bitgold project, which never went into implementation, technically contains many similarities with bitcoin.

These ideas further refined concepts that form the building blocks of blockchain, such as decentralized digital currency and cryptographically secure chains.

1.2.1.1. The Emergence of Bitcoin and Other Developments on Blockchain

The launch of Bitcoin in 2008 marked a milestone for blockchain projects. The advent of Bitcoin and subsequent developments in the blockchain field are summarized below based on Ron Karjian and Robert Sheldon's article "History of Blockchain" on TechTarget (2023).

In 2008, an individual or group operating under the pseudonym Satoshi Nakamoto introduced cryptocurrency and blockchain technology to the world through a White Paper. This document laid the foundation for Bitcoin, the first cryptocurrency, and emphasized a decentralized, peer-to-peer (P2P) transaction system that bypassed traditional intermediaries such as banks and governments. Despite widespread speculation, Nakamoto's identity remained a mystery surrounded by many theories (L.S., 2015).

The fundamental architecture of Bitcoin and blockchain was inspired by technologies and concepts from the previous three decades. Nakamoto's innovative approach involved the idea of a sequential "blockchain" that could be extended without requiring approval from a central authority. A digital currency was defined as a series of digital signatures that allow the transfer of ownership by digitally signing the hash of the previous transaction and the public key of the next owner and adding them to the currency's history.

Bitcoin emerged in 2009 under the financial pressure of the 2008 financial crisis. Initially valued at less than a penny, Bitcoin's first block, known as the Genesis block containing 50 bitcoins, was mined by Nakamoto (Cooling, 2024). This turning point confirmed that the blockchain model worked.

Nakamoto published the first software version of Bitcoin on the open-source software platform SourceForge.

The first Bitcoin transaction was conducted when Nakamoto sent 10 bitcoins to Hal Finney (Kuhn, 2023). This year also saw significant developments such as the establishment of the first Bitcoin exchange that facilitated the currency's first trading (Cryptopedia Staff, 2022) and the creation of a dedicated forum for Bitcoin news and discussions.

To preserve Bitcoin's scarcity, Nakamoto limited the total Bitcoin supply to 21 million units (Kamsky, 2023).

By 2010, Bitcoin was used for the first time in a purchase transaction when 10,000 bitcoins were exchanged for two pizzas (Kamau, 2022).

Throughout 2011 and subsequent years, the Bitcoin ecosystem expanded with the introduction of alternative cryptocurrencies like Litecoin, the establishment of influential platforms like Bitcoin Magazine, and significant investments in blockchain technology. Notably, the Ethereum network, introduced in 2015, marked a significant evolution by enabling smart contracts and decentralized applications (Marr, 2024).

The blockchain field has continued to evolve with the discovery of new applications beyond cryptocurrencies and corporate recognition. Despite challenges such as regulatory barriers and security breaches, the sector has seen significant growth, innovation, and adoption. By 2021, Bitcoin reached unprecedented high values. The emergence of Non-Fungible Tokens (NFTs) and Decentralized Finance (DeFi) platforms demonstrated blockchain technology's potential to transform various sectors.

Today, blockchain has evolved beyond cryptocurrencies toward services and solutions. Currently, blockchain technology applications are used in sectors such as business, finance, and supply chain management. Security, decentralization, transparency, and immutable record-keeping capabilities have been adopted by the business world.

In summary, blockchain technology has evolved through gradual advances in cryptography and digital security and has become increasingly widely used technology in business.

1.2.1.2. Definition of Blockchain Technology

According to Christian Catalini from MIT, "blockchain technology is a system that enables a network of computers to reach agreement on the true state of a distributed ledger at regular intervals. Such (digital) ledgers can

contain various types of shared data such as transaction records, transaction properties, credentials, or other information. The ledger is typically protected by a clever combination of cryptography and game theory and does not require trusted nodes as in traditional networks (Church, 2017).”

Blockchain is defined as a database used as storage space for a decentralized network (Zarrin et al., 2021: 2841).

Blockchain is a shared, decentralized, cryptographically secured, and immutable digital ledger (Arun et al., 2019: 33).

Blockchain is the decentralized ledger behind the digital currency bitcoin; this ledger is a structure where groups of transactions known as blocks are linked together (hence the term blockchain is used) and the same copy is stored in each of approximately 60,000 computers in the bitcoin network (Finley & Barber, 2019).

A blockchain is essentially a distributed record database or a public ledger of all transactions and digital events that have been executed and shared among all participants in a network (Ceylan & Işık, 2023: 130).

Based on the definitions above, blockchain can be thought of as a digital record ledger; however, this ledger is not kept in a single location but is distributed across countless computers worldwide. The ledger consists of pages in the form of lists of transactions or records known as “blocks.” When a block is filled with records, it is sealed and linked to the previous block, creating a blockchain, hence the term “blockchain” or “blok zinciri” in Turkish.

Below are the fundamental concepts of blockchain:

- **Digital Ledger:** Typically, an accounting ledger keeps records of transactions that occur. Throughout history, ledgers recorded using pen and paper have been used to track the exchange of goods and services. In modern times, ledgers are typically stored digitally in large databases operated by a central trusted third party on behalf of a user community. These centrally owned ledgers can be maintained centrally or distributedly (Yaga et al., 2019: 49). A ledger is used to record transactions or information and is replicated thousands of times across computers in a network. When a transaction is recorded on the blockchain, it cannot be changed. This ensures data integrity. Each block in the chain contains numerous transactions. With each new transaction, a record is added to every ledger (digital recording device) in the network.

- **Decentralization and Immutability:** This ledger is not a record kept at a single central point; it is distributed across a wide network of computers, requiring anyone who wants to change the record to alter records around the world. This makes manipulation or hacking extremely difficult. Unlike traditional databases controlled by a central authority, blockchain is distributed among multiple nodes (computers), ensuring there is no single point of control or failure. Blockchain technology, due to its distributed nature, is not suitable for changing past records. A hacker would have to change not just one block in the chain, but all subsequent blocks and other replicas on the network as well (Higginson et al., 2017).
- **Permissioned and Permissionless Blockchains:** Blockchains are typically divided into permissioned and permissionless chains. Permissionless blockchains are public, and anyone can examine the state of the blockchain. Permissioned blockchains, on the other hand, allow authorized individuals and institutions to read them. Permissioned blockchains are often chains specific to an institution or sector and are therefore not open to the public (Sedlmeir et al., 2022: 1779).
- **Trust and Transparency:** The visibility of transactions on the blockchain and the immutable nature of transaction history contribute to a system of trust and transparency. Every transaction on the blockchain is recorded and can be seen by anyone who is part of the network, ensuring transparency. The immutable nature of transactions also guarantees a trust environment. The fact that no other intermediary enters between parties conducting transactions on the blockchain has eliminated the need for trust in an intermediary. In this sense, blockchain is sometimes also referred to as trust-free (Hawlitshchek et al., 2018: 53).

In essence, a blockchain is a method of recording transactions or information in a secure, transparent, and decentralized manner, with each piece of data linked to the previous one, thereby creating a continuous chain.

1.2.1.3. Basic Components and Terms of Blockchain

- The basic components and terms of blockchain are compiled below based on Krishnan (Krishnan, 2020: 389-390).
- **Blocks:** A blockchain is a series of blocks, each containing a collection of data. These blocks are linked together in chronological order to form a chain. Each block also contains a timestamp and provides clarity about when the data was recorded. Each block consists of two parts: block header and block body (Educative, 2024).

- Chain: Blocks arranged in sequential order form the chain of the architecture (Clark, 2021).
- Hash: The term “hash” refers to a broad concept commonly used in computer science and cryptography. Essentially, a hash function takes a data block of any size and produces a fixed-size digest or hash value (Silva, 2003).
- Nodes: Computers in blockchain architecture are called nodes, and each node has a copy of the ledger. Each node participates in transactions and verifies the validity of transactions (Ammous, 2016: 1).
- Mining: Mining involves creating the hash for the transaction block. Transactions cannot be forged, thus maintaining the integrity of the chain. Complex mathematical calculations are used in mining to verify transactions. Miners verify the validity of transactions and then the transaction is included in a secure block. Miners are rewarded for creating the secure hash of the block (Kiayias et al., 2016: 368).
- Consensus Mechanisms: Consensus includes the rules that must be followed for adding a new block to the network. They play a critical role in maintaining integrity and security in the blockchain network. Examples include Proof of Work (PoW) and Proof of Stake (PoS) (Lashkari & Musilek, 2021: 43622).
- Decentralized Autonomous Organizations (DAOs): A Decentralized Autonomous Organization (DAO) is a unique organizational model where basic operations are coded into computer programs and executed autonomously without the need for constant human intervention. Rules and principles are embedded in the code, transforming the DAO into a self-governing digital structure that supports decentralized decision-making mechanisms. This innovative approach eliminates the need for a central authority and promotes transparency and automation. The rules and regulations governing a DAO are written directly into the source code. This represents a paradigm shift from the traditional understanding of rulemaking where laws are written on paper. Now these principles exist within lines of code. This code-based governance provides autonomous management and immutability features through execution via algorithms. While the system allows for changes, any proposed regulation must be approved by majority vote of the DAO community. This rule-based structure limits individuals’ ability to unilaterally change the DAO (Mert et al., 2022).

1.2.1.4. Proof of Work (PoW) and Proof of Stake (PoS)

- Proof of Work (PoW) and Proof of Stake (PoS) are two different consensus mechanisms used to validate transactions and add new blocks to the chain in blockchain networks. Each has its own characteristics and effects on blockchain security, efficiency, and overall operation.
- In the Proof of Work (PoW) model, a user who is the first to solve a computationally complex puzzle records and publishes the next block. The solution to this puzzle is proof that work has been done. The puzzle is designed to be difficult to solve but easy to verify that the proposed solution is valid. This allows all other full nodes to easily verify proposed next blocks, and blocks that do not provide a valid solution to the puzzle are rejected (Yaga et al., 2019: iv). The characteristics of the Proof of Work method are listed below:
 - Basic Concept: Proof of Work - Blockchain Mining is a costly process that requires large amounts of electricity consumption and increasingly specialized hardware, and this is accomplished through a consensus mechanism called “proof of work.” When a miner finds a valid hash that is requested to be calculated for a block, this situation is accepted as proof that they have performed a large amount of costly computation. Blocks containing false or illegitimate information are considered invalid and all computations performed are wasted. In this way, finding a valid hash is an indicator that the miner has contributed to the maintenance of the Bitcoin network (Schar & Berentsen, 2020: 34).
 - Security: As stated above, the difficulty of mathematical problems ensures network security. Solving these problems is computationally expensive and time-consuming, which deters malicious actors.
 - Energy Consumption: A significant disadvantage of the proof of work method is high energy consumption, as it requires large amounts of computational power and electricity. Moreover, since this computation does not provide added value beyond verification, it is considered wasteful (Swan, 2015: 83).
 - Decentralization: While the proof of work method promotes decentralization, there is a risk that a small number of miners or pools may dominate the network (Cointelegraph, 2024). Miners with the highest computational power and capacity can win validation competitions consecutively.
- In 2011, a new approach was proposed on the Bitcointalk forum to address the inefficiencies of the proof of work (PoW) consensus mechanism.

hanism and reduce the number of computational resources needed to run the blockchain network. According to this new proposal, to validate transactions in a crypto network, a user only needs to demonstrate that they own a certain amount of cryptocurrency specific to the blockchain project (Cointelegraph, 2024).

- **Basic Concept:** In PoS, the creator of a new block is determined based on the user's wealth, i.e., their 'stake.' Instead of miners, there are validators who lock some coins as stake in the network. In this system, people use their own money as 'collateral' to ensure the ledger remains correct and up-to-date, and they want the system to run successfully. If they abuse the ledger, they lose their own money, which is why this collateral system ensures everyone behaves honestly. Additionally, they cannot use the value they put as collateral for other purposes. This method allows people to validate transactions based on their stake rather than spending large amounts of energy to perform calculations. This results in less energy consumption and therefore less environmental damage (Yaga et al., 2019: 32).
- **Energy Efficiency:** PoS is much more energy efficient than PoW because it does not require extensive computational work.
- **Security:** PoS secures the network by making it disadvantageous for validators to create fraudulent transactions.
- **Centralization Risk:** PoS has the potential risk of leading to a more centralized system. Those with more wealth (or stake) have more power and influence over the network (River Proof-of-Stake, 2024).

1.2.1.5. Comparison of Proof of Work and Proof of Stake Methods

Below is a comparison of these two methods with different parameters:

Energy Consumption:

Proof of Work consumes more energy than Proof of Stake. This is because miners processing blocks spend large amounts of processor power and electricity to solve mathematical problems as quickly as possible. In Proof of Stake, investing capital is sufficient to become a block processor, making PoS a more environmentally friendly option.

Security:

Both systems provide strong security through different means. While Proof of Work relies on computational work, Proof of Stake depends on economic

stakes. In both systems, the cost of block processing miners making erroneous and fraudulent transactions is heavy.

Network Control:

While Proof of Work can lead to centralization of mining and validation pools, Proof of Stake can lead to wealth concentration. In this sense, both have the potential for those with more economic power to gain weight in network control.

Scalability:

PoS generally offers better scalability solutions due to lower energy and computational requirements. Blocks processed through Proof of Stake allow for a much higher number of transactions.

Rewards:

In both methods, the block processor is rewarded.

In summary, while both Proof of Work and Proof of Stake aim to maintain the integrity and security of blockchain networks, they do so through fundamentally different approaches, and each has its own advantages and challenges. The choice between the two systems depends on various factors such as security, energy efficiency, scalability, and the desired level of decentralization in the blockchain network. Table 2 lists and compares the differences between the two methods.

Table 2. Comparison of Proof of Work and Proof of Stake Methods

Proof of Work Method	Proof of Stake Method
The miner uses a large amount of computational power.	Each new block is processed in proportion to the amount of stake held by the validator.
The first miner to solve the hash-mathematical problem is rewarded.	The validator who processes the block is rewarded.
Miners compete; over time, those who reach solutions faster and improve capacity gain dominance, leading to centralization.	Validators may gain an advantage over time depending on their financial resources.
Consumes high energy and is slower.	Offers cost and energy efficiency and operates faster.

Source: Adapted from Sheikh et al., 2018.

1.2.1.6. Smart Contracts and Decentralized Applications (DApps- Decentralized Applications)

Smart contracts and Decentralized Applications (dApps) play a key role in the blockchain ecosystem by offering various functions and fundamentally changing the application standards and routines of many industries.

Smart contract definitions are provided below:

- Smart contracts are self-executing contracts. These digital contracts automatically come into effect when conditions are met. For example, when a buyer and seller meet all predetermined parameters for an agreement, payment for a good can be released instantly (Rodeck & Curry, 2022).
- A smart contract is a self-executing computer program that automatically fulfills the terms of a contract without the participation of third parties. The execution of smart contracts can include money exchange, service provision, unlocking content protected by digital rights management, or changing the name on a land deed, among other types of data movements (Barney & Lawton, 2023).
- Smart contracts, unlike legal contracts, primarily contain if-then statements that run in self-executing software code (Orcutt, 2018). Nodes on a blockchain implement a smart contract as a software program, allowing blockchain users to associate additional information with a transaction (Murray, 2019: 17).

Based on the definitions above, it can be said that smart contracts are contracts that directly contain the terms and conditions of an agreement in code form and automatically execute transactions when predefined conditions are met.

A common application of smart contracts is in the real estate sector. In a real estate sale, a scenario where smart contracts are used can be envisioned. The contract holds the buyer's payment in escrow and automatically transfers ownership of the property to the buyer when all agreed conditions are met, such as passing a property inspection and obtaining mortgage approval. This process ensures that both parties adhere to their commitments without needing an intermediary such as a real estate agent or lawyer.

Smart contracts benefit from all the default advantages of blockchain technology:

- Transactions can be conducted without intermediaries,

- Records are trustworthy and transparent,
- Authorized persons can view records,
- Transactions are recorded in a distributed ledger,
- Records are irreversible and immutable, and
- The risk of fraud or manipulation is reduced.
- Decentralized Applications (dApps) and Smart Contracts are defined below.

A decentralized application (dApp for short) refers to an application executed by numerous users over a decentralized network (Wu, 2019).

Decentralized Applications (dApps) are applications built on blockchain networks that use smart contracts to offer functions such as digital asset management, decentralized finance (DeFi), gaming, and more (Crypto APIs Team, 2022).

Since blockchain inherently lacks a central control mechanism, applications on blockchain automatically become decentralized applications. Decentralized applications existed before blockchain and operated on peer-to-peer networks without connecting to a center (Wu et al., 2021: 2033).

Decentralized Applications (dApps) interact with blockchain through smart contracts. These applications can also issue their own tokens, and these tokens can be traded along with crypto asset tokens (Dai, 2020: 100).

A notable example of Decentralized Applications (dApps) is a decentralized exchange (DEX) in the cryptocurrency world, such as Uniswap. Uniswap allows users to exchange different types of cryptocurrencies without needing a central authority to oversee trades. The platform uses smart contracts on the Ethereum blockchain to automate and secure all transactions. Users maintain control of their funds until they execute a trade, reducing the risk of theft or fraud that can be seen in centralized exchanges (Uniswap, 2024).

The advantages of decentralized applications are listed below:

- Decentralized Applications (dApps) eliminate central servers,
- They reduce system failures by operating on decentralized networks,
- They reduce censorship risks by operating on decentralized networks,
- They provide user control and autonomy, and
- They allow direct interaction without intermediaries.

1.2.1.7. *Differences Between Smart Contracts and Decentralized Applications*

Smart contracts are pre-written codes that are automatically executed on blockchain and act like digital enforcement agents, making transactions secure. On the other hand, Decentralized Applications (dApps) operate on decentralized networks and use smart contracts to conduct transactions, directly connecting users with providers. Essentially, a decentralized application (dApp) is a complete application, while a smart contract functions as its component and works like an API connection between the decentralized application (dApp) and blockchain (Admin, 2018).

Table 3 lists the features and differences of Smart Contracts and Decentralized Applications. In summary, decentralized applications (dApps) operating on blockchain are broader programs that encompass autonomous mini programs called smart contracts.

Table 3. Comparison of Decentralized Applications (dApps) and Smart Contracts

Decentralized Applications (dApp)	Smart Contracts
Blockchain-based application/site	The smart contract connects the decentralized application (dApp) to the blockchain.
Standalone program	Functions as a connector.
Backend code runs on a decentralized network	A pre-written small piece of code that is part of a decentralized application (dApp)
A complete computer program	A small component of the decentralized application (dApp)

Source: Webcom System. (2024).

1.2.2. **Issues and Challenges**

Since blockchain is a new technology, it has various technical and operational issues and challenges. Blockchain technology has three main groups of issues. These are: technical challenges, interoperability challenges, and security issues.

Blockchain technology faces two major technical challenges, particularly scalability and interoperability.

1.2.2.1. Scalability Issues

- The scalability issue of blockchain arises due to the increase in the number of transactions and users as the network grows. The ability of blockchain networks like Bitcoin to complete only a few transactions per second shows a significant performance difference compared to traditional financial solutions like Visa. This situation creates challenges in terms of blockchain technology adoption and practical applications. Various solutions are proposed to solve the blockchain scalability problem, including better consensus mechanisms, sharding, and nested blockchains.
- Consensus and Validation: Consensus mechanisms are critically important for blockchain networks to reach agreement on the validity of transactions without a central authority. They ensure that all transactions are securely verified and added to the blockchain. The Byzantine Generals Problem demonstrates the difficulty of achieving consensus in a distributed network where participants cannot trust each other. Consensus mechanisms like Proof of Work and Proof of Stake are designed to solve this problem by requiring participants to do work or stake assets to ensure their honest participation in the network (Rosic, 2020). As previously stated, the Proof of Work (PoW) mechanism requires intensive computation, which contributes to scalability issues. Alternative consensus mechanisms like Proof of Stake (PoS) have been developed to improve transaction processing times and reduce energy consumption.
- Storage Architecture: The blockchain scalability problem stems from the increasing data storage needs with new users and transactions added to the network. Since each node needs to store the entire history of the blockchain, storage requirements increase significantly, seriously affecting the scalability of the chain (Geroni, 2021). Storing complete blockchain data at each node requires significant storage space, which potentially means only institutions with large resources can operate full nodes, leading to centralization.
- Off-chaining and State Channels: Methods such as “off-chaining” and “state channels” have been proposed to increase scalability. Techniques like off-chaining and state channels are used to reduce load and transaction costs by allowing some transactions to be conducted outside the main blockchain. Off-chaining reduces network load by enabling transactions to be processed outside the main chain. State channels create a communication channel between participants to

conduct transaction updates and data exchange outside the blockchain (Codementor, 2022).

- **Sharding and Subchains:** Sharding divides the blockchain into smaller, more manageable pieces, allowing parallel processing and reducing overall processing time. On the other hand, subchains are chains derived from the main chain but operating separately to perform specific functions (Howell, 2022).

1.2.2.2. Interoperability Issues

The concept of blockchain interoperability refers to the ability of different blockchain networks to seamlessly share data, messages, and tokens. This capability is critically important in a world with numerous blockchain platforms and enables the creation of cross-chain decentralized applications (dApps) that can operate across various blockchains. Interoperability solutions provide the foundation for developers to build complex applications and for traditional systems to effectively interact with various blockchain environments (Blockchain Interoperability, 2023).

Technical Compatibility: Blockchains can use different programming languages, smart contract platforms, or data structures. Ensuring seamless compatibility between these blockchains is vital for facilitating data and value transfer. For example, when a decentralized finance (DeFi) application developed on Ethereum wants to interact with a supply chain management platform built on a different blockchain like Solana, these blockchains use different programming languages, leading to compatibility issues (Blockchain Interoperability, 2023).

Fragmented Ecosystem: With the proliferation of blockchains, developers have gained access to various platforms on which they can run their smart contracts, but this freedom has come at a new cost. Each chain being isolated with its own walls has limited cross-chain transitions (Lawrence, 2023).

Overcoming these challenges is vital for the broader adoption and implementation of blockchain technology. Efforts continue to develop solutions that increase scalability, such as Layer 2 solutions, and promote interoperability between different blockchain platforms (Codementor, 2022).

1.2.2.3. Security Issues

While blockchain technology offers many advantages, it is not without security concerns. Various attack types and security vulnerabilities have been identified over the years, which underscores the necessity of robust security

measures. These attack types are summarized and listed below. The list headings are adapted from Jessica Groopman (2023). For explanations, relevant sources have been consulted and Groopman's explanations have also been utilized.

1.2.2.4. Attack Types and Security Vulnerabilities

Below are the attack types in the blockchain field and security vulnerabilities defined:

- **51% Attack:** This attack occurs when a single miner or group of miners' controls more than 50% of a network's hash rate, allowing this group to manipulate the blockchain (Luther et al., 2016: 396). This creates opportunities for blocking transactions, stopping payments, reversing transactions, and conducting double spending fraud.
- **Cryptojacking:** This involves hijacking computers to use their computational power for cryptocurrency mining. Malicious software infects a target device and uses the device's resources to mine cryptocurrency for the attacker (Tekiner et al., 2021: 120).
- **Flash Loan Attacks:** In these attacks, smart contracts designed to support flash loans that enable borrowing assets without collateral are exploited to siphon assets. This involves manipulating smart contract inputs to redirect funds (Qin et al., 2021: 3).
- **Rug Pull:** This attack type involves fraud where (crypto developers or internet influencers) promote a project and then abandon it, running away with investors' funds (Zhou et al., 2024).
- **Phishing Attacks:** Here, attackers use social engineering to obtain users' credentials, install malware, or obtain private keys (Gupta et al., 2016: 537).
- **Sybil Attacks:** Attackers create and use numerous fake identities to gain control of the network. When they reach a sufficient number of nodes, they can conduct a 51% attack (Levine et al., 2006: 224).
- **DDoS (Distributed Denial of Service) Attacks:** Distributed Denial of Service attacks involve overloading a network to slow it down or crash it, thereby denying services to legitimate users (Mirkovic & Reiher, 2004: 40).
- **Human Error Risk:** The theft of blockchain project user passwords (private keys) due to improper storage is another security issue (Ahmed et al., 2012: 82).

1.2.2.5. The Largest Blockchain Attacks and Fraud Cases

Although those dealing with blockchain claim that blockchain is very secure for technological reasons, every system has vulnerabilities. Even though blockchain technology securely records all transactions, if a user's password is compromised, it can lead to the emptying of the user's funds, regardless of how securely they are recorded in a chained and distributed manner on the blockchain. Or due to insufficient legal regulations, inadequately supervised cryptocurrency exchange platforms can appropriate funds after collecting them, as seen in examples like Thodex in Turkiye and FTX in America.

While this book lists the security elements and methods of blockchain technology, it is not claimed that this technology is completely secure, and when considering the list of the largest attacks in the blockchain field below, security vulnerabilities should be seriously reviewed. The following list is arranged from the highest to lowest monetary value.

At the top of security issue examples is FTX with losses of \$8 billion. In November 2023, Sam Bankman-Fried was found guilty in a legal case related to the management of the FTX exchange. In the case where Sam Bankman-Fried was tried, prosecutors claimed that this individual embezzled at least \$8 billion from FTX customers and investors, and the case concluded with the jury finding Sam Bankman guilty (Cohen & Godoy, 2023). Among the allegations was the use of these funds for high-risk investments through the hedge fund Alameda Research. Additionally, Bankman was accused of spending FTX funds on luxury real estate and personal expenses, channeling a significant amount to political donations. Bankman's conviction demonstrated the need for stricter regulations in the cryptocurrency sector.

Ronin Network was subjected to the largest cryptocurrency hack in history in March 2022, targeting the network supporting the Axie Infinity blockchain game. This breach led to the theft of approximately \$625 million worth of Ethereum and USDC. US authorities determined that the heist was carried out by the North Korean state-sponsored hacking group Lazarus Group. Binance managed to recover \$5.8 million of the stolen funds a month later (Wilson & Howcroft, 2022).

In another significant hack, the decentralized finance platform Poly Network was attacked by a user through a security vulnerability. Funds worth over \$600 million were stolen, including \$33 million in Tether. The project team called for the return of funds on social media, and the hacker began cooperating. All money was recovered within two days. The motivation behind the attack

was thought to be the attacker's search for a challenge or entertainment (Chavez-Dreyfuss & Price, 2021).

In November 2022, more than \$600 million was stolen from the crypto wallets of FTX, an important player in the cryptocurrency sector founded by Sam Bankman-Fried mentioned in the above paragraph (Zhen et al., 2022).

In October 2022, Binance's BNB Bridge was attacked by hackers who exploited a smart contract error in the BSC Token Hub cross-chain bridge, and approximately \$570 million worth of BNB tokens were stolen (Shaver, 2022).

The Coincheck exchange in Japan suffered a major theft in January 2018 due to security vulnerabilities related to a hot wallet, resulting in the theft of 523 million NEM coins. This incident was worth approximately \$534 million (Curran, 2018).

Mt. Gox experienced its first major hack incident in 2011. This event was the first indicator of Mt. Gox's security vulnerabilities until the larger-scale hack incident in 2014. The 2011 hack affected a small amount for that period, and Mt. Gox made full refunds to all its users. This incident revealed significant weaknesses in Mt. Gox's security practices and laid the groundwork for the subsequent larger-scale hack (Sedgwick, 2019).

On February 3, 2022, a security breach occurred on the Decentralized Finance (DeFi) platform called Wormhole. This platform was designed to facilitate token and non-fungible token (NFT) transfers between various blockchains such as Ethereum, Solana, and Binance Smart Chain. The attacker exploited a vulnerability using a fake sysvar account and managed to mint 120,000 ETH (wETH) tokens on the Solana network. These tokens were later deemed invalid. The attacker then exchanged 93,750 wETH tokens for equivalent ETH tokens on the Ethereum network. The remaining invalid tokens were also exchanged for USDC and SOL tokens according to the Certic incident analysis report (Distributed Networks Institute, 2022).

On March 13, 2023, Euler Finance, a permissionless lending and borrowing protocol on Ethereum, was subjected to a "flash loan" attack. While this was not the first Decentralized Finance (DeFi) attack of the year, it was the largest with approximately \$200 million in losses. Hackers stole funds in USDC, Bitcoin (wBTC), staked Ether (stETH), and DAI, an algorithmic stablecoin maintained by MakerDAO. A hack of this magnitude demonstrated ongoing threats to widely used Decentralized Finance (DeFi) protocols and potential abuse opportunities opened by flash loans (Chainalysis Team, 2023).

In December 2021, \$196 million worth of cryptocurrency was stolen from the BitMart exchange. The exchange's CEO explained that the hack occurred

due to a stolen private key. This explanation drew attention to the exchange's security vulnerabilities while pointing to security threats on cryptocurrencies (Sigalos, 2021).

Türkiye also witnessed one of the frauds in the blockchain field. Faruk Fatih Özer, the founder of the cryptocurrency exchange called Thodex, disappeared after embezzling two billion dollars (Erbil, 2021). Faruk Fatih Özer, who was later caught, was sentenced to 11,196 years in prison (Çelik, 2023).

These incidents demonstrate the diversity of security threats in the blockchain and cryptocurrency field; they also reveal the importance of being constantly vigilant against potential security vulnerabilities and attacks and the necessity of strong security measures.

1.2.2.6. Legal Regulations and Challenges

Global legal regulations for cryptocurrencies and blockchain technologies encompass various approaches from different countries with their own unique economic, legal, and technological contexts.

In the European Union, the Markets in Crypto-Assets Regulation (MiCA) represents a comprehensive framework regulating the cryptocurrency and blockchain sector. MiCA establishes a unified regulatory approach across all EU member states, focusing on consumer protection, anti-money laundering, and financial market stability. It introduces detailed White Papers for crypto asset issuers, special requirements for asset-referenced tokens and e-money tokens, along with audit standards for significant assets. After authorization, MiCA allows crypto asset service providers (CASPs) to operate throughout the EU, potentially creating a global reference point for cryptocurrency regulation (Capaccioli, 2023).

In the US, federal and state governments have shown significant interest in cryptocurrencies, with most federal action focusing on oversight at the level of institutions such as SEC, CFTC, FTC, Treasury (including IRS), OCC, and FinCEN. However, despite active participation from these institutions, formal regulation-making has remained limited. Federal institutions and policymakers have recognized the importance of blockchain technology for America's future infrastructure and that the US must maintain its leading position in the development of this technology. The US Congress has introduced several bills since 2022 aimed at bringing clarity to the cryptocurrency sector. These bills include the Responsible Financial Innovation Act (RFIA), which provides regulatory clarity for institutions tasked with overseeing digital asset markets, the Toomey Stablecoin Act offering a regulatory framework for stablecoins,

and the Digital Commodity Consumer Protection Act (DCCPA) granting the CFTC authority to regulate digital commodity trading (Cristopher, 2023).

Additionally, the Digital Trade Clarity Act has been introduced to clarify the regulatory treatment of digital assets not considered securities by the SEC or federal courts. State governments have shown variation in their approaches to regulating cryptocurrencies and blockchain technology. While some states have passed regulations encouraging the technology, others have imposed stricter requirements. Wyoming has passed laws supporting the creation of crypto-focused banks and regulating DAOs, while Utah has adopted similar laws. In contrast, Florida and the District of Columbia have tightened regulations requiring money transmission licenses for crypto-related activities. The Uniform Law Commission and American Law Institute have amended the Uniform Commercial Code to include definitions for digital assets, targeting broader, technology-agnostic definitions to accommodate future technological evolution. The Biden Administration has issued an Executive Order outlining its strategy to reduce risks in the digital asset space while supporting innovative developments, focusing on six main priorities: consumer and investor protection, financial stability, illicit finance, US leadership in the global financial system, financial inclusion, and responsible innovation. In March 2023, the White House published the President's Economic Report criticizing the speculative nature and limited economic benefits of cryptocurrencies, stating that some crypto assets are permanent and covered by existing regulations (Dewey & Patel, 2024).

In Japan, blockchain-based tokens are regulated not by a single comprehensive law but based on their functions and uses. Cryptocurrencies like BTC and ETH and utility tokens are classified as "Crypto Assets" under the Payment Services Act (PSA), and businesses dealing with these assets must register as Crypto Asset Exchange Service Providers (CAESP) (Patairyra, 2023b).

Currency-pegged stablecoins like USDC and USDT are regulated as "Electronic Payment Instruments" (EPI) under the PSA, and businesses dealing with such assets must register as Electronic Payment Instrument Exchange Service Providers. So-called algorithmic stablecoins that are not collateralized by fiat currency and whose values are tied to currency through algorithms do not fall into the EPI category as they are not accepted as Currency Denominated Assets and are instead considered Crypto Assets if they can be transferred or traded to unspecified persons on blockchain. "Security tokens" representing stocks, bonds, or fund shares are regulated as electronically recordable transferable rights under the Securities and Exchange Act (FIEA), and businesses dealing with such transactions must register as

Type I Financial Instrument Business Operators. Other tokens with unique characteristics that do not have an economic function as payment instruments, such as Non-Fungible Tokens (NFTs), are not regulated in principle under the existing regulatory framework (Nagase et al., 2023).

Japan has created legal frameworks that are relatively supportive of cryptocurrency and blockchain innovation. This has created environments conducive to growth in this sector by recognizing potential economic benefits and technological advances.

The Chinese government has supported blockchain technology by recognizing its potential and creating policies that encourage its application across various industries. However, it has simultaneously imposed a strict ban on all cryptocurrency-related transactions, mining, trading, and initial coin offerings. These bans apply in China, including relevant blockchains. Since 2021, non-fungible tokens (NFTs) have gained great popularity in China, and many giant internet companies have developed digital collection platform businesses. The potential of non-fungible tokens (NFTs) to diversify the digital economy and promote cultural and artistic endeavors has been fully recognized in China. The Chinese government encourages the application of non-fungible tokens (NFTs) in the digital economy. For example, the Shanghai Municipal Government issued a Notice on the Publication of the 14th Five-Year Plan for Digital Economy Development in June 2022, explicitly supporting leading enterprises in Shanghai to learn about developing non-fungible token (NFT) trading platforms (Liao, 2022).

In the past two years, non-fungible tokens (NFTs) have been widely used in art, gaming, and metaverse businesses in China. Many companies, including leading internet platform players and luxury brands, have issued non-fungible tokens (NFTs) or invested in non-fungible tokens (NFTs). Successful application examples include non-fungible token (NFT) platforms created by internet companies built on private blockchains or consortium blockchains, Ant Chain and Bigverse NFT, China. However, China's non-fungible token (NFT) market has two notable characteristics: All non-fungible token (NFT) transactions are priced and traded in renminbi (or central bank digital currency) instead of cryptocurrencies. Many platforms consciously avoid using the term "non-fungible token (NFT)" to downplay their token nature and instead prefer the term "virtual collections." To minimize legal risks associated with cryptocurrencies, some platforms prohibit secondary transactions. As a result, China's non-fungible token (NFT) market has not been fully explored (Wang et al., 2023).

Turkiye is one of the countries with the fastest cryptocurrency adoption worldwide, and according to a report published by the Information Technologies and Communication Authority in May 2020, it is estimated that more than five million people in Turkiye own cryptocurrency. Currently, there are no legal investor protection mechanisms for crypto assets. However, the government is working on a draft law regarding crypto assets and crypto asset service providers that envisages making changes to the Capital Markets Law. This draft law is expected to bring additional obligations for crypto asset service providers operating in Turkiye and to be submitted to the Turkish Grand National Assembly soon. With the Central Bank regulation that came into effect in April 2021, crypto assets were defined differently from capital market instruments and determined as “an intangible asset that can be virtually created and distributed with distributed ledger technology or similar technologies.” The main features of the draft law can be listed as follows: Crypto asset service providers will need to obtain operating licenses from the Capital Markets Board (CMB); these providers will be defined as organizations offering services such as crypto asset exchange platforms and crypto asset custodians; CMB will have the authority to make secondary regulations on a range of issues from operating principles of crypto asset service providers to crypto assets that can be traded. The draft law will also bring limitations to the activities of unlicensed organizations and their offers to residents of Turkiye; individuals and institutions operating without licenses or permits will face criminal sanctions for engaging in capital market activities (Onar & Subaşı, 2024).

Due to distrust in less developed financial systems, countries with unstable economies have higher rates of unbanked citizens. This trend is not limited to developing countries; even countries with developed economies like the US have a significant unbanked population. For many people, the main barrier is not having enough money; because financial services come with various costs such as account fees, credit card memberships, and transaction costs, making it difficult for low-income individuals to participate in the traditional financial system. Decentralized finance applications represent a transition from traditional, centralized financial systems to peer-to-peer finance provided by decentralized technologies built on blockchain networks. This new model allows people to directly access and manage financial transactions such as loans, savings, insurance, asset trading, and more, eliminating the need for banks and brokers as traditional financial intermediaries (Patairyra, 2023a). These differences and deficiencies in legal regulations prevent decentralized finance applications from entering daily life and prevent unbanked or banking-inaccessible populations from experiencing the convenience of these systems.

The global legal regulatory landscape showing great diversity creates challenges for those working in blockchain and cryptocurrency fields, especially for businesses operating across borders. Understanding different regulations, grasping legal consequences in various jurisdictions, and staying compliant in a rapidly changing regulatory environment are significant challenges for players in this field.

As technology and applications continue to develop, regulatory responses from governments worldwide will continue to evolve.

1.2.2.7. Intellectual Property Issues

The intersection between cryptocurrencies and intellectual property law is of vital importance, with IP protection playing a key role in the digital currency landscape. As previously mentioned, cryptocurrencies operating with blockchain technology are decentralized digital currencies whose values are determined by market supply and demand, with no central authority overseeing transactions. In the cryptocurrency field, the protection of intellectual property is as important as in any other sector for companies to innovate and remain competitive (Akansha, 2023).

There are several types of intellectual property related to cryptocurrencies, including patents, trademarks, copyrights, and trade secrets. Patents protect the innovative technology behind cryptocurrencies; trademarks secure names and logos; copyrights are for original works related to cryptocurrencies such as software and technical documentation; and trade secrets protect confidential information such as source code and business strategies. Obtaining a patent or trademark for cryptocurrency-related innovations requires applying to the appropriate patent and trademark office and ensuring that the application does not infringe on existing rights. The decentralized nature of blockchain and the lack of cryptocurrency-specific regulations in many countries create significant challenges in enforcing IP rights and addressing infringements. It is critical to protect intellectual property rights in the cryptocurrency field, address infringement issues, and for international agreements such as the Patent Cooperation Treaty and the Paris Convention for the Protection of Industrial Property (Intepat Interns, 2020) to provide a legal framework. A balance must be found between protecting intellectual property and encouraging innovation and competition. While appropriate intellectual property laws provide a foundation for encouraging the development of new technologies in cryptocurrencies, it should be considered that excessive protection can stifle competition and innovation (Rodriguez, 2023).

According to Krumholz et al. (2018: 18), ideas that have become public domain cannot be patented, and a large portion of blockchain technology falls into this category. According to the same authors, a fundamental concept of blockchain cannot be patented under intellectual property coverage.

Intellectual property (IP) issues and the legal consequences of smart contracts in blockchain technology represent a unique and evolving challenge. Smart contracts, which are automatic, self-executing contracts where the terms of the agreement are written into code, raise questions about enforceability, jurisdiction, and the application of traditional contract law. The code supporting smart contracts may also be subject to IP rights, bringing up questions about copyright and patentability. This is particularly complex in open source blockchain environments where it can be difficult to distinguish proprietary technology.

Additionally, the decentralized and immutable nature of blockchain complicates traditional IP enforcement. For example, when a smart contract is deployed on a blockchain, it is not directly possible to modify or remove it in the event of an IP infringement claim. Furthermore, the global and borderless nature of blockchain technology means that IP disputes can involve multiple jurisdictions with different IP laws, leading to legal complexities.

As blockchain technology continues to advance and integrate into various sectors, it will be functional for legal regulations to evolve to address these new challenges.

1.2.3. Types of Blockchain Platforms

The main categories of blockchain platforms are generally listed below:

- **Cryptocurrencies:** This is the most well-known category, including Bitcoin, Ethereum, Litecoin, and many other digital currencies. These projects focus on creating a decentralized, digital medium of exchange using blockchain technology (Rosic, 2024).
- **Smart Contract Platforms:** In the 1990s, a smart contract was proposed as a computerized transaction protocol that executes the contractual terms of an agreement. Contract clauses integrated into smart contracts are automatically enforced when a specific condition is met (for example, a party breaching the contract will be automatically penalized) (Zheng et al., 2020).
- **Decentralized Finance (DeFi) Projects:** These projects aim to recreate traditional financial systems such as banks and exchanges using blockchain technology. Decentralized Finance (DeFi) platforms offer

services such as lending, borrowing, and trading in a decentralized manner. Instead of getting a loan from a bank, people get loans directly from someone else through smart contracts. These systems eliminate intermediaries like banks (Popescu, 2020).

- **Non-Fungible Tokens (NFTs):** Projects in this category focus on creating unique digital assets typically associated with digital art, collectibles, and game items. Non-fungible tokens (NFTs) are used to prove ownership and authenticity of digital goods on blockchain (Wang et al., 2021). Examples of NFT trading platforms include OpenSea and Rarible.
- **Enterprise Blockchain Solutions:** Enterprise blockchain projects develop blockchain applications for businesses and organizations. They focus on e-government, healthcare industry, energy industry, and banking industry, as well as supply chain management, identity verification, and more, offering enhanced security and transparency (Konstantinidis et al., 2018). IBM is one of the most well-known examples in this field.
- **Decentralized Autonomous Organizations (DAOs):** Decentralized Autonomous Organizations, one of the fundamental concepts of blockchain discussed earlier in this book, appear in practice as communities that are self-directed and managed through smart contracts without a central authority or administrative hierarchy (Axelsen et al., 2022). As previously mentioned, these projects are organizations whose rules are coded as computer programs, unaffected by central government, controlled by organization members, and transparent. Decentralized Autonomous Organizations are also among the leading and widespread project types.
- **Privacy Coins:** Projects like Monero and Zcash focus on enhancing privacy and security. They offer more anonymous transaction capabilities compared to traditional cryptocurrencies (Stevens, 2023).
- **Services Using Blockchain Infrastructure:** This category includes projects focused on developing fundamental infrastructure for the blockchain ecosystem, including scalability solutions, interoperability platforms, and data storage solutions. Examples include Chainlink (for oracle services) and Filecoin (for decentralized information and file storage) (Olanrewaju, 2023).
- **Tokenization Platforms:** A new way has emerged in the operation of digital platforms that differs from traditional counterparts by leveraging blockchain technology and solving transactions using their own digital currency and relying on decentralized or peer-to-peer management.

Issuing the platform's digital currency, namely "utility tokens," provides a way to finance platform development without relying on capital investors (Davydov & Khalilova, 2019).

- **Stablecoins:** A Stablecoin represents a type of cryptocurrency designed to maintain a consistent value by being pegged to a stable asset, distinguishing it from traditionally fluctuating cryptocurrencies. Unlike normal cryptocurrencies, stablecoins are typically pegged to concrete, stable assets such as specific fiat currencies, for example, the US dollar or Euro, which can be exchanged on trading platforms. Additionally, some stablecoins can also be pegged to alternative assets such as precious metals like gold or different cryptocurrencies. This combination of stability and blockchain advantages offers a broader range of uses for digital transactions and financial applications (Rosencrance, 2023). This category is vital for those who want to use digital assets for daily transactions or as a stable store of value, filling the gap between the traditional financial system and the digital currency space.

Each category addresses different needs and use cases within the blockchain and cryptocurrency ecosystem, contributing to diversity and innovation in the field.

1.2.4. Blockchain Projects Implementation Examples

Blockchain technology has found countless applications in different sectors that transform our approach to data management and transactions. Here are some notable use cases and real-world examples:

- **Social Media:** Steem is a social blockchain platform that rewards users with cryptocurrency for creating original content, giving users control over their data (steem.com, 2024).
- **Education:** The University of Nicosia in Cyprus has used blockchain to store certificates and degrees and is the first university to accept cryptocurrencies for tuition payments (Vidal et al., 2020).
- **Healthcare:** Healthureum is a blockchain-based system used to control and calculate changes in medical records. It addresses data management challenges in the healthcare sector by storing data links on blockchain while keeping large files outside the blocks (Enterpriseitworld, 2018).
- **Entertainment:** In the entertainment sector, blockchain technology has been used in games like Plague Hunters and Beyond the Void. **Plague Hunters:** A free strategy game with an Ethereum marketplace

that uses non-fungible tokens (NFTs) for players to buy and sell weapons and hunters. *Beyond the Void*: This game utilizes Ethereum's blockchain technology, allowing players to buy, sell, and trade "cosmetic in-game items" through non-fungible token (NFT) transactions (Sahu, 2022).

- **Real Estate:** Blockchain enables significant innovation in the real estate sector by facilitating smoother, more secure transactions and offering a global market. Projects like Propy, Harbor, ShelterZoom, and StreetWire are notable examples of blockchain applications in real estate, offering solutions from property purchasing to asset liquidation (Dunn, 2022).
- **Supply Chains:** Blockchain technology enhances supply chain transparency and traceability through its decentralized structure, creating an auditable record of all transactions, goods movements, and ownership changes. This helps reduce fraud in logistics while enabling faster resolution of disputes and increasing accountability (Antier, 2024).
- **Healthcare Sector:** Estonia, which has been implementing a blockchain-based healthcare system since 2012, has provided an example that significantly increases data security and operational efficiency in healthcare. Nearly all the country's health information is stored on blockchain (Einaste, 2018).
- **Music and Art Industry:** Blockchain technology and non-fungible tokens (NFTs) have changed the rules of the game in the art industry by creating digital scarcity and offering a robust solution against unauthorized reproduction and piracy of artworks. The innovation brought by Non-Fungible Tokens has fundamentally changed how digital art is perceived, directly challenging issues related to art reproduction and scarcity. Before non-fungible tokens (NFTs), digital artworks could be easily copied and distributed without permission, reducing their value and violating artists' copyrights. Now, thanks to non-fungible token (NFT) technology, artists creating digital products have the ability to create unique digital artworks that offer scarcity similar to physical artworks and increase their value in the digital realm (Crooks, 2023).

These examples demonstrate how blockchain technology is used in various and effective ways across different sectors.

1.2.3. Blockchain Studies in Türkiye

Blockchain studies in Türkiye have begun to manifest themselves through pioneering projects in various sectors. Türkiye's first financial blockchain project, developed by Borsa İstanbul's information technology team, began synchronizing customer database information between Borsa İstanbul, Takas İstanbul, and Merkezi Kayıt İstanbul to execute transactions quickly, reliably, and transparently. This project is built on the KYC (Know Your Customer) concept and includes adding new customer information, updating existing information, and document management through the blockchain network (Borsa İstanbul, 2018).

Meanwhile, Slash Ventures, which invests in blockchain-based projects, is pushing the boundaries of digital experiences by sharing the latest investments in the sector and developments in web3 technology. The fund's first investment targets customers' Web3 transformation with Earnify and supports the ecosystem with initiatives such as the "Slashers Internship" program for youth (Yalçın, 2023).

In collaboration with IBM, Türkiye's first supply chain blockchain project was implemented for a broad consortium including Güler Dinamik Gümrük Müşavirliği, ATEZ Yazılım, Chain&Chain Technologies, Schneider Electric, Schenker Arkas, Vakıfbank, Universal Eğitim ve Danışmanlık, FLS Lojistik, and ACC Yetkilendirilmiş Gümrük Müşavirliği. This project aims to build a bridge from Lyon to Manisa, planning to conduct commercial and financial tracking through the blockchain network. This project aims to eliminate errors in the supply chain, accelerate processes, and increase transparency (Yanık, 2018).

Blockchain technology is being used in Türkiye by companies such as Akbank, Bankalararası Kart Merkezi (BKM), proofstack, and Global Miles in areas such as finance, copyright protection, and independent miles programs.

With Akbank's agreement with Ripple, it was stated that blockchain technology would be used for overseas money transfers (Deniz, 2019).

The Turkish company called Proofstack offers a blockchain service to register all kinds of creative products (<https://proofstack.io/>) (Papuççıyan, 2018).

Global Miles became Türkiye's first mobile miles program independent of banks and airline companies using blockchain technology (Kara, 2016). The company continues its operations at globalmiles.com.

Bankalar Arası Kart Merkezi-BKM offers training in different categories on card payments to employees of its member banks and financial institutions

through an educational platform called BayBayNakit Akademi. For the Belgem.io application designed to store, display, and share certificates obtained by participants at the end of training on a private Ethereum blockchain, BKM chose the Ethereum Proof-of-Authority Consortium solution available on the Azure cloud platform as the blockchain platform (Blockchain Türkiye, 2019; Belgem.io, 2019).

T2 Software is also among the companies using blockchain technology in Türkiye. By establishing a ‘Blockchain as a service’ system, it provides services based on blockchain infrastructure to institutions. It developed an internal loyalty program called BBN for employees of Bankalar Arası Kart Merkezi. This application is known as one of the first applications created using blockchain infrastructure in Türkiye. When employees successfully complete assigned tasks, they are rewarded with a currency called ‘keklik’ and can use this currency for purchases made through BBN (Opinyu, 2022).

These studies show that blockchain technology in Türkiye has application potential not only in the financial sector but also in various areas such as logistics, copyright protection, and customer loyalty programs.

1.3. The Concept and Framework of Competition

One of the three main contexts that constitute the research topic of this book is competition.

The concept of competition in the business world stands out as a fundamental force that encourages innovation and determines the success line of enterprises. The examination of the impact of competitive dynamics on strategic decision-making has significantly engaged academics and company executives, resulting in the formation of important theories and frameworks. These strategic tools help guide organizations through the countless challenges and opportunities presented by business environments.

The topic of competition encompasses much more than direct competition between businesses. Joseph Schumpeter brought forward the concept of “creative destruction” by defining innovation and technological progress as vital driving forces of economic progress and competitive dynamics. Schumpeter’s views clarified the importance of innovation and entrepreneurship in promoting economic growth and reshaping markets (Schumpeter, 1942). In this sense, Schumpeter enabled the understanding that competition between firms shapes society, the economy, and the world.

In addition to Schumpeter’s theory, Bruce Henderson and Boston Consulting Group’s Growth-Share Matrix method has had a lasting impact

on how companies evaluate their portfolios and make strategic investments (Reeves et al., 2014: 2). This matrix reinforced the indispensability of strategic foresight in competitive environments by examining the critical decisions businesses face to maintain competitive power and growth.

The Market-Based View argues that a firm's performance is significantly influenced by the industry context in which it operates. At the center of this theory lies the idea that competitive advantage is derived from positioning and leveraging industry forces. Michael Porter's famous works "Competitive Strategy" (1980) and "Competitive Advantage" (1985) have been instrumental in transforming this perspective into a framework. Porter's analysis of industry forces and competitive strategies has become a cornerstone in strategic management literature. This work has also been used as a fundamental source for this book and will be used in the examination of blockchain-based platform economies in subsequent sections.

The Resource-Based View shifts focus inward, arguing that unique internal resources and capabilities are the key to competitive advantage. This theory, developed by academics such as Wernerfelt, Barney, and Rumelt, emphasizes that resources must be valuable, rare, inimitable, and non-substitutable to provide sustainable advantage over competitors. Barney's article "Firm Resources and Sustained Competitive Advantage" (1991: 99-120) published in the *Journal of Management* demonstrates how internal assets can lead to superior performance.

Building on the Resource-Based View, the Dynamic Capabilities View, introduced by David Teece and colleagues, focuses on a firm's ability to adapt to rapidly changing environments, integrate internal and external competencies, and reconfigure. The 1997 article "Dynamic Capabilities and Strategic Management" in the *Strategic Management Journal* explains how these capabilities enable companies to achieve and sustain competitive advantage in variable markets.

The Knowledge-Based View is built on the premise that knowledge is the most critical resource for achieving competitive advantage. It explains the importance of tacit knowledge and the firm's processes of creating, acquiring, and using knowledge. Ikujiro Nonaka's (1991: 96-104) article "The Knowledge-Creating Company" in *Harvard Business Review* addresses the dynamics of creating and managing knowledge as a source of competitive advantage.

The Relational View argues that competitive advantage can also stem from a firm's relationships with its partners, suppliers, and customers. Dyer and

Singh's (1998: 660-679) article "The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage" published in the *Academy of Management Review* examines how inter-organizational ties can serve as a unique source of competitive advantage.

The Transient Advantage Theory, reflecting the rapidly changing nature of modern markets, was presented by Rita Gunther McGrath and argues that competitive advantage is often temporary rather than permanent. McGrath's (2013: 62-70) *Harvard Business Review* article "Transient Advantage" discusses the necessity for firms to continuously innovate to achieve sustainable success through a series of transient competitive advantages.

The discussion of strategic groups, as detailed by Michael C. Porter and others, has further enriched the competition discourse. These groups are clusters of firms within an industry that adopt similar strategies or business models, allowing for more nuanced competitive analysis and strategic positioning (Porter, 1979: 214-227).

Michael Porter's presentation of the Five Forces Model in "Competitive Strategy: Techniques for Analyzing Industries and Competitors" (1980: 4) marked an important turning point in strategic management literature. Porter's framework provided a methodical framework for evaluating competitive forces in an industry, including the intensity of competition, the threat of new entrants, the bargaining power of suppliers and buyers, and the threat of substitutes. This model has become a fundamental part of the process of understanding the competitive environment and developing strategies that guarantee long-term advantage.

1.3.1. Porter's Five Forces Model

Michael Porter's Five Forces Model has been recognized as a powerful tool for analyzing the competitive forces that shape industry attractiveness and profitability (Grundy, 2006). Introduced in Porter's groundbreaking work in 1980 "Competitive Strategy: Techniques for Analyzing Industries and Competitors," this framework provides a structured approach for organizations to evaluate their competitive environments. This analysis helps businesses understand the strength and dynamics of forces affecting competition in their industries, facilitating strategic decision-making to enhance competitive advantage.

The threat of new entrants indicates the potential for new competitors to enter the market and disrupt market equilibrium (Bruijl et al., 2018). High barriers to entry help protect existing firms from new entrants and maintain higher profitability. These barriers can include economies of scale, capital

requirements, access to distribution channels, technological expertise, and regulatory compliance. When entry barriers are low, new entrants can more easily disrupt market prices, reduce market share, and intensify competition. Strategic responses to this threat include innovation, strengthening customer relationships, and leveraging government policies to raise entry barriers.

According to Porter's model's force titled "Threat of Substitute Products or Services," substitutes offer an alternative solution to the same customer needs and potentially draw customers away from the industry's products (Dälken, 2014: 3). The threat of substitutes is higher when customers face low switching costs or when substitutes offer a price advantage or performance improvement. Industries must continuously innovate and improve their value propositions to reduce the threat of substitutes. Understanding the specific factors that make substitutes attractive and addressing them can help firms maintain competitive advantage and customer loyalty.

According to Porter's model's element titled "Buyer Power," buyers affect the industry through their ability to demand lower prices, higher quality, or better service, directly impacting profitability. Buyer bargaining power is higher when there are few buyers, when they purchase in large quantities, or when products are undifferentiated (Kabeyi, 2018: 39). Firms can reduce buyer power by differentiating their products, building strong relationships with customers, or implementing cost leadership strategies to offer competitive prices without compromising margins.

According to Porter's model's element titled "Supplier Bargaining Power," suppliers can exert power over an industry by raising prices, reducing the quality of goods, or decreasing the availability of materials. This power is more pronounced when there are few substitutes for input materials, when suppliers are more concentrated than the sector they serve, or when the input is a significant part of the product's cost (Dobbs, 2012: 24). Companies can counter supplier power by diversifying their supplier base, integrating vertically to control their inputs, or collaborating with suppliers to ensure mutual benefits.

The final force in Porter's model, Competitive Rivalry, determines the overall competitive strength of the industry environment. Factors contributing to high competition include numerous equally balanced competitors, slow industry growth, high fixed costs, and lack of differentiation. Intense competition puts pressure on prices, reduces margins, and requires continuous innovation (Andriotis, 2004: 132). Firms can overcome this challenge by focusing on market segmentation to better serve specific niches, creating high switching

costs through loyalty programs, and pursuing innovation to differentiate their offerings.

In conclusion, Michael Porter's Five Forces Model provides a comprehensive tool for analyzing an industry's competitive forces. By understanding and strategically responding to the threat of new entrants, the threat of substitutes, buyer bargaining power, supplier bargaining power, and the intensity of competitive rivalry, firms can better position themselves for competitive advantage. This analysis is crucial for any organization seeking to evaluate its strategic position and stand out in market competition.

1.3.2. Porter's Five Forces Model's Place in the Context of Platform Economies and Blockchain Platforms

Below, Porter's Five Forces model is examined in the context of platform economies and blockchain platforms:

1.3.2.1. The Threat of New Entrants in the Context of Platform and Blockchain Technologies

The threat of new entrants is a critical dimension in Michael Porter's Five Forces model and provides valuable insights into the dynamics of competitive advantage and industry attractiveness. As previously mentioned, this force examines how easily new competitors can enter an industry and subsequently challenge established businesses. The presence of strong entry barriers is critically important for protecting an industry's profitability and providing sustainable competitive advantage for existing firms.

The entry of new players into an industry increases capacity, creates a desire to gain market share, and often brings new approaches to serving customer needs. These dynamics can lead to price wars, increased costs, and pressure on profit margins for existing companies. The threat of new entrants largely depends on the entry barriers present in the sector and the response of existing competitors. When barriers are low, the likelihood of new companies entering the market is high, creating a significant threat for established firms (Ural, 2014: 3).

One of the biggest barriers to entry in Platform Economies is finding a high volume of content/service providers while simultaneously finding a high volume of users/customers/consumers. If a platform cannot achieve economies of scale in terms of service providers and consumers/users, it remains uncompetitive. The blockchain field requires qualified workforce and very large amounts of technological capacity. Qualified workforce and high technological capacity create significant capital requirements, forming entry

barriers. Access to distribution channels also creates a barrier for platform economies and blockchain technologies. iPhone and Android-based market structures or different platforms that create interfaces for blockchain services can restrict the entry of new projects and their ability to meet users. As previously mentioned, platform technology and blockchain technology laws are newly developing and vary from country to country. Legal regulations in a particular country can create barriers for new entrants. Projects that pioneer Platform Economies and the use of Blockchain Technology have achieved significant brand power worldwide, and this brand power attracts potential customers like a magnet. For example, Ethereum, the creator of smart contracts, hosts the largest number of projects. The strategy for projects entering the market could be to collaborate with existing platforms in the market and evaluate technology with innovative approaches.

The threat of new entrants is a crucial factor affecting industry dynamics and competitive strategies. Understanding entry barriers and effectively implementing strategies to strengthen them can enable established firms to protect their market positions and maintain long-term profitability. While new entrants can encourage innovation and competition, established companies must continuously assess and respond to this threat to protect their competitive advantages (Evans, 2008: 5).

1.3.2.2. The Threat of Substitute Products and Services

As previously mentioned, the threat of substitute products or services represents a critical element in Michael Porter's Five Forces model and demonstrates the competitive pressure exerted by alternative solutions offered to consumers. This force emphasizes the risk that customers may switch to substitutes in response to price increases, quality changes, or the availability of newer, more innovative products. Substitutes limit the industry's potential returns by placing a ceiling on the prices firms can charge, directly affecting profitability. Substitute products or services meet the same or similar needs for customers but originate from outside the sector. The presence of close substitutes can significantly affect customer loyalty and pricing power within an industry (Adelakun, 2020: 3).

For example, the threat posed by ride-sharing applications like Uber or Lyft to traditional taxis demonstrates how technological innovation can create powerful substitutes that transform industries. The key criterion for determining the threat of substitutes is customers' tendency to switch based on factors such as price, performance, effort, or cost.

The price-performance relationship of the service offered by players entering the blockchain smart contracts field will determine their success. The cost and ease of switching from one platform to another will again increase or decrease the substitute's chances of success. The level of perceived product and service differentiation is the reference point for whether substitutes are considered substitutes.

The threat of substitute products or services is a significant force that can constrain profitability and influence strategic decision-making (Maresova, 2014: 136). By understanding the factors that increase the attractiveness of substitutes and implementing strategies to reduce this threat, companies can better position themselves to retain customers and maintain competitive advantage. Adapting to changing consumer preferences, investing in differentiation, and developing customer loyalty are critical steps in overcoming the challenges created by substitute products or services.

1.3.2.3. Bargaining Power of Suppliers

The bargaining power of suppliers is one of the five forces in Michael Porter's effective model for analyzing an industry's competitive environment. This force examines the extent to which suppliers can influence the terms and conditions of their goods and services, potentially affecting the profitability and strategic options of businesses dependent on them. High supplier power can constrain firms' ability to compete, as suppliers can demand higher prices, limit the quality or availability of products, or transfer costs to industry participants (Baburaj et al., 2016: 3).

The bargaining power of suppliers can be considered as hardware technology providers and validators (miners) in the context of platform economies and blockchain. Hardware technology consists of elements such as computer chips and memory units, and constraints in these areas give suppliers bargaining power. Similarly, a contraction in the number of validators would increase the power of validators who can be considered suppliers. Moreover, this situation poses a threat to decentralization and distributed architecture, which are the main features of blockchain technology. The difficulty and cost of leaving pioneering platforms in the blockchain field and switching to new platforms gives suppliers bargaining power.

The bargaining power of suppliers is a critical component of Porter's Five Forces model and explains the impact suppliers can have on industries' competitive environment and profitability. By understanding the factors that contribute to supplier power, companies can develop strategies to reduce their effects. Diversification, vertical integration, strategic partnerships, and

developing strong supplier relationships are vital tactics in managing supplier power (Mugo, 2020: 33).

1.3.2.4. Bargaining Power of Suppliers

The bargaining power of buyers is one of the five forces in Michael Porter's model for analyzing competition within an industry. The concept of buyer power is based on the premise that customers can influence market conditions and business strategies through their purchasing choices (Safari et al., 2016: 74). When buyers possess significant power, they can demand lower prices, higher quality products, and more favorable service conditions, which can directly affect the profitability and competitive positions of firms within the industry. This dynamic is particularly prevalent in markets where products are undifferentiated or alternative suppliers can be easily found.

In platform economies and in the context of blockchain technology, several factors determine the bargaining power of buyers. What determines buyer power in platform economies is not so much the presence of many buyers, but rather the presence of many sellers. This is because buyers gain the opportunity to choose from numerous suppliers. The unique structures of platforms using blockchain technology allowing for differentiation limits buyers' power. Since differentiated suppliers do not offer standard products and services, buyers lose the power to switch suppliers. A common feature of platform economies and blockchain platforms is that transparency is a characteristic feature of platforms using these technologies. Due to transparency, buyers who can easily access information can choose the most suitable platform and technology for themselves. When sellers view buyers as partners rather than competitors and move toward collaboration, this eliminates the power of both buyers and suppliers and leads to effective use of resources.

The bargaining power of buyers is a crucial element in Porter's Five Forces analysis and significantly affects the competitive environment and strategic decisions within an industry (Cafferky, 2005: 20). Understanding the factors that increase buyer power and implementing effective strategies to manage this power can help companies maintain competitive advantage, ensure profitability, and promote sustainable business growth.

1.3.2.5. Competitive Rivalry

Competitive rivalry (Khurram, 2020: 2) forms a central force in Michael Porter's Five Forces model and defines the degree of competition among existing firms within an industry. This force not only shapes the competitive environment but also significantly affects the overall profitability and strategic

direction of the firms involved. High levels of competition can lead to aggressive product pricing, increased marketing efforts, product innovations, and enhanced customer services. All of these can reduce profit margins and increase operational costs.

The number of blockchain smart contract platform providers, the industry's growth rate, the level of differentiation, transaction and speed capacity determine the intensity of competition in this field. Typically, strategies to cope with competition include differentiation, innovation, market segmentation or choosing niche markets, establishing strategic alliances, and using cost-reducing methods.

Firms that effectively assess the competitive environment and implement strategies to differentiate themselves, innovate, and serve their customers can survive and thrive even in industries with intense competition levels (Isabelle, 2020: 28). Strategic positioning and operational efficiency are key to coping with the challenges brought by intense competition to ensure long-term sustainability and growth.

Methodology: Selecting and Sourcing Blockchain Platforms

A strategic and systematic approach has been adopted in the selection of platforms in this research. The primary factor guiding platform selection is market capitalization, which is a widely accepted measure of a platform's economic value and market performance. This measure reflects the market's confidence in a particular blockchain project and investors' assessment of a platform's potential growth and stability.

2.1. Data Sources

Data obtained from platforms' official websites and publicly available financial records are meticulously compiled to provide empirical evidence of each platform's economic performance. Particularly, market capitalization data is of critical importance because this data reflects the collectively assessed value of the platform by market participants and demonstrates the platform's perceived success and growth potential.

The formula for calculating market capitalization is as follows (Carta Team, 2023):

Market Capitalization = Current Share (or Coin) Price × Total Number of Shares (or Coins) in Circulation

In the context of a publicly traded company, this means multiplying the current share price by the total number of shares in circulation. For cryptocurrencies, this involves multiplying the current price of the cryptocurrency by the total circulating supply of that cryptocurrency. This calculation provides a total value representing the company's or cryptocurrency's total market value.

Cryptocurrency exchanges are valuable sources for market capitalization data of specific cryptocurrencies. These platforms provide current price information for various cryptocurrencies. As stated above, market capitalization is calculated by multiplying a cryptocurrency's current price by its circulating supply.

For this research, it is critical to select a cryptocurrency exchange platform that stands out as the most reliable, legitimate, and trustworthy among available options. Below is a comparison of popular cryptocurrency exchange platforms. First, information is provided about Coinbase, the cryptocurrency exchange that will be used as the basis for this research.

- **Coinbase:** A highly popular and successful cryptocurrency exchange based in the US and listed on Nasdaq, Coinbase offers a user-friendly interface and secure trading experience. With a strong security record, Coinbase has not experienced a major hack incident and implements measures to prevent users from sending cryptocurrency to known fraudulent addresses. For US-resident users, fiat deposits, in other words money that has not yet been converted to cryptocurrency, are insured up to \$250,000 under FDIC-Federal Deposit Insurance Corporation insurance. However, there is no FDIC guarantee after money is converted to crypto (Coinbase Help, 2024). While Coinbase supports over 200 cryptocurrencies, it does not include Tether; instead, it offers USDC, a stablecoin pegged to USD. Nasdaq (National Association of Securities Dealers Automated Quotations) is a global electronic marketplace for securities trading and also serves as a benchmark index for US technology stocks. Known for its high-technology and internet-based companies, Nasdaq is one of the world's largest exchanges, often associated with innovation and growth in the technology sector (Tretina, 2021).
- **Nasdaq listing is important for Coinbase for the following reason:** Being listed on a major exchange like Nasdaq is considered a sign of corporate maturity, stability, and compliance with regulatory standards. This has elevated Coinbase's reputation in the financial world. Coinbase is the only cryptocurrency exchange listed on Wall Street/New York-based Nasdaq as of February 2024 when this book was written.
- **Binance.US:** This platform is the US-specific version of the globally recognized Binance exchange. Designed to meet US regulatory requirements, Binance.US offers a familiar interface for experienced investors but provides a more limited cryptocurrency selection compared to its global counterpart. Binance.US is not permitted to operate in every state (Ullrich, 2023).

- **Crypto.com:** This Hong Kong-based exchange is known for crypto and NFT trading, offering additional benefits such as interest rewards on certain cryptocurrencies and cashback rewards on debit card usage. The fee structure varies depending on trading volume. However, it is not accessible in New York (Adams, 2024).
- **Gemini:** A US-based exchange established in compliance with New York state laws, Gemini is known for high security and regulatory compliance, making it a reliable choice for large-scale and institutional investors. It insures all USD deposits and supports over 90 cryptocurrencies. The trading fee structure is advantageous for higher volume transactions (Frankenfield, 2023).
- **Kraken:** Kraken is a San Francisco-based cryptocurrency exchange that allows users to buy and sell various cryptocurrencies. It supports trading with multiple fiat currencies, including US dollars, Canadian dollars, euros, and Japanese yen. As of January 15, 2023, Kraken ranks as the world's third-largest cryptocurrency exchange with a daily trading volume of \$333 million. The platform provides trading opportunities for over 200 cryptocurrencies and more than 600 cryptocurrency pairs (Seth, 2023).

2.2.1. Coinbase

Based on the comparison above, Coinbase will serve as the primary source for obtaining numerical market valuation data of blockchain platforms. As a blockchain marketplace, Coinbase is known for its strict listing criteria and filters the most stable and reliable blockchain platforms to offer them to investors on its market (exchange).

Coinbase holds the distinction of being the first exchange company in the cryptocurrency sector in the United States to go public on the Nasdaq Exchange in 2021 (Beltran, 2021). This milestone is a significant measure of its compliance with federal regulations. It also demonstrates that it has gained the trust and reputation of American federal institutions. Coinbase is a widely recognized cryptocurrency exchange that provides a platform for digital currency trading, transfer, and storage. Founded in San Francisco, California in 2012, Coinbase has become one of the most prominent and trusted platforms in the cryptocurrency field. Its legitimacy and reputation are based on several factors:

Regulatory Compliance: Coinbase operates in compliance with various financial services and consumer protection laws and is one of the few cryptocurrency exchanges registered as a Money Services Business with

FinCEN in the US (coinbase, 2024). It complies with various regulatory requirements including Anti-Money Laundering (AML) and Know Your Customer (KYC) protocols (coinbase, 2023).

Security Measures: Coinbase is known for its robust security practices, storing 98% of customer funds in offline cold storage, providing protection against theft or loss risks. It also offers additional security features such as two-factor authentication (2FA) for user accounts.

Insurance Protection: As previously mentioned, Coinbase provides Federal Deposit Insurance Corporation (FDIC) insurance coverage for amounts up to \$250,000 of non-cryptocurrency funds held by the company on behalf of customers, adding an additional layer of security for users' funds.

Public Company: In April 2021, Coinbase became a public company on the Nasdaq Exchange, an important milestone that contributed to its reputation (La Monica, 2021). Being a public company means it is subject to strict financial reporting and transparency requirements.

Despite all these strengths of Coinbase, as with every platform dealing with digital currencies, there are inherent risks associated with cryptocurrency trading and holding. However, Coinbase's commitment to regulatory standards, strong security measures, and transparent business practices have strengthened its position as a legitimate and reliable institution in the cryptocurrency exchange field. Since the blockchain and cryptocurrency field has witnessed various frauds as stated in previous sections, using an exchange recognized by public institutions as a source is, in a sense, a matter of reliability for a scientific study. For these reasons, the study will be based on Coinbase data to ensure accuracy in case selection.

2.2.2. The Significance of Being Listed on Coinbase

Being listed on Coinbase represents a high-quality standard for a blockchain project. Therefore, even the least successful projects on the platform meet certain success criteria. In other words, even the least successful project mentioned in this study based on Coinbase represents projects with superior qualities and technology, founders and managers who are top-level engineers in the blockchain project universe. If sports are used as a metaphor, even the lowest-ranked project on Coinbase is an "NBA" team.

This examination previously indicated that the five blockchain projects with the highest market capitalization and the five blockchain platforms with the lowest market capitalization would be analyzed. The reason for using

these less successful projects as a comparative group is to separately identify success factors.

The common characteristics of these 10 platforms enabled their listing on Coinbase. Therefore, focusing solely on the attributes of the top five projects without comparison would produce misleading results, as many of these attributes are also found in the five projects at the bottom of the ranking.

This methodology will help distinguish the fundamental success factors that differentiate projects from each other, rather than the basic, standard criteria necessary for any legitimate blockchain project.

Relying specifically on market capitalization as a selection criterion is proportional to the objectivity and measurability of this figure. Market capitalization offers a transparent and reproducible selection method.

Coinbase divides blockchain projects into four main groups: Decentralized Finance (DeFi), Smart Contracts, Currencies, and Stablecoins (Coinbase Categories, 2024). Each of these categories represents a different aspect or use case of blockchain technology.

2.2.2.1. Smart Contracts

- Smart Contract Platforms are blockchain networks that act as a foundation where developers can build and implement decentralized applications (dApps) through smart contracts. These platforms provide the necessary infrastructure, programming language, execution environment, and consensus mechanism that facilitate the development of a wide range of applications capable of operating autonomously and securely without the need for a central authority (Coinbase Smart Contracts, 2024).
- Platforms such as Ethereum that enable the creation and execution of smart contracts fall into this category. These projects offer developers the opportunity to create decentralized applications (dApps) for various purposes beyond merely financial transactions.

2.2.2.2. Decentralized Finance (defi):

- Decentralized Finance (DeFi) refers to financial services that typically operate on a decentralized network running on a blockchain. Unlike traditional finance, decentralized finance (DeFi) does not require reliance on central financial intermediaries such as banks, brokers, or exchanges. Instead, it uses smart contracts on blockchains (Coinbase DeFi, 2024).

- Projects in this category may include decentralized lending platforms, yield farming protocols, decentralized exchanges (DEXs), and other financial applications where users can borrow, lend, or trade assets in a decentralized manner.

2.2.2.3. Currencies:

- This category primarily includes digital, or cryptocurrencies designed to be used as a medium of exchange. These are digital equivalents of money designed for transactions and purchases (Coinbase Currencies, 2024).
- Bitcoin, often referred to as “digital gold,” is the most prominent example. Other digital currencies designed for transactions, such as Litecoin or Bitcoin Cash, can also be given as examples in this category.

2.2.2.4. Stablecoins:

- Stablecoins are a type of cryptocurrency designed to have a stable value, as opposed to the significant price fluctuations seen in other cryptocurrencies. They typically achieve this stability by being pegged to a reserve asset such as the US dollar or gold (Coinbase Stablecoins, 2024).
- Tether (USDT) and USD Coin (USDC) are common stablecoin examples. These are frequently used to facilitate trading and serve as a stable store of value in the crypto ecosystem, particularly for traders and investors who want to avoid the volatility of other cryptocurrencies.

This book will focus solely on Smart Contract Platforms from the categories above.

2.2.3. Platform Examination Pool

Coinbase lists a total of 35 projects in the Smart Contracts category. For the purposes of this research, the examination scope has been narrowed to projects that are at least 3 years old or older. This criterion is used to ensure that the selected platforms have sufficient historical data records for analysis. Given that blockchain technology is still nascent, a 3-year timeframe is considered significant for observing and evaluating the growth and development of these platforms. All selected platforms were listed on Coinbase in 2020 or earlier years. It should be noted that a project that began trading on Coinbase in

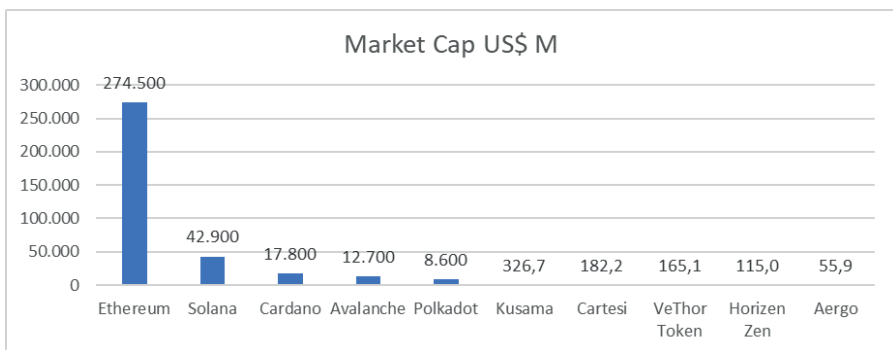
2020 does not mean it started in 2020; the project may have started much earlier and entered the Coinbase market in 2020.

Table 4. Coinbase Launch Dates for Selected High and Low Market Capitalization Platforms

Blockchain Platform	Listing Date on Coinbase
Ethereum	January 2016
Solana	June 2020
Cardano	January 2018
Avalanche	September 2020
Polkadot	October 2020
Kusama	January 2020
Cartesi	June 2020
VeThor Token	November 2018
Horizen (ZEN)	September 2017
Aergo	April 2019

Source: Coinbase.com, January 31, 2024, 1:15 PM

Table 4 lists the ventures in the case study pool, ranked according to their market capitalizations as of January 31, 2024. The platforms listed in the Table 4 represent the smart contract platforms with the highest and lowest market capitalizations on the Coinbase platform.



Graphic 1. Top and Bottom Five Platforms by Market Capitalization

Source: Coinbase.com, January 31, 2024, 1:15 PM

The columns for the platforms with the lowest market capitalizations shown in Table 4 are not visible in Graphic 1. The market capitalizations of the first five platforms are so high that the \$55 million platform value becomes too small to be displayed on the graph compared to the smallest market capitalization of \$326 million. However, even the smallest market capitalization platform has reached a market value of \$55 million in as short a period as five years, which can be considered a significant success for these projects that started with only software capital.

2.2.4. Project and Platform Terminology

The ventures examined within the scope of this book do not fit the classic company definition. They lack traditional shareholding structures and corporate governance. Therefore, how these ventures should be designated is also a matter requiring decision.

The term “project” is used in the blockchain field when referring to open-source initiatives, community-focused developments, or specific aspects of a broader ecosystem (for example, a new protocol improvement or a decentralized application built on a blockchain platform). All the ventures examined in this book began as projects.

In the blockchain context, a platform refers to a fundamental technology or framework that enables the development and operation of applications, smart contracts, and other blockchain-based projects. Platforms in blockchain provide the necessary infrastructure and tools for developers and users to interact with the blockchain ecosystem.

Therefore, it would be more accurate to refer to the ventures examined in this book as platforms. However, these platforms are simultaneously projects that undergo continuous change and evolution.

When referring to these ventures within this book, the term “platform” will primarily be used, with the term “project” also being utilized where needed.

Platform Cases Using Smart Contracts

Below are listed cases that use blockchain technology and smart contracts. Each case has been examined under the same subheadings to enable comparison. First, the platform subject to the case is introduced, its business model is summarized, and then market analysis is conducted. Since these cases are technology platforms, one of the most important sections in this examination is how these platforms use blockchain technology. In one of the subheadings, how the platforms subject to the cases use blockchain technology is examined. Subsequently, how each platform generates competitive value is addressed. In this manner, the five projects with the highest market capitalization and the five projects with the lowest market capitalization registered on Coinbase and categorized under smart contracts have been examined as cases.

3.1. Project Overview: Ethereum (ETH)

Feature	Description
Name	Ethereum
Year Listed on Coinbase	2015
Consensus Mechanism	Proof of Stake (PoS) with Stake-Based Validation
Block Processing Time	Approximately 15 seconds
Transactions per Second (TPS)	4,000 TPS
Programming Language	Solidity
Interoperability	Limited
Token Name	ETH
Founders	Vitalik Buterin, Anthony Di Iorio, Charles Hoskinson, Mihai Alisie, and Amir Chetrit
Positioning	Pioneer of smart contracts and large-scale blockchain solutions
Target Audience	All potential users within the blockchain ecosystem, from developers to enterprise users

3.1.1. Platform Description

The Ethereum examination was prepared based on the platform's official website and the case's official White Paper. While collecting case information, speculative information from various websites and sources that mention the case project was avoided, and only information obtained from reliable and official sources of the platform subject to the case was used (Ethereum home page, 2014) (Ethereum White Paper, 2013).

Ethereum is a decentralized, open source blockchain system with smart contract functionality, launched in 2015 by a team consisting of Vitalik Buterin and other founding partners. It is the second-largest cryptocurrency platform by market capitalization after Bitcoin (Coinbase Ethereum, 2024). Ethereum's innovation lies in its platform that enables developers to build and deploy a wide range of applications from cryptocurrencies to complex decentralized finance (DeFi) protocols and smart contracts.

Ethereum's most fundamental feature that distinguishes it from other blockchain platforms is that when it was established, it aimed to free the internet from large corporations that monopolize it and create a free infrastructure where anyone can develop the applications they want. The unique vision of Ethereum's founder, Vitalik Buterin, who was 19 years old in 2023, moved beyond being a young person's dream to become reality, introducing the concept of smart contracts and the Ethereum platform to the world (Abra, N.D.).

Ethereum's business model is non-traditional; it operates as a decentralized platform that facilitates peer-to-peer transactions and agreements through smart contracts without requiring central authorities or intermediaries. Its main product is the Ethereum blockchain itself, which provides a platform for decentralized applications (dApps) and smart contracts. The platform's native cryptocurrency, Ether (ETH), is used to pay participating nodes for computations performed and to pay for transaction fees and services on the network (Kraken Ethereum, 2024).

Ethereum's governance is decentralized and community driven. Major decisions regarding protocol upgrades and changes are made through a combination of core developer discussions, Ethereum Improvement Proposals (EIPs), and community consensus (Ethereum Improvement Proposal, 2024).

The Ethereum Foundation, as a non-profit organization, plays an important role in financing and supporting Ethereum's research and development efforts.

The Ethereum community, consisting of developers, miners, and users, plays a critical role in the platform's development, decision-making processes, and

innovations. Community members contribute by participating in Ethereum events, developing decentralized application (dApps) projects, participating in network security through mining, and proposing Ethereum Improvement Proposals (EIPs) to introduce new features or improvements to the Ethereum protocol. Additionally, developers can find funding for their own projects under the Ethereum umbrella (Ethereum Community, 2024).

3.1.2. Market Analysis

Ethereum operates within the rapidly evolving blockchain and cryptocurrency market, competing with other blockchain platforms that offer smart contract capabilities such as Avalanche, Polkadot, Solana, and Cardano (Ethereum Competitors, 2024). Despite the competition, Ethereum maintains its leadership position in this field, particularly in the Decentralized Finance (DeFi) and Non-Fungible Token (NFT) sectors, thanks to its first-mover advantage and strong developer community.

Ethereum holds a significant market share in the blockchain field, possessing the largest number of decentralized applications (dApps) and an extensive developer community (Cointurk News, 2024). Its user base continues to grow with the expanding Decentralized Finance (DeFi) sector, the popularity of non-fungible tokens (NFTs), and increasing corporate interest in blockchain technology. Ethereum's transition to Ethereum 2.0, which changed its consensus system to provide energy efficiency and scalability, will accelerate its growth.

3.1.3. Technological Framework

Ethereum is a cryptocurrency and blockchain platform that provides a decentralized, global computer where developers can create decentralized applications (dApps) and unique crypto tokens. First introduced in a white paper published in 2013 by software developer Vitalik Buterin, Ethereum is a decentralized virtual machine equipped with a programming language that allows developers to create and run smart contracts. Smart contracts are computer programs that can automatically facilitate, verify, or enforce the terms of an agreement between human or computer counterparts. The Ethereum network rewards distributed computational power spent on a smart contract with ether, the platform's currency.

Ethereum Virtual Machine (EVM): Functions as a decentralized computer that executes smart contracts. Through the infrastructure it provides, it also serves other blockchain projects (Ethereum Virtual Machine, 2024).

As a Consensus Mechanism, Ethereum transitioned from Proof of Work (PoW) to Proof of Stake (PoS) with Ethereum 2.0, increasing energy efficiency and scalability (Ethereum PoS, 2024).

3.1.4. Value-Adding Factors

Ethereum's value proposition lies in its ability to provide a secure, decentralized platform capable of executing smart contracts at scale and creating decentralized applications (dApps). This enables developers, businesses, and individuals to create and use applications that offer transparency, security, and less dependency on intermediaries. Below is a summary of Ethereum's value proposition (Coinmarketcap Ethereum, 2024).

- **Smart Contracts and Decentralized Applications (dApps):** Ethereum enables the creation of applications that operate autonomously on the blockchain, reducing risks of censorship, interruption, and fraud.
- **Decentralization and Security:** By reducing dependency on centralized entities, it offers a secure, decentralized platform that potentially reduces data breaches and central control.
- **Ecosystem and Network Effects:** It benefits from a broad ecosystem of developers, users, and businesses, with innovation opportunities increasing as more participants join.
- **Flexibility and Integration:** It supports a wide range of projects and standards that encourage innovation among tokens, Decentralized Finance (DeFi) applications, and more.

Ethereum creates value through innovative use of blockchain technology, providing a new paradigm for decentralized applications and finance. Revenue streams include transaction fees (gas fees) that users pay to execute smart contracts and decentralized applications (dApps). The platform's value is also enhanced by its vibrant ecosystem that includes a wide range of services and applications built on the Ethereum blockchain (Northcrypto, 2024).

3.1.5. Challenges and Opportunities

Ethereum's advantages such as smart contracts, decentralization, and a vibrant ecosystem have laid the foundation for innovation across various industries. However, despite its numerous strengths, Ethereum faces challenges regarding scalability (transaction speed and costs) and environmental impact, requiring focused efforts to overcome these challenges (Roberts, 2024).

The development of Ethereum 2.0, based on the Proof of Stake method, presents significant opportunities for the platform, including improved

scalability, reduced environmental impact, and enhanced security. Additionally, growing interest in Decentralized Finance (DeFi), non-fungible tokens (NFTs), and blockchain technology in general offers new opportunities for innovation and adoption. With its strong community and developer base, Ethereum is well-positioned to capitalize on these opportunities and maintain its leadership in the blockchain field (Güven, 2024).

3.2. Project Overview: Solana (SOL)

Feature	Description
Name	Solana
Year Listed on Coinbase	2020
Consensus Mechanism	Proof of History (PoH) combined with Proof of Stake (PoS)
Block Processing Time	0.4 seconds
Transactions per Second (TPS)	65,000 TPS
Programming Language	Rust
Interoperability	Yes
Token Name	SOL
Founders	Anatoly Yakovenko and Raj Gokal
Positioning	Speed and scalability; large-scale blockchain infrastructure
Target Audience	All potential users within the blockchain ecosystem, from individual developers to enterprise-scale applications

3.2.1. Platform Description

This examination of Solana was prepared based on the platform's official website and the case's official White Paper. While collecting case information, speculative information from various websites and sources that mention the case project was avoided, and only information obtained from reliable and official sources of the platform subject to the case was used (Solana, www.solana.com, 2024; Solana White Paper, 2020).

Solana is a high-performance blockchain platform founded by Anatoly Yakovenko in 2017. It is designed to support decentralized applications (dApps) and cryptocurrencies through its unique consensus mechanism, which combines Proof of History (PoH) with Proof of Stake (PoS) (Solana, www.solana.com, 2024).

Solana has emerged as a standout in the blockchain field with its high transaction capacity and low transaction costs, positioning itself as one of the fastest blockchains currently available. The platform aims to solve the scalability problems faced by other blockchains while maintaining decentralization and security features.

Solana's business model is built around providing fast, secure, and scalable blockchain infrastructure to developers and companies looking to create decentralized applications (dApps) or implement smart contracts. Its main product is the Solana blockchain itself, with its native cryptocurrency SOL used for transaction fees and staking. The platform addresses a wide range of users and developers by offering various services including Decentralized Finance (DeFi) applications, non-fungible tokens (NFTs), and decentralized exchanges (DEXs) (Alchemy, 2023).

Solana's governance has a less decentralized structure compared to platforms like Ethereum, with the Solana Foundation (<https://solana.org>) (Solana Foundation, 2024) and Solana Labs (<https://solanalabs.com>) (Solana Labs., 2024) playing important roles in its development and strategic direction. However, the community still plays a critical role in network security and decision-making processes through validator participation. Community participation also extends to development, with many independent developers and teams building on Solana.

Community members, including developers, validators, and users, make significant contributions to the Solana ecosystem by developing new applications, participating in network consensus, and proposing improvements. This collaborative effort encourages innovation and growth within the platform (Ozturk, 2024).

3.2.2. Market Analysis

Solana operates in a highly competitive blockchain environment, competing head-to-head with other scalable blockchains such as Solana, Ethereum, Binance Smart Chain, and Cardano (Soriano, 2023a). Despite intense competition, Solana has successfully established a strong market presence, particularly in the Decentralized Finance (DeFi) and non-fungible token (NFT) sectors, due to its high transaction speeds and low fees. The rise of decentralized applications and the growing demand for scalable blockchain solutions have further supported Solana's growth.

Compared to its competitors, Solana's faster transaction processing speed and the attractive features it offers to developers and users have contributed to rapid growth in both market share and user base.

Among blockchains hosting more than 1,000 developers, Ethereum and Solana stand out. Solana has demonstrated the highest growth rate in its developer community, with an 83% increase. This growth is particularly noteworthy given that, as recently as 2021, Solana was classified as a mid-sized ecosystem with fewer than 1,000 developers (Chain DeBrief, 2023).

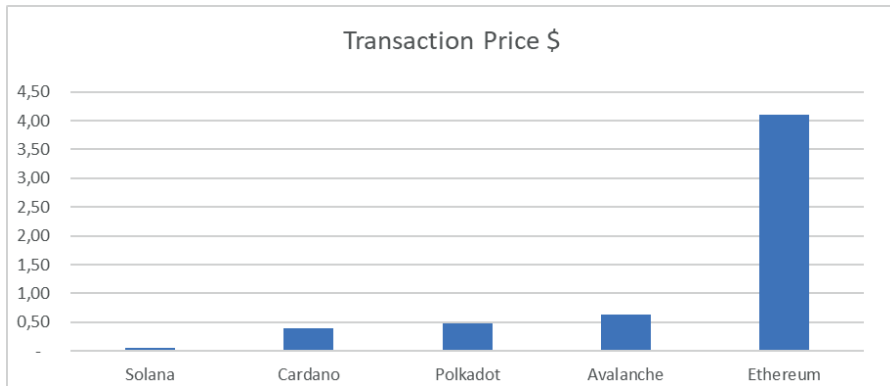
As the blockchain and cryptocurrency sectors continue to evolve and expand, they present significant potential for further market growth. The continuous development of Solana's ecosystem, along with its partnerships with various companies and projects, has contributed to its increasing prominence and relevance in the market.

3.2.3. Technological Framework

Solana's Technological Framework has an innovative feature. It uses Proof of History (PoH) to create a historical record that proves the occurrence of an event in time, thereby increasing the efficiency of the consensus mechanism (Notomoro, 2024). This is combined with Proof of Stake (PoS) for network security, resulting in a high-performance blockchain capable of processing thousands of transactions per second. Thanks to this innovative combination, the network has managed to maintain its secure and decentralized structure while executing transactions very quickly. Solana's native token SOL has assumed many roles within the ecosystem. For example, transaction fees are paid with SOL.

Solana's appeal stems from the high-scale transaction volume and low fees it offers when developers want to build scalable decentralized applications (dApps).

Graphic 2 lists the transaction prices of the five ventures with the highest market capitalization. As can be seen, Solana is the project with the lowest transaction price in this group, and it can be considered that Solana has taken second place in the smart contracts market due to its high transaction speed, scalability, and low transaction price. In the same list, although Ethereum, the leading player in the smart contracts field, has the highest transaction price, it maintains its first-mover advantage. Transaction prices are calculated with a special formula for each blockchain project. Additionally, since each platform's native token is priced according to exchange movements, transaction costs are constantly changing.



Graphic 2. Transaction Price Comparison of Blockchain Platforms

Source: Solana Daily, 2021, retrieved from Solana's official Twitter account on January 27, 2024, https://twitter.com/solana_daily/status/1442474189525434370/photo/1

Unlike other blockchain networks that struggle with congestion and high transaction costs during peak times, Solana has the capacity to process tens of thousands of transactions per second without compromising cost or performance. This capability positions Solana as a competitive blockchain platform for a wide range of applications from decentralized finance (DeFi) projects to non-fungible tokens (NFTs) and beyond.

The main advantages of Solana's architecture are its scalability, speed, and low transaction costs. However, these come with challenges such as centralization concerns due to high hardware requirements for validators and network outages, which could potentially limit the number of participants who can afford to run a node.

3.2.4. Value-Adding Factors

Solana offers an attractive value proposition with its ability to process high transaction volumes at low cost, making Solana an appealing platform for developing and deploying decentralized applications (dApps) and digital assets. Its infrastructure supports a wide range of applications from Decentralized Finance (DeFi) to non-fungible tokens (NFTs), appealing to a diverse user base (Kraken Solana, 2024):

- **High Transaction Capacity:** Solana has the capacity to process tens of thousands of transactions per second, making Solana faster compared to other blockchain platforms. This high transaction capacity is vital for applications requiring fast and scalable solutions.

- **Low Transaction Fees:** Despite its high performance, Solana offers extremely low transaction fees, maintaining cost-effectiveness for both developers and users. This affordability encourages more transactions and interactions within the ecosystem.
- **Fast Transaction Times:** Solana's innovative consensus mechanism, the combination of Proof of History (PoH) with Proof of Stake (PoS), enables fast block confirmation times and improves user experience.
- **To explain Solana's Proof of History (PoH) methodology in simple terms,** this method is a way of recording events over time on the blockchain. In traditional blockchains, all participants in the network need to agree on the order and timing of transactions, which can be time-consuming and limit scalability.

Solana creates value through innovative blockchain technology that enables fast and scalable applications. Revenue streams are derived from services offered on the platform and transaction fees. The ecosystem also incentivizes users and developers through staking rewards and grants for project development (Solana Grants, 2023).

3.2.5. Challenges and Opportunities

The main challenges faced by the platform are listed below:

- Network stability issues evidenced by past outages (Gilbert, 2023).
- Risk of centralization due to hardware requirements for miners-validators.
- Intense competition from other blockchain platforms.

The opportunities available to the platform are listed below:

- Realization of interest in the significant advantages Solana offers in Decentralized Finance Applications (DeFi) and non-fungible tokens (NFTs)
- Potential for widespread acceptance as a platform for high transaction volume applications.
- Continuous improvement and scaling of its infrastructure to support a broader range of applications and services.

Solana's innovative approach to blockchain scalability and efficiency, despite challenges common to rapidly growing platforms, positions it well to benefit from the expanding blockchain ecosystem. Its focus on performance and user

experience continues to attract developers and users, creating opportunities for future growth and innovations.

3.3. Project Overview: Cardano (ADA)

Feature	Description
Name	Cardano
Year Listed on Coinbase	2017
Consensus Mechanism	Ouroboros – Proof of Stake (PoS), a scientifically designed stake validation protocol
Block Processing Time	Approximately 20 seconds
Transactions per Second (TPS)	1,000 TPS
Programming Language	Haskell
Interoperability	Yes
Token Name	ADA
Founder	Charles Hoskinson
Positioning	Scientifically researched blockchain platform offering large-scale, peer-reviewed solutions
Target Audience	All potential users in the blockchain market, from developers to institutional users

3.3.1. Platform Description

The Cardano analysis has been prepared based on the platform's official website and official White Paper. While collecting case information, speculative data from various websites and sources referring to the case project were avoided, and only information obtained from the reliable and official sources of the platform under study was used (<https://www.Cardano.org>, 2020) (Cardano White Paper, 2020).

Cardano aims to be a blockchain platform equipped with the necessary tools and technologies for changemakers, innovators, and visionaries who seek to create opportunities for many people and bring about positive global change. Founded in 2015 by Ethereum co-founder Charles Hoskinson, Cardano is being developed by the Input Output Hong Kong (IOHK) (Input Output HK, 2024) team. Cardano is supported by three main organizations: IOHK, the Cardano Foundation (Cardano Foundation, 2024), and EMURGO (EMURGO, 2024).

EMURGO can be defined as the commercial arm of the Cardano blockchain. It serves as a bridge for businesses and developers who wish to expand the Cardano ecosystem and develop solutions using Cardano's blockchain technology. The main objective of EMURGO is to promote the adoption of Cardano and to provide businesses with technical, educational, and consulting services to support real-world applications of blockchain technology. The foundation of Cardano's development lies in an academic approach, which distinguishes it through its commitment to peer-reviewed scientific research. In addition to its academic foundation, like the previously mentioned three blockchain projects, Cardano targets high scalability, interoperability, and sustainability. The Cardano blockchain employs a unique proof-of-stake algorithm called Ouroboros to secure the network (Cardano Ouroboros, 2024).

Cardano's business model focuses on providing a more secure, transparent, and sustainable blockchain infrastructure for the development of decentralized applications (dApps), smart contracts, and private blockchain solutions. Its main product is the Cardano blockchain, which not only serves as a platform for the ADA cryptocurrency but also supports other financial and social applications. The platform's value proposition is built on robust security features, scalable architecture, and reduced energy consumption compared to proof-of-work blockchains (Messari Project Cardano, 2024).

Cardano's governance is designed to be highly democratic and participatory, allowing ADA token holders to engage in the decision-making process through a voting system (Cardano Governance, 2024). While the Cardano Foundation, IOHK, and EMURGO play key roles in the development and promotion of the platform, the true power lies within the community due to Cardano's democratic structure; the community guides the evolution and adoption of the platform. Community members play a key role in the Cardano ecosystem by participating in governance, contributing to the platform's development through proposals, and joining various innovation projects. This community-oriented approach ensures that Cardano remains aligned and responsive to the needs and interests of its users (Cardano Voltaire, 2024).

3.3.2. Market Analysis

Cardano operates within a highly competitive blockchain landscape alongside platforms such as Ethereum, Solana, Polkadot, and Binance Smart Chain (Helalabs Cardano Competitors, 2024). It differentiates itself through its scientific development approach and its focus on sustainability and interoperability. The global rise of Decentralized Finance (DeFi), non-fungible tokens (NFTs), and digital transformation presents both opportunities

for Cardano's growth and adoption, as well as challenges due to competitors moving in similar directions.

Although Cardano has a smaller market share compared to Ethereum, it continues to grow steadily through strong community support and ongoing development efforts. Its positioning as a science-based innovation platform contributes to its differentiation. Since its establishment, the introduction of smart contract functionality has opened new avenues for growth, offering the potential to capture a significant share of the decentralized applications (dApps) and Decentralized Finance (DeFi) markets. The presence of 1,315 projects within the Cardano ecosystem and the inclusion of some of the industry's largest DeFi and NFT platforms indicate that Cardano is poised for further expansion (Emurgo Cardano Projects, 2024).

3.3.3. Technological Framework

Cardano employs a layered blockchain architecture that separates the settlement layer, which handles transactions conducted with ADA, from the computation layer, which supports smart contracts and decentralized applications (dApps). This separation provides greater flexibility and scalability.

At the core of Cardano's approach is the Ouroboros proof-of-stake (PoS) algorithm, which offers a more energy-efficient alternative compared to proof-of-work (PoW) systems.

Cardano's architecture is uniquely designed around two primary layers: the Cardano Settlement Layer (CSL), which manages transactions involving ADA, and the Cardano Computation Layer (CCL), which facilitates smart contracts and applications (Cardano Computational Layer, 2024). This separation is intended to enhance system flexibility and scalability by allowing updates and modifications to the smart contract execution layer without disrupting the ledger layer. In addition, Cardano utilizes its internally developed Ouroboros Proof-of-Stake consensus mechanism, which is faster and more efficient than traditional Proof-of-Work models previously used by other blockchains in terms of both energy efficiency and security. Ouroboros divides time into epochs and slots, within which slot leaders are selected to validate transactions, significantly reducing the energy consumption associated with block production activities (Cardano Ouroboros, 2024).

The layered architecture and Proof-of-Stake consensus mechanism offer several advantages, including scalability, energy efficiency, and the ability to support complex transactions and smart contracts. However, these innovations also present challenges, such as the ongoing need for technological advancements to ensure security and performance at scale (Adams, 2023).

3.3.4. Value-Adding Factors

Cardano offers a sustainable, secure, and scalable blockchain platform that appeals to developers, businesses, and users seeking to build and deploy decentralized applications (dApps) and smart contracts. Its emphasis on scientific research and peer-reviewed clear future technological advancements.

- **Research-Oriented Approach:** Cardano stands out for its commitment to peer-reviewed research and a methodical development approach. This ensures that all modifications and upgrades are thoroughly examined before implementation, aiming for high reliability and scalability (Cardano Docs, 2024).

- **High Security:** Through its unique Ouroboros Proof of Stake (PoS) consensus mechanism, Cardano achieves high levels of security while being more energy-efficient than Proof of Work (PoW) systems, reducing the risk of attacks.

- **Sustainability:** Cardano focuses on long-term sustainability in terms of environmental impact and governance model. It aims to support a wide range of applications with a minimal carbon footprint.

- **Interoperability and Compliance:** Cardano is designed to be interoperable with other blockchains and existing systems, placing strong emphasis on regulatory compliance. This makes it particularly appealing to businesses and financial services (Cardano Docs Interoperability, 2024).

Cardano creates value through its distinctive blockchain development approach, which prioritizes sustainability and interoperability. It generates revenue through transaction fees, enterprise-grade service offerings, and partnerships. Additionally, the platform incentivizes user participation and stakeholder engagement through its staking model, which rewards ADA holders for their contributions to network security and governance.

3.3.5. Challenges and Opportunities

The main challenges faced by the platform are listed below:

- **Coping with rapid technological advancements and evolving user expectations.**

- **Expanding its ecosystem to include a broader range of decentralized applications (dApps) and services.**

- **Competing with blockchain platforms of similar scale and speed within the same class (Newberry, 2021).**

The opportunities available to the platform are listed below:

- Leveraging its scientific approach and emphasis on sustainability to attract environmentally conscious stakeholders.
- Capitalizing on the growing interest in blockchain technology for Decentralized Finance (DeFi), non-fungible tokens (NFTs), and broader social and financial inclusion.
- Continuing to innovate in blockchain scalability, interoperability, and security to maintain its competitive advantage.

Cardano's strategic focus on research-based development and its commitment to creating a more sustainable and scalable blockchain platform position it well to address the evolving needs of the digital economy and the broader society. Its ability to balance innovation with sustainability makes Cardano an appealing choice for developers, businesses, and users dedicated to fostering positive global change through blockchain technology.

3.4. Project Overview: Avalanche (AVAX)

Feature	Description
Name	Avalanche
Year Listed on Coinbase	2020
Consensus Mechanism	Avalanche Consensus Protocol, incorporating elements of Proof of Stake (PoS) and Proof of Work (PoW)
Block Processing Time	1.5 seconds
Transactions per Second (TPS)	4,500 TPS
Programming Languages	Solidity, Go, and others
Interoperability	Yes
Token Name	AVAX
Founder	Emin Gün Sirer
Positioning	High-speed blockchain with rapid finality and scalability for large-scale applications
Target Audience	All potential customers across the blockchain ecosystem, from individual users to institutional enterprises

3.4.1. Platform Description

The Avalanche analysis has been prepared based on the platform's official website and official White Paper. While collecting case information, speculative data from various websites and sources referring to the case project were

avoided, and only information obtained from the reliable and official sources of the platform under study was used (Avax Network Community, 2024) (Cardano White Paper, 2020).

Avalanche is a highly scalable, open-source platform for launching decentralized finance (DeFi) applications, financial assets, trading systems, and other services. Created by the company Ava Labs, founded in 2018 by Cornell University Professor Emin Gün Sirer, Avalanche distinguishes itself through a unique consensus mechanism that offers high transaction throughput, low latency, and a more energy-efficient approach compared to traditional proof-of-work (PoW) blockchains (Avalanche Consensus, 2024).

Avalanche's business model is based on providing a robust infrastructure for Decentralized Finance (DeFi) applications, enterprise blockchain solutions, and digital asset trading. Its core offerings include the Avalanche network, which supports a wide range of blockchain applications-both private and public-and its native token, AVAX, which is used for transaction fees, network security, and participation in the consensus mechanism. The platform's value proposition lies in its ability to combine scalability, security, and decentralization, making Avalanche an attractive choice for developers and businesses alike (Kraken Avalanche, 2024).

Avalanche has adopted a unique governance model that involves AVAX token holders in decision-making processes such as network upgrades and resource allocation. The platform encourages active participation from its entire community, including developers, validators, and users who contribute to the ecosystem's growth and innovation. This approach fosters a dynamic and interactive community that supports the platform's continuous evolution (Avalanche Ecosystem, 2024).

Community members play a critical role in Avalanche's development by proposing improvements, participating in the validation process, and building applications on the platform (Github Avalanche, 2024). Their participation is essential for identifying network needs, testing new features, and ensuring that the platform remains a leading force in the blockchain space.

3.4.2. Market Analysis

Avalanche operates in the rapidly evolving fields of Decentralized Finance (DeFi), smart contracts, and blockchain technology, competing with other scalable platforms such as Ethereum, Solana, Polkadot, BNB Chain, and Cardano (Alchemy Avalanche Alternatives, 2024). Avalanche holds a competitive advantage through its unique consensus mechanism and its ability to balance scalability, security, and decentralization. The growing demand for

Decentralized Finance (DeFi) applications and services (Emergen Research, 2023) presents significant opportunities for Avalanche's expansion.

By rapidly establishing a presence within the blockchain community, Avalanche has built a substantial user base and an expanding ecosystem of decentralized applications (dApps). Although it is relatively new compared to established platforms such as Ethereum, its innovative technology and strong focus on Decentralized Finance (DeFi) give it considerable growth potential, especially as it continues to attract developers and projects (Avalanche DeFi, 2024).

3.4.3. Technological Framework

Avalanche employs an innovative approach to blockchain technology through its consensus mechanism, which significantly reduces transaction confirmation time and provides a higher degree of scalability. This mechanism also enables the creation of multiple specialized blockchains-known as subnets-that support a wide range of use cases.

Avalanche's architecture is revolutionary, featuring a design that divides the platform into three distinct but interoperable chains: the Exchange Chain (X-Chain), the Platform Chain (P-Chain), and the Contract Chain (C-Chain) (Avalanche Chains, 2024). This three-chain design allows Avalanche to achieve exceptional scalability and versatility. The X-Chain is dedicated to the creation and trading of digital assets, the P-Chain coordinates validators and subnet creation, and the C-Chain is optimized for building and executing smart contracts (Avalanche P-C-X Chains, 2022).

This tri-layer structure enables developers to build scalable and customizable decentralized applications (dApps), fostering a diverse and dynamic ecosystem ranging from decentralized finance (DeFi) to non-fungible tokens (NFTs) and beyond. Avalanche's commitment to innovation extends to its consensus mechanism, which differs from traditional Proof of Work (PoW) and Proof of Stake (PoS) models. The consensus protocol is designed to function across multiple independent subnets, resulting in a highly scalable and efficient network capable of processing thousands of transactions per second without compromising security or decentralization (Avalanche Consensus, 2024).

The advantages of Avalanche's architecture include high transaction throughput, rapid finality, and energy efficiency. However, the platform also faces challenges, such as ensuring long-term security and scalability as the number of networks and subnets increases. Additionally, attracting and retaining developers and projects in a competitive ecosystem remains an ongoing mission.

Avalanche continues to face intense competition from powerful rivals such as Ethereum as it strives to maintain its market share and profitability. Structural factors within the market also pose barriers to growth. According to Coinshares Research Blog, token incentives have not always achieved the desired outcomes. A trend is emerging toward smaller, more independent, and customizable chains-Avalanche's own subnets-which indicates growth in a promising direction (Shannon, 2023).

3.4.4. Value-Adding Factors

Avalanche presents a compelling value proposition through its high-performance blockchain platform designed for speed, scalability, and security. This makes it an ideal foundation for Decentralized Finance (DeFi) projects, enterprise solutions, and any application requiring rapid transaction finality. The platform's ability to support customized subnets offers developers greater flexibility and room for innovation.

- **High Scalability and Fast Transactions:** Through its unique consensus mechanism, Avalanche delivers high transaction capacity and rapid finality, enabling thousands of transactions per second and reducing transaction completion times to under two seconds.

- **Decentralization with Low Latency:** Unlike some platforms that sacrifice decentralization for speed, Avalanche maintains a high degree of decentralization and security while achieving low-latency transaction processing.

- **Interoperable Blockchain Networks:** Avalanche supports the creation of private and public blockchain networks with distinct governance and application models, promoting interoperability within the Avalanche ecosystem (Blockchain Council Avalanche, 2024).

Avalanche creates value by providing efficient, scalable, and secure blockchain applications. Its revenue streams include transaction fees, network services, and potentially the creation and trading of digital assets on the platform. The incentive structure, including staking rewards for validators, encourages active participation and investment in the network, further securing its infrastructure and driving ecosystem growth (Avax Validators, 2024).

3.4.5. Challenges and Opportunities

The main challenges faced by the platform are listed below:

- Navigating and gaining leadership within an extremely competitive blockchain landscape.

- Ensuring network security and scalability as the ecosystem continues to expand.
- Sustaining technological innovation to stay ahead of competitors.

The opportunities available to the platform are listed below: Maintaining its leadership by continuously enhancing speed, scalability, and interoperability capabilities (Atomic Wallet, 2024).

- Capitalizing on the explosive growth of the Decentralized Finance (DeFi) sector.
- Attracting a broader range of developers and projects through its unique features.
- Leveraging its scalable architecture to expand beyond Decentralized Finance (DeFi) into new markets and applications.

Avalanche's strategic focus on speed, scalability, and security within blockchain technology positions it uniquely to benefit from the increasing demand for Decentralized Finance (DeFi) and other blockchain applications. Its continuous engagement with the community (Avax Network Community, 2024) and commitment to technological innovation establish Avalanche as a key player capable of addressing the challenges and seizing the opportunities of the evolving digital economy.

3.5. Project Overview: Polkadot (DOT)

Feature	Description
Name	Polkadot
Year Listed on Coinbase	2020
Consensus Mechanism	Nominated Proof of Stake (NPoS)
Block Processing Time	Approximately 6 seconds
Transactions per Second (TPS)	1,000 TPS
Programming Language	Rust
Interoperability	Yes
Token Name	DOT
Founders	Gavin Wood, Robert Habermeier, and Peter Czaban
Positioning	Interoperability and scalability for large-scale blockchain ecosystems
Target Audience	All potential participants across the blockchain market, from individual developers to large enterprises

3.5.1. Platform Description

The Polkadot analysis has been prepared based on the platform's official website and official White Paper. While collecting case information, speculative data from various websites and sources referring to the case project were avoided, and only information obtained from the reliable and official sources of the platform under study was used (Polkadot Home Page, 2020) (Polkadot White Paper, 2020).

Polkadot is a next generation blockchain protocol designed to enable multiple blockchains to operate securely together and share information. Founded in 2016 by Dr. Gavin Wood, one of the co-founders of Ethereum, Polkadot aims to address the scalability and interoperability challenges commonly observed in existing blockchain networks. Polkadot allows for the creation of parallel blockchains, called parachains, each with their own specific uses and tokens. These parachains can connect to the main Relay Chain, thereby facilitating cross-chain transfers of data and value (Polkadot Technology, 2024).

Polkadot's business model revolves around its innovative network architecture that supports multiple blockchains. Its primary product is the Polkadot network, consisting of the Relay Chain-where transactions are finalized-and the parachains. Its native token, DOT, serves multiple purposes within the ecosystem, including governance, staking, and bonding. Polkadot's value proposition lies in its ability to provide developers with a scalable, interoperable, and secure platform for building diverse blockchain applications (Polkadot Network, 2024).

Polkadot adopts a sophisticated governance model that includes all DOT token holders in the decision-making process, enabling a democratic approach to network upgrades and changes. The governance system is designed to evolve based on community input and participation, fostering a strong sense of ownership and engagement among its members (Polkadot OpenGov, 2024).

Community members contribute actively to Polkadot's development by participating in governance, proposing network upgrades in forums, and building projects on the platform (Polkadot Forum, 2024). Their active participation not only encourages innovation but also ensures that the network remains adaptable and responsive to changing needs and technologies.

3.5.2. Market Analysis

Polkadot operates within the competitive blockchain platform landscape alongside major players such as Ethereum, Solana, and Avalanche. It also

competes specifically with blockchain projects that utilize layer and chain technologies (Soriano, 2023b). Its focus on interoperability and scalability positions it strongly in the market, particularly as demand for cross-chain applications and services continues to grow. The platform's innovative approach to blockchain architecture provides it with a distinct competitive advantage.

Since its launch, Polkadot has attracted a wide range of developers and projects, expanding its market share and user base (Polkadot Developer Growth, 2022). As the industry moves toward a multi-chain future and the need for interoperable solutions becomes increasingly critical, platforms capable of meeting these needs are expected to see significant growth in market share.

3.5.3. Technological Framework

Polkadot utilizes a distinctive blockchain architecture that separates its main network (Relay Chain) from various specialized blockchains (parachains). This design allows different blockchains to communicate and transact seamlessly with one another, offering greater scalability and flexibility (Polkadot Architecture, 2024).

- At the core of Polkadot's design lies a unique architecture composed of the Relay Chain, parachains, and bridges that enable interoperability. The Relay Chain serves as Polkadot's main blockchain and is responsible for shared security, consensus, and cross-chain interaction across the network. Parachains are individual blockchains that can have their own tokens and are optimized for specific use cases such as data storage, finance, or identity verification (Polkadot Parachains, 2024). Bridges allow parachains to connect and communicate not only with each other but also with external networks such as Ethereum and Bitcoin (Polkadot Bridges, 2024). This architecture provides a high degree of flexibility and innovation, enabling developers to create customized solutions that interact with the broader blockchain ecosystem.

- Polkadot's vision extends beyond simply facilitating blockchain interoperability; it seeks to create a fully decentralized and private web where users maintain control over their data and digital identities (Cryptopedia Staff, 2023).

- By enabling different blockchains to work together seamlessly, Polkadot addresses one of the major challenges in the blockchain space-isolated networks. Its scalable, secure, and interactive platform fosters collaboration and innovation, creating opportunities for new applications and services that could not exist within a single blockchain environment.

- Polkadot employs a “Nominated Proof of Stake” (NPoS) consensus mechanism designed to ensure cross-chain communication and interoperability. In this system, DOT token holders participate as validators and nominators to maintain network security. Validators verify blocks and help keep the network updated and secure, while nominators support trusted validators by voting for them, thereby contributing indirectly to network integrity. This mechanism aims to achieve a balance between security and participation (ByBitLearn, 2023).

- Polkadot is a Layer-0 blockchain designed to host Layer-1 blockchains (parachains) that serve specific multi-chain applications. The network operates in a heterogeneous structure where transactions are processed in parallel, and each shard can have distinct state transition functions, allowing every L1 chain to be uniquely tailored to its intended application and value proposition (Polkadot 1.0, 2024).

Polkadot’s architecture offers significant advantages, including enhanced scalability, increased security, and the ability to create specialized blockchains for different use cases. However, its system complexity presents challenges in terms of development and maintenance, requiring a high level of technical expertise and resources (Pros and Cons of Polkadot, 2024).

3.5.4. Value-Adding Factors

Polkadot’s value proposition is built on its ability to allow multiple blockchains to operate independently while sharing information when necessary. This interoperability enables the creation of a wide range of applications-from Decentralized Finance (DeFi) to data management-on a secure and scalable platform.

- **Interoperability:** Polkadot enables different blockchains to transfer messages and value in a trust-free manner, addressing one of the most critical issues in the blockchain space-isolated networks that cannot interact with one another.

- **Shared Security:** Parachains benefit from the collective security provided by Polkadot’s Relay Chain. This shared security model means that individual chains do not need to develop their own resource-intensive security mechanisms.

- **Scalability:** By processing transactions in parallel across multiple parachains, Polkadot achieves significantly higher throughput compared to traditional blockchains that operate on a single chain (Cryptoeq Polkadot, 2023).

Polkadot serves both as a payment network and as a platform for operating independent blockchains known as parachains. As users stake \$DOT tokens, the network's overall security strengthens. It enables blockchains to connect in a permissionless and secure way, effectively eliminating bridging risks. Each newly added parachain and user increases the overall value of the ecosystem (Tokenomicshub Polkadot, 2024).

3.5.5. Challenges and Opportunities

The main challenges faced by the platform are listed below:

- Managing a complex and highly competitive blockchain ecosystem.
- Bearing the time and costs associated with the complex operational mechanisms required (Khomenko, 2023).

The opportunities available to the platform are listed below:

- Capitalizing on the growing demand for interoperable blockchain solutions.
- Expanding its ecosystem through strategic partnerships and collaborations.
- Leveraging Polkadot's unique capabilities to lead the development of new blockchain applications and services.

Polkadot's innovative approach to blockchain interoperability and scalability positions it as a key player in the emerging digital economy. Its ability to meet the diverse needs of various blockchain applications and services-combined with a strong community and governance model-creates the foundation for significant growth and a lasting impact within the blockchain space.

3.6. Project Overview: Kusama (KSM)

Feature	Description
Name	Kusama
Year Listed on Coinbase	2020
Consensus Mechanism	Nominated Proof of Stake (NPoS)
Block Processing Time	Approximately 1.5 seconds
Transactions per Second (TPS)	10,000 TPS
Programming Language	WebAssembly
Interoperability	Yes
Token Name	KSM

Founders	Gavin Wood, Robert Habermeier, and Peter Czaban
Positioning	Experimental blockchain network designed for innovation and pre-production testing
Target Audience	Developers and innovators seeking to test new blockchain solutions on a smaller and more flexible scale

3.6.1. Platform Description

This analysis of Kusama has been prepared based on the platform's official website and official White Paper. While collecting case information, speculative data from various websites and sources referring to the case project were avoided, and only information obtained from the reliable and official sources of the platform under study was used (Kusama Home Page, 2020).

Kusama is defined as a scalable, multi-chain network designed for radical innovation and early-stage implementations of Polkadot. Initiated by the same team behind Polkadot, including Dr. Gavin Wood, Kusama was created to allow developers to experiment and deploy new blockchain applications in a real-world environment with reduced risks. Within its ecosystem, Kusama encourages rapid progress and innovation, aiming to push the boundaries of what is possible with blockchain technology (Coinmarketcap, 2024).

Kusama's business model is based on providing a testing ground that enables blockchain developers to innovate without high risk. Its primary service is the Kusama network, which includes advanced features such as on-chain governance, parachains, and parathreads. Kusama's native token, KSM, is used within the ecosystem for governance, transactions, and staking fees. Its value proposition lies in providing developers with a real-world testing environment that facilitates rapid experimentation and deployment (Kusama Explore, 2024).

The founders of Kusama are the same as those of Polkadot. Kusama, however, features a distinct governance structure that operates more freely and rapidly than its more mature counterpart. The on-chain governance mechanisms allow holders of the native KSM token to vote on network upgrades and funding proposals. Community members play a vital role in the Kusama ecosystem by actively participating in governance decisions, proposing upgrades, and experimenting with new technologies on the platform. This open governance model fosters a vibrant and dynamic community that encourages participation and innovation (Kusama Guide, 2024).

3.6.2. Market Analysis

Kusama competes with platforms such as Algorand, Aptos, Avalanche, Beam, Ethereum, and its sister network Polkadot (Tokenterminal Kusama, 2024). Although relatively small in scale, the innovative solutions it introduces are often adopted by larger platforms, elevating Kusama to their level. As previously mentioned, its unique position as a preliminary exploration and development environment for Polkadot projects provides developers with the opportunity to test and refine applications before full deployment. The growing interest in blockchain technology and the increasing demand for innovative solutions continue to drive interest in platforms like Kusama.

While Kusama's market share remains smaller than that of established platforms, its distinctive positioning and the steady influx of new projects into its network offer significant growth potential. Its user base consists of developers, validators, and early adopters who are drawn to the most innovative blockchain projects, all of whom contribute to its expanding ecosystem. Primarily designed to facilitate testing, Kusama aims to provide developers with greater flexibility while refining and completing the design of Polkadot-based platforms (Kraken Kusama, 2024).

3.6.3. Technological Framework

Kusama employs a sophisticated blockchain architecture that supports interoperable innovations such as parachains and parathreads. This architecture allows multiple applications to operate simultaneously on the same network, enabling scalability, interoperability, and rapid innovation.

- Within the context of Kusama and Polkadot, the term “canary network” used for Kusama carries a metaphorical meaning (Polkadot's Canary Network, 2024). It signifies that Kusama functions as an early warning system for Polkadot. In real-world conditions, it serves as an experimental testing ground where developers can deploy and test new blockchain projects, protocols, or innovations before introducing them to the Polkadot network. This approach helps identify potential issues, risks, or weaknesses in a less critical environment, preventing problems during deployment on the more stable and large-scale Polkadot network. As a result, Kusama enables faster development cycles and the testing of cutting-edge blockchain technologies, ensuring that only well-tested and robust innovations are implemented on Polkadot.

- Kusama's architecture closely mirrors Polkadot's multi-chain network structure and supports interoperability and scalability for various blockchain projects. It includes a Relay Chain that provides security and interoperability among parachains-individual blockchains that can specialize in a wide range

of applications, from Decentralized Finance (DeFi) to Non-Fungible Tokens (NFTs) and beyond. However, Kusama differentiates itself through its governance model and network parameters, which favor faster development and deployment cycles. This environment operates independently from the stricter requirements of Polkadot's main network, offering flexibility for ventures and developer teams eager to push the boundaries of blockchain technology and experiment with new ideas (Kusama Parachains, 2024).

- Kusama's ethos is encapsulated in its slogan "Expect Chaos." The platform is deliberately designed for risk-takers and innovators within the blockchain community who value flexibility and speed over the more conservative and methodical approaches of established networks.

The advantages of this architecture include high scalability, flexibility for developers, and an environment conducive to innovation. However, it also presents challenges such as maintaining network security and stability amid rapid changes and ensuring the quality of projects deployed on Kusama given its open and experimental nature.

3.6.4. Value-Adding Factors

Kusama provides a robust platform for blockchain experimentation by allowing projects to test and refine their technologies in a live yet forgiving environment. This enables developers to innovate with lower risk, accelerate development cycles, and bring cutting-edge technological projects to market more quickly.

- **Rapid Innovation:** Through faster governance mechanisms and upgrade processes, Kusama offers developers the ability to quickly deploy and test new blockchains or applications. This environment is ideal for experimenting with innovations before introducing them into larger ecosystems such as Polkadot.

- **Low Entry Barriers:** Compared to Polkadot, Kusama provides a more accessible platform for entrepreneurs and developers seeking to launch projects without significant initial investment, due to its lower economic threshold (Boogard, 2024).

- **High Degree of Interoperability:** Like Polkadot, Kusama offers cross-chain interoperability within its ecosystem, enabling seamless communication and value transfer between different networks (Kusama Guide Interoperability, 2024).

Kusama creates value by facilitating early-stage project development, testing, and deployment within its ecosystem. Its revenue streams may include transaction fees and parachain lease offerings. The platform also incentivizes

participation through KSM rewards for staking and governance, aiming to build a self-sustaining and innovative community (Kriptomat, 2024).

3.6.5. Challenges and Opportunities

The main challenges faced by the platform are listed below:

- Operating as an experimental network with a higher likelihood of encountering technical issues compared to enterprise-grade networks.
- Balancing network security and stability with the need for rapid innovation (Hapskorea, 2024).
- Managing its relationship with Polkadot and differentiating its long-term value proposition.

The opportunities available to the platform are listed below:

- Serving as a leading innovation hub for blockchain technology.
- Capitalizing on the increasing demand for blockchain solutions by facilitating the development of innovative applications.
- Strengthening its ecosystem through strategic partnerships and collaborations to enhance overall network value and utility.

Kusama's unique approach to blockchain development and its role as a pre-production environment for Polkadot projects provide fertile ground for innovation and rapid advancement in the blockchain space. Its community-driven governance model and commitment to an open, experimental culture create favorable conditions for sustained growth within the evolving blockchain landscape.

3.7. Project Overview: Cartesi (CTSI)

Feature	Description
Name	Cartesi
Year Listed on Coinbase	2020
Consensus Mechanism	Proof of Stake (PoS)
Block Processing Time	30 minutes
Transactions per Second (TPS)	Not explicitly stated; claims higher throughput than leading blockchain networks by completing most operations on lower-layer networks and recording only results on the main chain.
Programming Languages	Linux, Python
Interoperability	Yes

Token Name	CTSI
Founders	Rob Viglione and Rolf Versluis
Positioning	Simplifying blockchain application development using mainstream programming languages
Target Audience	Developers interested in building blockchain-based applications without needing to learn blockchain-specific coding languages

3.7.1. Platform Description

The Cartesi analysis has been prepared based on the platform's official website and official White Paper. While collecting case information, speculative data from various websites and sources referring to the case project were avoided, and only information obtained from the reliable and official sources of the platform under study was used (Cartesi Home Page, 2018).

Cartesi is a blockchain platform that enables developers to code smart contracts and decentralized applications (dApps) using standard programming languages. Founded in 2018, Cartesi aims to address the challenges of scalability and usability in blockchain development. By allowing developers to use familiar tools and software, it provides a Linux-based infrastructure that significantly reduces the barriers to building decentralized applications (dApps) (Cartesi About, 2024).

Cartesi's business model focuses on providing a decentralized computing platform that enhances the scalability and programmability of blockchain applications. Its main product, Cartesi Node, integrates the blockchain with a Linux operating environment, enabling complex and computation-intensive processes to be executed off-chain while maintaining security and decentralization (Cartesi Node, 2024). Cartesi also offers the Descartes Software Development Kit (SDK), which allows developers to build scalable decentralized applications (dApps) using mainstream software stacks (Cartesi Compute, 2024). The platform's value proposition lies in offering a developer-friendly environment that combines the power of traditional software with the security and decentralization of blockchain technology.

Cartesi operates with a governance model that encourages community participation and decision-making. Its governance framework includes a Governance Forum where participants can review proposal requests, explore funded projects, and contribute ideas that shape Cartesi's technical vision. This forum provides a structured environment with categories such as General Discussions, Meta Governance & Policies, Cartesi Grant Program, Technical

Vision Forum, and Requests for Proposals (RFPs), ensuring community involvement in shaping the platform's strategic direction (Cartesi Governance, 2024).

3.7.2. Market Analysis

Cartesi operates in the rapidly evolving blockchain technology market, competing with other layer-2 solutions and smart contract platforms that aim to address similar scalability and usability challenges (Cartesi White Paper, 2018: 1). The increasing demand for more efficient and user-friendly blockchain solutions positions Cartesi competitively, with a focus on developer experience and application scalability.

Although still relatively new, Cartesi has attracted attention for its innovative approach to blockchain application development. The growing interest among developers in building complex and scalable decentralized applications (dApps) on more accessible platforms signals significant growth potential. Expanding its developer community and user base will play a critical role in increasing its market share within the blockchain industry.

3.7.3. Technological Framework

Cartesi utilizes blockchain technology by implementing a Layer-2 infrastructure that enables decentralized applications to operate within a Linux environment. This setup allows complex computations without compromising the decentralized nature of blockchain, offering a practical solution to the scalability trilemma by moving computations off-chain (Cartesi Overview, 2024).

- Cartesi functions as a Layer-2 scalability solution that simplifies smart contract development by allowing developers to use familiar tools and programming languages.
- The combination of Optimistic Rollups and the Cartesi Machine Emulator-powered by Linux libraries-facilitates the creation of smart contracts and decentralized applications (dApps). This development overcomes Ethereum's scalability limitations and enables a blockchain structure that supports more complex applications. A dApp running on Cartesi Rollups operates through a combination of Cartesi Rollups for development, a Linux-based virtual machine for backend processing, and an integrated environment that unifies user interfaces with backend logic.

- The rollup mechanism executes complex computations off-chain, improving blockchain efficiency by limiting the on-chain function to transaction recording. The blockchain intervenes only when a computation result is disputed. This approach offloads heavy computations, optimizing data and potentially increasing transaction capacity up to forty-fold. Moreover, applications within the rollup can perform nearly any type of computation, using advanced virtual machines operating in a separate execution layer for greater complexity.
- By allowing development with mainstream software, Cartesi aims to lower the entry barrier to blockchain programming and foster integration with traditional development ecosystems.
- Through integrating Linux and conventional programming environments with blockchain, Cartesi enables complex and intensive computations to be processed off-chain while preserving the security and decentralization benefits of on-chain settlement.
- At the heart of Cartesi's offering lies its innovative Layer-2 technology that addresses two of blockchain's most pressing challenges: scalability and developer accessibility. By offloading computation without compromising security or decentralization, Cartesi significantly reduces transaction costs and increases processing speeds.

The primary advantage of Cartesi's architecture is its ability to bring mainstream developer tools and scalability to blockchain applications. However, it also faces challenges such as ensuring the security and integrity of off-chain computations and achieving seamless integration between off-chain and on-chain data.

3.7.4. Value-Adding Factors

Cartesi's value proposition lies in making blockchain development as accessible and scalable as traditional software development. By bridging blockchain technology with mainstream software practices, Cartesi opens decentralized innovation to a wider range of developers and industries, potentially accelerating dApp adoption and evolution (Binance Cartesi, 2024).

- **Scalable Practical Computation:** Cartesi enables decentralized applications (dApps) to perform complex off-chain computations using Linux and other mainstream software stacks, all while preserving decentralization. This significantly broadens the range of applications that can be built on blockchain.

- **Lower Development Barriers:** By allowing developers to code using mainstream tools and environments, Cartesi lowers the entry barrier for blockchain development and attracts a broader developer base into the ecosystem.
- **Enhanced Performance and Cost Efficiency:** Off-chain computation reduces blockchain workload, leading to higher performance and lower transaction costs for decentralized applications.

Cartesi creates value by enabling the development of more complex, efficient, and user-friendly decentralized applications (dApps). Its revenue streams may include transaction fees for services offered on the platform and partnerships with enterprises seeking blockchain-based solutions. Incentive programs-such as developer grants and community funding-further encourage innovation and platform growth.

3.7.5. Challenges and Opportunities

The main challenges and opportunities faced by the platform are outlined below:

Challenges:

- Balancing the security of blockchain with the flexibility of traditional software development.
- Encouraging new developers to adopt Cartesi technology for decentralized application (dApp) development.
- Navigating a competitive landscape filled with alternative solutions addressing blockchain scalability and usability.

Opportunities:

- Leveraging the growing demand for scalable and developer-friendly blockchain solutions (Wearablox Cartesi, 2024).
- Building partnerships with educational institutions and enterprises to expand the developer ecosystem.
- Innovating in blockchain application development to capture new markets and emerging use cases.

Cartesi's approach-integrating traditional software development environments with blockchain technology-offers a unique solution to existing challenges in the blockchain industry, bridging the gap between conventional programming and decentralized innovation.

3.8. Project Overview: VeThor Token (VTHO)

Feature	Description
Name	VeThor Token
Year Listed on Coinbase	2018
Consensus Mechanism	Proof of Authority (PoA)
Block Processing Time	Approximately 10 seconds
Transactions per Second (TPS)	Not precisely stated; claimed to be higher than leading blockchain platforms due to its authorized master node system that significantly reduces transaction time.
Programming Language	Solidity
Interoperability	Yes
Token Name	VTHO
Founder	Sunny Lu
Positioning	Sustainability through a dual-token system
Target Audience	Users and organizations seeking stable blockchain transaction costs

3.8.1. Platform Description

The VeThor Token analysis is based on the official website of the platform, VeChain, and its official White Paper. As VeThor Token is a part of the VeChain Thor Blockchain, the evaluation draws exclusively on official and reliable sources related to the platform, avoiding speculative third-party data (VeChain Home Page, 2020; VeChain White Paper, 2020).

VeChain was founded during a period when public blockchain adoption for enterprise applications was limited, yet interest in the potential of blockchain technology was rapidly increasing. The project aimed to create a trustworthy, decentralized platform that enables transparent information flow, effective collaboration, and fast value transfer. Its white papers articulate the vision of becoming a sustainability-focused blockchain platform delivering tangible economic, ecological, and social benefits through blockchain-based business applications (VeChain White Paper, 2020: 3).

VeChain serves as a strong example of blockchain platform evolution. Since its inception, it has released three White Papers-labeled 1, 2, and 3-to mark different developmental phases. While not radically distinct, these iterations collectively demonstrate the platform's rapid progression within just a few years.

VeThor Token (VTHO) operates as part of the VeChain Thor blockchain, designed to enhance supply chain management and business process efficiency through blockchain technology. The VeChain Thor platform, initiated by the VeChain Foundation, uses a dual-token system consisting of VeChain Token (VET) and VeThor Token (VTHO) (VeChain Economic Model, 2024). VTHO functions as “energy” or gas, powering transactions and smart contracts on the VeChain Thor blockchain.

VeChain’s business model focuses on providing Blockchain-as-a-Service (BaaS) solutions to enterprises, particularly in logistics, luxury goods, food safety, and pharmaceuticals (VeChain ToolChain Platform Values, 2024). Among its offerings is VeChain ToolChain, a comprehensive blockchain application development platform. The value proposition lies in improving supply chain transparency, efficiency, and trust through blockchain-based technology.

VeChain operates under a hybrid governance model that integrates centralized and decentralized elements. The VeChain Foundation oversees the strategic development and utilization of the VET and VTHO tokens, while community members—including VET holders—participate in governance through voting mechanisms. This structure supports a dynamic and participatory community involved in decision-making and platform evolution (VeChain Governance, 2024).

Community members, including developers and VET holders, contribute to the VeChain ecosystem by proposing and voting on upgrades, participating in network consensus, and developing decentralized applications (dApps) on the platform. Their involvement is vital for driving continuous innovation and improvement across the network.

3.8.2. Market Analysis

VeChain Thor competes with other blockchain platforms that serve enterprise-level clients. The growing demand for blockchain solutions in sustainability, supply chain management, and business process optimization presents significant opportunities for VeChain (VeChain Thor, 2024).

Through partnerships with several high-profile corporations and organizations, VeChain has strengthened its market presence in the enterprise blockchain sector. Given the rising interest in sustainability and blockchain-driven business solutions, the platform holds strong growth potential (Global Markets Insights, 2023).

3.8.3. Technological Framework

The VeChain Thor blockchain uses a Proof-of-Authority (PoA) consensus mechanism that balances centralization, efficiency, and decentralized security. Its dual-token system-where VET is used for value transfer and VTHO for transaction costs-simplifies resource utilization across the network (Introduction to VeChain, 2024).

VeThor Token (VTHO) operates within the VeChain Thor blockchain ecosystem, which is known for its focus on supply chain management and business process optimization through distributed ledger technology. As one of the two main tokens in the VeChain ecosystem, alongside VeChain Token (VET), VTHO represents the underlying cost of using the blockchain. It is consumed when transactions are made, or smart contracts are executed on the VeChainThor blockchain. This dual-token model is designed to facilitate transactions and smart contract execution by decoupling the cost of using the blockchain from the speculative value of its tokens, thereby stabilizing transaction costs and making them more predictable for enterprises.

- **Dual-Token System:** VET is used for value transfers, while VeThor Token (VTHO) covers smart contract operations and on-chain transaction fees (Docs.VeChain, 2024).

- **Proof-of-Authority (PoA) Consensus:** The network relies on authorized validators (Authority Masternodes) to maintain the blockchain, emphasizing efficiency and scalability (Antolin, 2023).

- **Smart Contracts and dApps:** Like other blockchain platforms, VeChain supports the development and deployment of smart contracts and decentralized applications (dApps) (CoinMarketCap VeChain, 2024).

- **IoT Integration:** Through Internet of Things (IoT) integration, VeChain enables the collection of real-world data to enhance supply chain applications. The system allows manufacturers to assign unique identifiers to products, enabling them to be tracked throughout the supply chain. This improves transparency, reduces counterfeiting, and ensures product quality. Integrated IoT devices can record and monitor data such as temperature, humidity, and location in real time-an especially valuable feature for pharmaceutical and luxury goods industries (Nicolosi, 2023).

3.8.4. Value-Adding Factors

The value proposition of VeChain lies in its ability to provide a sustainable, scalable, efficient, and secure blockchain platform for enterprise use, particularly

in supply chain management. The use of VTHO as gas supports the transaction economy and incentivizes the holding and utilization of VET tokens.

- **Transaction and Smart Contract Facilitator:** VTHO is used to execute transactions and run smart contracts on the VeChainThor platform, making it an essential component for the operation of decentralized applications (dApps) within the ecosystem.

- **Dual-Token System:** VeChainThor operates on a dual-token model where VET serves as the main value carrier and VTHO represents the underlying cost of blockchain usage. This system aims to balance cost predictability with the demand for network resources. By separating blockchain usage costs (VTHO) from value transfer (VET), VeChainThor ensures that fluctuations in VET's price do not affect blockchain operation costs—resulting in greater predictability for enterprises (Takyar, N.D.).

- **Blockchain Solution for Green Supply Chains:** VeChainThor provides a blockchain-based framework that covers key stages such as recycling, processing, and reuse. This enables brands to track the origin and movement of their products globally, ensuring responsible and environmentally sustainable sourcing practices (VeChain, 2020).

As described above, VeChain creates value by improving supply chain transparency and efficiency through blockchain-based enterprise services. Revenue streams may include service fees for VeChain ToolChain and other enterprise solutions. User incentives, such as the generation of VTHO for VET holders, further promote participation and investment within the ecosystem.

3.8.5. Challenges and Opportunities

The main challenges faced by the platform are as follows:

- Intense competition within the rapidly evolving blockchain technology sector.
- Ensuring widespread adoption of VeChain's solutions across different industries.
- Balancing centralization for efficiency with decentralization for trust and security.
- The cost of establishing a blockchain node (Sofi, 2022).

Opportunities

The platform's opportunities are outlined below:

- Expanding its ecosystem through strategic partnerships and integrations.
- Leveraging the growing global interest in blockchain for supply chain optimization.

VeChain's approach to integrating blockchain technology into enterprise supply chains positions it as a pioneer in the Blockchain-as-a-Service (BaaS) market. Its unique dual-token model and hybrid governance structure provide a practical framework for blockchain adoption across various industries.

3.9. Project Overview: Horizen (ZEN)

Feature	Description
Name	Horizen (ZEN)
Year Listed on Coinbase	2017
Consensus Mechanism	Zendoo Hybrid Protocol – an efficient and fast combination of Proof of Work (PoW) and Proof of Stake (PoS).
Block Processing Time	Approximately 18.5 seconds
Transactions per Second (TPS)	Although no fixed number is officially stated, Horizen claims significantly higher throughput than leading blockchain platforms by offloading most processes to sidechains and recording only results on the main chain.
Programming Language	Ethereum Virtual Machine (EVM) compatible
Interoperability	Yes
Token Name	ZEN
Founders	Hervé Larren and Robert Viglione
Positioning	Privacy-Oriented Blockchain Infrastructure
Target Audience	Users, developers, and validators who seek complete data privacy within blockchain platforms.

3.9.1. Platform Description

This case study on Horizen (ZEN) has been prepared based on the platform's official website and White Paper.

While gathering data, speculative information from unofficial web sources was avoided, and only reliable, official data related to the project was used (Horizen Home page, 2019).

Horizen (ZEN) is a privacy-oriented blockchain platform designed to give users control over their digital footprint.

Launched in 2017, Horizen has evolved from a privacy-focused cryptocurrency into a comprehensive blockchain development platform supporting decentralized applications (dApps) and customizable blockchain chains.

Focusing on privacy, security, and scalability, the project aims to provide a robust ecosystem that enables developers and users to transact and communicate securely (CoinMarketCap Horizen, 2024).

The business model centers around the Horizen blockchain platform, offering:

- ZEN (a privacy-focused cryptocurrency),
- Zendo (a scalable and decentralized sidechain protocol), and
- Sphere by Horizen, a multifunctional application integrating wallet, messaging, and other services (Horizen Zendo, 2024; Horizen Sphere, 2024).

Horizen's value proposition lies in its strong privacy features, scalable architecture, and versatile platform for decentralized applications (dApps) and private blockchain solutions.

Horizen implements a unique governance model incorporating both on-chain and off-chain elements, enabling community participation in decision-making processes.

The Horizen Community Council (HCC) acts as a bridge between the development team and the community, promoting transparency and inclusiveness (Horizen HCC, 2022).

Community members contribute significantly to Horizen's evolution by submitting development proposals, engaging in governance, and participating in community-driven projects.

Their active involvement is essential for continuous improvement, innovation, and adaptability to market needs.

3.9.2. Market Analysis

Horizen operates within the blockchain technology sector, particularly competing in the privacy and decentralized application domains against other privacy-focused blockchains and platforms offering similar scalability solutions.

The growing demand for privacy and secure communication in digital transactions (Fortune, 2022) positions Horizen within a market that holds substantial growth potential.

Although Horizen's overall market share within the broader blockchain ecosystem remains modest, its focus on privacy and scalable blockchain solutions has attracted a distinct user base - one that continues to expand as businesses and individuals recognize the value of safeguarding commercial and personal data.

As concerns over digital privacy intensify and demand for decentralized solutions increases, Horizen's growth potential is expected to strengthen accordingly.

3.9.3. Technological Framework

Horizen employs a blockchain technology framework designed to support privacy, scalability, and decentralized governance.

Through its Zencoin sidechain protocol, the platform enables the creation of scalable and secure decentralized applications (dApps) and services, while the ZEN cryptocurrency facilitates privacy-enhanced transactions.

This technological approach offers developers and users a comprehensive toolkit for building solutions that balance privacy and scalability.

- **Cross-Chain Transfer Protocol (CCTP):** Horizen provides an innovative protocol that supports an unlimited, fully decentralized sidechain ecosystem, independent of any specific consensus mechanism or programming language (Horizen CCTP, 2024). This "*blockchain of blockchains*" architecture allows modular design, minimizes negative data leakage, and broadens design possibilities across the ecosystem.
- **Main Chain and Sidechain Separation:** The main chain operates on a modified Nakamoto consensus, ensuring resilience against malicious attacks, while application-specific logic is executed through specialized sidechains. The Sidechain Software Development Kit (SDK) equips developers with tools to deploy new blockchains leveraging Horizen's extensive node network and zero-knowledge cryptographic tools (Horizen Academy SDK, 2024).
- **zk-SNARKs (Zero-Knowledge Proofs):** These enable transaction verification without disclosing sensitive information, allowing block validation and processing without exposing the underlying data (Horizen, 2024).

- **Zendoo Sidechain Technology:** This architecture allows developers to create customized blockchain applications using various consensus mechanisms to fit specific use cases (Horizen Zendoo, 2024).

3.9.4. Value-Adding Factors

Horizen's value proposition centers on offering a secure, privacy-oriented platform for both users and developers.

By emphasizing user privacy and data protection, Horizen provides a versatile ecosystem for building and deploying decentralized applications (dApps), sidechains, and blockchain-based solutions.

- **Enhanced Privacy:** Horizen employs zk-SNARKs (Zero-Knowledge Succinct Non-Interactive Arguments of Knowledge), enabling users to conduct transactions and communications without revealing sensitive information (zk-SNARKs vs zk-STARKs, 2024).
- **Decentralized Sidechains:** The platform supports the creation of decentralized, customizable sidechains that allow developers to build privacy-focused dApps and services while leveraging the security of the main chain (Horizen Academy Sidechains, 2024).
- **Flexible Software Development Kit (SDK):** Horizen offers a comprehensive SDK that simplifies blockchain application development and enables developers to more easily create privacy-oriented solutions (Horizen Academy SDK, 2024).

Horizen generates value through innovative blockchain solutions that attract both developers and users interested in privacy and scalability.

Its revenue streams may include services offered via the sidechain protocol and partnerships with enterprises seeking privacy-focused blockchain infrastructures.

Additionally, community incentives and stakeholder engagement programs promote ecosystem growth and continuous innovation.

3.9.5. Challenges and Opportunities

The key challenges and opportunities are listed below:

Key Challenges:

- Balancing privacy features with regulatory compliance.
- Ensuring the long-term scalability and security of the network.

- Increasing developer and user adoption in a highly competitive market environment.

Key Opportunities:

- Leveraging the rising demand for privacy and secure communication in digital transactions.
- Strengthening its position by innovating in privacy-focused blockchain solutions and decentralized applications (dApps).

Horizen's commitment to privacy, security, and scalability establishes a distinctive position within the blockchain industry.

Its innovative approach to community-driven governance and technological implementation provides a strong foundation for continued growth and influence in the privacy and decentralized application sectors.

Effectively addressing these challenges while capitalizing on emerging opportunities will be critical to Horizen's sustained success and expansion.

3.10. Project Overview: Aergo (AERGO)

Feature	Description
Name	Aergo
Year Listed on Coinbase	2019
Consensus Mechanism	Delegated Proof of Stake (DPoS) and Proof of Authority (PoA)
Block Processing Time	1 second
Transactions per Second (TPS)	Over 10,000 TPS
Programming Languages	LUA and SQL
Interoperability	Yes
Token Name	AERGO
Founders	Phil Zamani and Won-Beom Kim
Positioning	Enterprise-Ready Blockchain Platform
Target Audience	Corporations and individuals seeking an easy-to-use blockchain solution for entering the blockchain space.

3.10.1. Platform Description

The Aergo case study was prepared based on the platform's official website and official White Paper.

During data collection, speculative or unverified sources were avoided, and only reliable, official materials related directly to the case were used (Aergo Home page, 2019; Aergo White Paper, 2019).

Aergo is a blockchain platform that enables enterprises to develop, deploy, and manage decentralized applications (dApps) and blockchain systems easily and efficiently. Founded in 2018, Aergo aims to bridge the gap between enterprise IT systems and blockchain technology, incorporating both public and private blockchain architectures. The platform is supported by Blocko, one of South Korea's leading blockchain technology firms (Blocko, 2024).

Aergo's business model focuses on providing a comprehensive suite of blockchain services specifically tailored for enterprises.

This includes cloud-based blockchain hosting, a smart contract platform, and a marketplace for decentralized applications (dApps).

The platform is suitable for both permissioned and permissionless blockchain environments and is open to creative individuals as well as organizations seeking to implement blockchain projects.

By allowing the use of SQL, a widely known programming language, Aergo lowers the entry barrier for developers interested in writing smart contracts. These projects can also be launched and funded as startups within the ecosystem.

Aergo's value proposition lies in offering an easy-to-use platform that combines the transparency and security of public blockchains with the control and efficiency of private ones (CoinMarketCap Aergo, 2024).

Aergo employs a hybrid governance model that integrates elements of both centralized and decentralized decision-making. This model maintains platform agility while allowing developers, customers, and stakeholders to participate in governance through proposal and voting mechanisms.

The Aergo community plays an active role in shaping the platform's future, contributing to its growth and management (Aergo Community, 2024). Community members -including developers, businesses, and technology enthusiasts - participate by developing dApps, taking part in governance decisions, and providing valuable feedback about features and services.

Their involvement fosters innovation and ensures that Aergo remains responsive to the evolving needs of its users.

3.10.2. Market Analysis

According to information from the Aergo website, the platform compares itself to leading blockchain projects such as Ethereum, Solana, and Avalanche (Aergo Comparison, 2024).

Aergo operates in the rapidly evolving and competitive Blockchain-as-a-Service (BaaS) market, competing with both established blockchain networks and emerging BaaS providers.

The growing demand for blockchain solutions across diverse industries - including finance, supply chain, and healthcare - presents significant opportunities for Aergo to expand its market share.

Although relatively new in the blockchain space, Aergo's focus on enterprise solutions and its strategic backing from Blocko provide strong foundations for growth. As more enterprises seek efficient and scalable blockchain solutions, Aergo's market share is expected to increase.

Its user base continues to grow among organizations seeking customizable blockchain platforms tailored to their business needs.

3.10.3. Technological Framework

Aergo leverages blockchain technology to deliver a secure, scalable, and flexible platform for developing and deploying decentralized applications (dApps) and enterprise blockchain solutions. To ensure both security and transaction efficiency, the platform integrates a high-performance blockchain core, an advanced smart contract engine, and a decentralized identity and access management system.

Hybrid Blockchain Architecture: Aergo offers public, private, or hybrid network deployment options as a service to meet diverse business requirements (Aergo White Paper, 2019: 5).

Smart Contracts: The platform provides advanced smart contract functionality to automate business processes and transactions efficiently.

Consensus Algorithm: Aergo employs a Delegated Proof of Stake (DPoS) mechanism designed to strike a balance between efficiency and decentralization (Aergo Consensus Algorithm, 2024).

Enterprise-Grade Features: Aergo enables SQL-based smart contracts, simplifying the transition for traditional businesses adopting blockchain technology (Aergo SQL, 2024).

The platform's architecture offers key advantages such as flexibility to support both public and private blockchain models, ease of integration with existing IT systems, and scalability, positioning Aergo as a practical and enterprise-ready blockchain framework.

3.10.4. Value-Adding Factors

Aergo's value proposition lies in its ability to provide enterprises with a powerful, scalable, and user-friendly platform.

Its design enables businesses to leverage blockchain technology to enhance efficiency, transparency, and innovation across their operations.

- **Hybrid Blockchain Model:** Aergo offers a hybrid blockchain framework that allows enterprises to benefit from both public and private blockchain features, ensuring security, privacy, and scalability while maintaining the advantages of decentralized networks (Binance Aergo, 2019).
- **Enterprise-Level Solutions:** Specifically designed for businesses seeking to integrate blockchain into their existing infrastructure, Aergo provides intuitive tools for developing, deploying, and managing blockchain applications effectively.
- **Scalability and Performance:** Engineered to address the scalability challenges of traditional blockchains, Aergo focuses on high transaction throughput and processing efficiency, making it suitable for enterprise-grade applications (Bybit Aergo, 2024).
- **Interoperability:** With interoperability as a core design principle, Aergo enables seamless integration and communication between different blockchain networks and traditional IT systems, facilitating value and data exchange across diverse platforms (Uphold Aergo Interoperability, 2024).

Aergo creates value by empowering organizations to implement blockchain technology without compromising operational flexibility or efficiency. Its adaptable infrastructure supports a wide range of industry use cases, helping enterprises transition smoothly into blockchain-based digital ecosystems.

Value Creation Process

Aergo creates value by enabling enterprises to develop and deploy decentralized applications (dApps) quickly and securely.

The platform's hybrid blockchain architecture addresses a wide range of enterprise needs, allowing seamless transitions between private and public frameworks.

This adaptability, complemented by SQL support, demonstrates Aergo's position as a true enterprise-grade technology.

In addition, Aergo distinguishes itself through its eco-friendly approach, featuring near-zero CO₂ consumption.

This environmental consciousness makes Aergo an attractive, forward-thinking option for organizations that prioritize sustainability and carbon footprint reduction.

Through its combination of ease of use, hybrid flexibility, enterprise readiness, and environmental responsibility, Aergo generates significant value for businesses seeking to leverage blockchain technology for innovation and growth (Aergo Home Page, 2024).

3.10.5. Challenges and Opportunities

Key challenges faced by the Aergo platform include the following:

- Differentiating Aergo from larger, well-established blockchain platforms and ensuring its unique value proposition stands out in a competitive market.
- Maintaining scalability and security as the user base continues to grow.
- Adapting to and complying with regulatory changes across different countries and jurisdictions.

Opportunities available to the platform are listed below:

- Leveraging the increasing demand for enterprise blockchain solutions.
- Expanding the ecosystem through strategic partnerships and collaborations with businesses and developers.
- Driving innovation in blockchain technology to address emerging business needs and new use cases.

Aergo's strategy of simplifying blockchain adoption for enterprises positions it to reach millions of potential organizations that have yet to enter the blockchain space. By focusing on accessibility, flexibility, and partnership-driven growth, Aergo is well-placed to strengthen its presence in the enterprise blockchain market.

Analysis and Findings

The following Table 5 and Table 6 present a comparative overview of the key features of various blockchain platforms.

Table 5. Comparative Analysis of the Blockchain Platforms with the Highest Market Capitalization Listed on Coinbase

Blockchain	Year Listed on Coinbase	Consensus Mechanism	Block Processing Time	Transactions per Second (TPS)	Programming Language	Interoperability	Token Name	Founders	Positioning	Target Audience
Ethereum	2015	Proof of Stake (PoS)	~15 seconds	4,000	Solidity	Limited	ETH	Vitalik Buterin, Anthony Di Iorio, Charles Hoskinson, Mihai Alisie & Amir Cherri	Pioneer of Smart Contracts and Large-Scale Blockchain Solutions	All potential users in the blockchain market, from A to Z
Solana	2020	Proof of History (PoH) + Proof of Stake (PoS)	0.4 seconds	65,000	Rust	Yes	SOL	Anatoly Yakovenko and Raj Gokal	Speed and Scalability; Large-Scale Blockchain Solutions	All potential users in the blockchain market, from A to Z
Cardano	2017	Ouroboros – Proof of Stake (PoS)	~20 seconds	1,000	Haskell	Yes	ADA	Charles Hoskinson	Scientifically Researched, Large-Scale Blockchain Solutions	All potential users in the blockchain market, from A to Z
Avalanche	2020	Avalanche Consensus Protocol (incorporating elements of Proof of Stake and Proof of Work)	1.5 seconds	4,500	Solidity, Go, etc.	Yes	AVAX	Emin Gün Siner	Rapid Finality and Large-Scale Blockchain Solutions	All potential users in the blockchain market, from A to Z
Polkadot	2020	Nominated Proof of Stake (NPoS)	~6 seconds	1,000	Rust	Yes	DOT	Gavin Wood, Robert Habermeier, and Peter Czaban	Interoperability and Scalability; Large-Scale Blockchain Solutions	All potential users in the blockchain market, from A to Z

Table 6. Comparison of the Lowest Market Capitalization Platforms Listed on Coinbase

Blockchain	Year Listed on Coinbase	Consensus Mechanism	Block Processing Time	Transactions per Second (TPS)	Programming Language	Interoperability	Token Name	Founders	Positioning	Target Audience
Kusama	2020	Nominated Proof of Stake (NPoS)	~1.5 seconds	10,000	WebAssembly	Yes	KSM	Gavin Wood, Robert Habermeier, and Peter Czaban	Experimental Blockchain	Those seeking to test new solutions on a smaller scale
Cartesi	2020	Proof of Stake (PoS)	30 minutes	Not specified	Linux, Python	Yes	CTSI	Rob Viglione, Rolf Versuis	Ease of Programming with Common Languages	Developers who want to build blockchain applications but are proficient only in mainstream programming languages
VeThor Token	2018	Proof of Authority (PoA)	~10 seconds	Not specified	Solidity	Yes	VTHO	Sunny Lu	Sustainability; Dual-Token Economic System	Those who want to maintain stable blockchain transaction costs
Horizen Zen	2017	Zendoo Proof of Work + Proof of Stake (hybrid consensus)	~18.5 seconds	Not specified	Ethereum Virtual Machine Compatible	Yes	ZEN	Hervé Larren, Robert Viglione	Privacy-Focused	Validators and miners seeking complete privacy within blockchain platforms
Aergo	2019	Delegated Proof of Stake (DPoS), Proof of Authority (PoA)	1 second	10,000+	LUA, SQL	Yes	AERGO	Phil Zamani, Won-Beom Kim	Enterprise-Ready Blockchain	Enterprises and individuals seeking an easy-to-use blockchain solution

Tables 5 and 6 present the key characteristics of leading blockchain platforms such as Ethereum, Solana, Cardano, Avalanche, and Polkadot (Table 5), as well as Kusama, Cartesi, VeThor Token, Horizen, and Aergo (Table 6). These characteristics include their listing years on Coinbase, the consensus mechanisms they employ, block processing times, transaction speeds (TPS – transactions per second), programming languages, interoperability features, native tokens, and founders. In addition, strategic information such as each platform’s positioning and target audience is also provided.

The positioning information was defined by the author of this book. However, all positioning statements were formulated based on a review of the respective organizations’ White Papers and official websites.

Ethereum’s role as the pioneer of smart contracts offering large-scale solutions and serving a broad client base, Solana’s emphasis on speed and scalability, Cardano’s research-driven methodology, Avalanche’s rapid transaction finality, and Polkadot’s focus on interoperability each define their distinct market positioning.

The consensus mechanisms of these platforms share common conceptual terminology such as “proof,” reflecting their shared goal of achieving trust and verification through cryptographic consensus. Yet, the fact that each platform employs uniquely named methods indicates that they attempt to address the consensus problem through distinct designs. Solana’s combination of Proof of History (PoH) and Proof of Stake (PoS) or Avalanche’s proprietary consensus protocol exemplify this diversity. Technical parameters such as block processing times and transactions per second (TPS) illustrate each platform’s performance and scalability capabilities.

The inclusion of programming languages in Tables 5 and 6 highlights the influence of blockchain programming languages on overall system performance. Learning a newly developed blockchain language often constitutes an entry barrier for developers. Ethereum’s programming language, Solidity, was developed by Gavin Wood, who also co-founded Polkadot and VeChain–VeThor Token, though Polkadot itself uses Rust instead of Solidity. The rapid evolution of blockchain technology has encouraged the creation and adoption of diverse programming languages to address emerging challenges.

Finally, the positioning column in Tables 5 and 6 reveals that while the first five platforms share similar large-scale orientations, the latter five occupy distinctive niches. Kusama’s experimental blockchain approach, Cartesi’s ease of programming with common languages, VeThor Token’s dual-token economic model, Horizen’s privacy-focused framework, and Aergo’s enterprise-friendly

blockchain integration reflect how blockchain technology caters to a variety of specialized market needs.

When examining the list of founders, it becomes apparent that some individuals have founded more than one blockchain platform. For instance, Charles Hoskinson was among the founders of Ethereum and is also the founder of Cardano. Similarly, Gavin Wood, Robert Habermeier, and Peter Czaban are the founders of both Polkadot and Kusama. The fact that these founders have participated in multiple projects at different times indicates, in a sense, an individual-level transfer of technological knowledge across projects.

The distinct solutions and target audiences offered by each platform demonstrate that blockchain technology extends far beyond the financial and technological sectors, illustrating its potential for application across a wide spectrum of industries and use cases.

4.1. Common Factors Contributing to Success: Shared Characteristics of the Top Five Blockchain Platforms

By analyzing Ethereum, Solana, Cardano, Avalanche, and Polkadot, it is possible to identify several common characteristics that have contributed to their success in the blockchain industry. Although each platform possesses its own unique value proposition and technological innovation, their sustained growth, market adoption, and continued relevance are rooted in a set of shared features. The common elements observed across these five leading projects are outlined below with corresponding examples.

4.1.1. Innovation and Technological Advancement

- All five of these platforms continue to evolve through constant innovation, focusing on addressing the inherent challenges of blockchain technology such as scalability, speed, and interoperability.
- The distributed nature of blockchain requires many geographically dispersed nodes to reach consensus on transactions. Each of these five platforms explores its own unique consensus mechanism to improve the efficiency of this process. For instance, Ethereum's transition from Proof of Work (PoW) to Proof of Stake (PoS) in what it calls Ethereum 2.0 aims to enhance scalability and energy efficiency.
- Distinct Consensus Mechanisms: Each project employs a consensus mechanism specifically designed to optimize certain aspects such as speed, security, and energy efficiency. This continuous pursuit of improvement, without simply replicating others, has enabled each plat-

form to contribute its own innovation to the field. For example, Solana developed the Proof of History (PoH) method, which records the chronological order of transactions rather than detailed transaction logs. This system significantly increases efficiency by verifying the sequential compatibility of transactions.

- Similarly, Cardano's Ouroboros PoS, Avalanche's proprietary consensus protocol, and Polkadot's shared security model have each contributed to enhancing overall performance and efficiency.
- Ethereum, the platform with the largest market share, created the smart contract category and is regarded as the technological successor to Bitcoin's blockchain. Although it operates on the oldest underlying infrastructure among major platforms, Ethereum retains the advantage of being a first mover, with the largest user base and number of projects. However, because many existing projects are built on its earlier technology, updating and transitioning to newer, more efficient systems poses significant challenges despite its ongoing efforts to reduce costs and modernize its framework.

4.1.2. Scalability and High Transaction Capacity

- The first blockchain, Bitcoin, operates with a highly secure but relatively slow and costly Proof of Work (PoW) consensus mechanism. While PoW ensures transaction reliability, it lacks the speed necessary to record real-world transactions efficiently and remains one of the most expensive consensus methods.
- Efficient Transaction Management: The five analyzed platforms have diverged from Bitcoin's PoW model, developing their own consensus mechanisms to significantly enhance speed and transaction capacity. Scalability has become a critical area of focus, as each blockchain platform seeks to handle transactions more efficiently through its own unique approach. Solana stands out for its exceptionally high processing capacity, capable of completing tens of thousands of transactions per second through parallel processing capabilities. In this regard, Solana has surpassed Mastercard's performance of approximately 5,000 transactions per second, and reaching Visa's rate of around 24,000 transactions per second may be possible within just a few months (Bitdegree, N.D.).
- Layered Architecture and Interoperability for Scalability: Polkadot and Cardano have adopted a layered architecture to enhance scalability while emphasizing interoperability. This approach not only im-

proves transaction throughput but also facilitates seamless communication across different blockchain networks.

4.1.3. Interoperability

- **Interoperability:** Among the five leading blockchain platforms, all except Ethereum have developed solutions for cross-chain compatibility. Since Ethereum was introduced earlier than its competitors, newer platforms were able to build upon and refine existing technology using more advanced methods. However, as Ethereum hosts the largest number of blockchain projects, many interoperability efforts inevitably focus on connecting with Ethereum-based networks. Consequently, the success of other chains is often linked to their ability to integrate and operate effectively with Ethereum's ecosystem.
- **Facilitating Cross-Chain Communication:** Polkadot's relay chain and parachains architecture and Cardano's cross-chain interoperability focus exemplify the growing importance of enabling smooth communication and information exchange between blockchains. Similarly, Avalanche emphasizes interoperability not only among public blockchains but also with private enterprise and government systems. Solana's rapid rise, becoming one of the fastest-growing chains after Ethereum, is largely due to its success in establishing bridges with 17 major blockchain networks (Solana Wormhole, 2024).
- **Layer 2 Solutions:** Ethereum's Layer 2 scaling developments, such as rollups, underline ongoing efforts to enhance interoperability while preserving the platform's security and decentralization principles.

4.1.4. Community and Ecosystem Development

- **Active Ecosystems:**

A strong and active community with continuous developer engagement is vital for the growth, innovation, and sustainability of all blockchain projects. All five of these leading platforms maintain active communities and provide resources, tools, and incentives to attract and retain developers. For instance, Ethereum, as the pioneering platform for decentralized applications (dApps) and smart contracts, has cultivated a vast network of developers, users, and businesses. This engagement drives the creation of new decentralized applications, services, and protocols that continuously add value to its ecosystem.

- Support and Incentives:

Providing developers with tools, resources, and financial incentives plays a critical role in fostering innovation and participation. The value of a blockchain platform grows proportionally with the number of people building on it. Ultimately, those who decide to adopt a blockchain platform are the highly skilled software engineers and developers responsible for developing its projects. Various funding and grant programs have been established to support blockchain developers (Malynovskyi, 2023). Common community engagement strategies include grants, hackathons, and educational resources.

- Hackathons:

Hackathons are events where software developers, designers, and other technology specialists collaborate intensively to develop innovative projects, solve specific problems, or experiment with new technologies. The term combines “hack” and “marathon,” reflecting an event in which teams work together over a short but intensive period—typically 24 hours to several days. Numerous hackathons are regularly organized within the blockchain industry (Devpost, 2024).

These events may focus on specific technologies, social challenges, or open-ended innovation themes. Hackathons offer participants the opportunity to rapidly transform ideas into prototypes and test emerging technologies. Additional benefits include networking, skill development, and opportunities to connect with potential employers or investors. At the end of the event, teams present their projects to a jury, which evaluates them based on creativity, innovation, feasibility, and technical execution. The most successful projects typically receive awards or funding. Such events are organized not only by educational institutions but also by technology companies, startup communities, and even governments.

4.1.5. Decentralization and Security

- Maintaining Balance:

Despite their differing approaches, achieving a high degree of decentralization while ensuring network security remains a central priority for all five projects. This commitment is reflected in their ongoing efforts to refine consensus mechanisms and governance models. Each project seeks to balance decentralization with performance, ensuring that neither speed nor scalability compromises security.

- **Security Measures:**

The adoption of advanced cryptographic techniques and regular security audits highlights the priority placed on protecting both the network and its users from vulnerabilities and attacks. While each project develops its own validation mechanisms, they all remain anchored in the core blockchain principles of decentralization and trustless security.

At the same time, to enhance speed and scalability, many platforms have adopted layered architectures or side-chain structures, where certain transactions are processed off-chain and later recorded on the main chain. According to each platform's claims, these methods do not compromise network security. However, whether these innovative, theoretically secure approaches may introduce unforeseen security risks will only become evident over time as real-world adoption increases.

4.1.6. Network Effects

- **Network Effect:**

The network effect refers to the phenomenon where the value of a product or service increases as the number of users grows. The fundamental logic behind this effect is that as more users join a platform, the overall value and attractiveness of the service increase for everyone, since opportunities for interaction and collaboration expand among users.

- **Strategic Importance:**

Network effects are especially significant for companies entering new markets or seeking rapid user base growth, such as in the blockchain industry. Platforms capable of establishing strong network effects often gain a substantial competitive advantage over their “off-network” rivals.

- **Increasing Utility:**

Network effects can be clearly observed in how the expanding adoption of these blockchain platforms contributes to their overall value and utility. Ethereum's smart contract infrastructure and ecosystem serve as a prime example of how diversified use cases drive both growth and adoption. In other words, the more effectively blockchain projects can meet existing business needs, the more likely they are to attract new projects to their platform. Beyond fulfilling those needs, demonstrating that they can do so faster, more securely, more efficiently, and at lower cost is equally critical.

- Role of Brand Recognition:

One key element that amplifies network effects is recognition. As the most recognized platform after Bitcoin, Ethereum's brand value enhances its appeal and credibility. Notably, IBM-though not listed on Coinbase-remains one of the major institutions developing numerous blockchain projects (IBM Blockchain, 2024). IBM's strong brand reputation significantly influences corporate clients seeking to adopt blockchain solutions. Consequently, corporate brand recognition can act as a driver of network effects, attracting further adoption and partnerships.

- Community Contributions:

Across all five platforms, user and developer participation-ranging from developing decentralized applications (dApps) to engaging in governance decisions-has strengthened network effects by attracting more participants and fostering continuous innovation. Nearly every major blockchain grants voting rights to token holders, reinforcing the democratic nature of blockchain ecosystems. This governance model not only decentralizes decision-making but also fosters a sense of ownership and belonging among validators and developers who view themselves as integral stakeholders in the platform's evolution.

4.1.7. Sustainability and Environmental Concerns

- Energy Efficiency Initiatives:

All five major platforms have recognized the environmental concerns associated with mining and the excessive energy consumption of earlier blockchain systems, leading them to pursue more energy-efficient models. Ethereum, through its "Ethereum 2.0" project, transitioned from the traditional Proof of Work (PoW) mechanism to the significantly more energy-efficient Proof of Stake (PoS) system. Similarly, Solana, Cardano, Avalanche, and Polkadot have each developed advanced variations of consensus mechanisms-beyond conventional PoW and even PoS frameworks-driven largely by their search for energy efficiency.

- Economic as well as Environmental Motivation:

The drive for energy efficiency is not merely rooted in environmental awareness; it is also an economic imperative. Since blockchain technology is offered as a service to other institutions, reducing operational costs is essential for maintaining competitive pricing and profitability. In other words, lowering energy consumption translates directly into cost efficiency and competitive advantage. Within an increasingly competitive market of enterprise-scale

blockchain solutions, cost efficiency remains a decisive factor influencing adoption.

- Sustainable Blockchain Operations:

These efforts reflect a broader industry-wide commitment to reducing the environmental footprint of digital assets and ensuring the sustainable growth of blockchain technology. In other words, the pursuit of energy efficiency is not limited to a few platforms-it represents a shared sectoral priority.

Collectively, the five leading platforms demonstrate a holistic approach to blockchain development-integrating technical innovation, community building, scalability, interoperability, and sustainability. Each of them focuses on the three foundational pillars of blockchain technology: scalability, security, and decentralization. Furthermore, their pursuit of ecological and economic sustainability underscores the industry's evolving effort to address blockchain's potential societal and environmental drawbacks.

4.2. Common Characteristics of the Bottom Five Platforms

The Shared Features of the Five Blockchain Platforms at the Bottom of the List are summarized below:

When examining the last five blockchain projects-Kusama, Cartesi, VeThor Token, Horizen, and Aergo-it becomes evident that each focus on addressing specific challenges within the blockchain field. While they may not match the top-tier platforms in market size, each employs innovative strategies to target niche segments, foster community and ecosystem development, and explore technological experimentation aimed at advancing the broader blockchain landscape.

4.2.1. Innovative Solutions for Specific Challenges

- Integrating Traditional and New Blockchain Frameworks:

Cartesi and Aergo exemplify efforts to integrate blockchain technology with traditional development environments. Cartesi enables decentralized applications (dApps) to be developed using standard programming languages, thereby reducing the learning curve for developers unfamiliar with blockchain-specific languages. Aergo, on the other hand, provides enterprise-oriented blockchain solutions, focusing on interoperability, scalability, and seamless integration with existing IT systems. Through this approach, Aergo aims to overcome common barriers to blockchain adoption within the corporate sector.

- Addressing Scalability and Privacy:

The five platforms at the lower end of the list each target critical blockchain challenges-particularly scalability and privacy-through unique value propositions. For example, Horizen enhances transaction privacy through zk-SNARKs (Zero-Knowledge Succinct Non-Interactive Argument of Knowledge) technology, allowing transactions to be verified without disclosing sensitive data. This not only improves privacy but also contributes to scalability by optimizing the amount of data processed on the blockchain.

- Innovation in Token Systems:

Paying transaction fees with native tokens remains a less discussed but significant issue in blockchain economics. Naturally, each blockchain project seeks to see the value of its native token rise, like how companies want their stock prices to appreciate. However, as transaction fees are often paid in these same tokens, an increase in token value also leads to higher transaction costs. The VeChain ecosystem addressed this by creating a dual-token system, introducing the VeThor Token (VTHO) to handle transaction fees. This innovation decoupled transaction costs from token market fluctuations, enhancing network stability and user affordability.

- Experimentation and Testing Ground:

Kusama serves as an experimental environment for testing new blockchain projects. Given that blockchain initiatives can be both time-consuming and costly, Kusama provides a safe, real-world testing platform for developers to trial innovative ideas before launching them on the main Polkadot network.

4.2.2. Niche Focus

- Each of the five lower-ranked blockchain platforms has carved out its own niche by targeting specific use cases or market segments:
- Kusama is known as Polkadot’s “canary network”, serving as a testing ground for developers to deploy high-risk and innovative projects in real-world conditions before official Polkadot implementation. This unique positioning has accelerated the development and validation of new blockchain technologies through rapid innovation cycles.
- VeThor Token, within the VeChain ecosystem, plays a critical role in transaction processing and smart contract execution, highlighting the importance of the dual-token mechanism in maintaining network operation and economic stability. Furthermore, VeChain positions it-

self as a sustainability-driven blockchain project, targeting enterprises seeking environmentally and socially responsible solutions.

- Horizen has positioned itself as the platform of choice for users prioritizing strong privacy guarantees. By leveraging Zero-Knowledge Proof (ZKP) technology, Horizen allows validators and node operators to confirm transactions without accessing any underlying transaction content, ensuring complete confidentiality.
- Aergo targets organizations wishing to adopt blockchain technology with minimal technical complexity. Although its slogan includes “individuals,” the emphasis lies on entrepreneurial individuals seeking to launch their own blockchain-based startups easily and efficiently.
- Cartesi, similar to Aergo, appeals to both individuals and organizations wishing to develop blockchain-based applications without learning specialized blockchain languages. By allowing developers to use standard programming languages they are already familiar with, Cartesi significantly reduces barriers to entry for blockchain application development.

4.2.3. Community and Ecosystem Development

- Encouraging Growth through Participation:

A key commonality among these platforms is their focus on cultivating strong communities and ecosystems. This is achieved by providing active developer support, forming strategic partnerships, and engaging with users and stakeholders. For example, Aergo’s focus on providing enterprise blockchain solutions is complemented by its efforts to expand its ecosystem through collaborations with companies from various industries. Similarly, Cartesi promotes developer participation by offering tools and resources that simplify the creation of decentralized applications (dApps), thereby fostering an active and growing developer community.

- Community Grants Programs:

Initiatives such as Cartesi’s Community Grants Program further incentivize participation by providing funding to expand its contributor network (Cartesi Governance and Grants, 2024).

Likewise, Kusama supports open-source software development and research through grants offered by the Web3 Foundation (Kusama Grants Programme, 2024). As previously mentioned, Horizen actively strengthens community

engagement through initiatives like the Horizen Community Council (HCC), which serves as a collaborative bridge between developers and users.

Overall, increasing participation across these ecosystems contributes directly to greater platform value, innovation, and sustained growth.

4.2.4. Innovation and Technological Advancement

- Pioneering New Blockchain Technologies:

One of the most striking shared features among these lower-ranked platforms is that they are all technological pioneers in their respective niches. Each contributes unique innovations to the blockchain space as follows:

- Kusama’s “Canary Network” model allows new blockchain features and upgrades to be tested under real-world economic conditions before deployment on Polkadot’s main network.
- Cartesi bridges traditional software development and blockchain by introducing a Linux-based virtual machine that facilitates smart contract execution using familiar programming environments.
- Aergo’s hybrid blockchain architecture combines the security and transparency of public blockchains with the control and efficiency of private blockchains, creating a versatile solution tailored to enterprise needs.
- VeChain leads the industry as the first dual-token blockchain project, introducing VeChain Token (VET) and VeThor Token (VTHO) to separate utility and governance functions.
- Horizen, meanwhile, pioneers’ privacy innovation by implementing state-of-the-art zero-knowledge technologies, securing its leadership in the privacy-focused blockchain segment.

In summary, the five platforms at the bottom of the list enrich the blockchain landscape by addressing unique challenges, focusing on specific niches, growing their communities and ecosystems, and introducing groundbreaking technological innovations. Their efforts not only solve existing limitations but also expand the possibilities of blockchain technology, paving the way for broader adoption and diverse applications across multiple industries.

4.3. Differences Between the Top Five and Bottom Five Blockchain Platforms by Market Value

The differences between the five highest-market-value platforms and the five lowest-market-value platforms reveal the diverse approaches and objectives

that exist within the blockchain ecosystem. These distinctions span a wide range-from core purposes and market impact to technological innovation and adoption strategies. The key differences are outlined below:

4.3.1. Scale and Scope

- General-Purpose vs. Specialized Applications:

The top five platforms-such as Ethereum, Solana, Cardano, Avalanche, and Polkadot-are designed as foundational infrastructures capable of supporting a broad spectrum of applications, from finance and gaming to logistics and healthcare. Their architectures were built with the ambition to serve as the backbone of a decentralized internet.

In contrast, the five smaller platforms tend to focus on specific use cases or industry needs. For example, Aergo's emphasis on enterprise blockchain solutions highlights a focus on customized functionality rather than broad applicability. Similarly, VeChain prioritizes sustainability projects, Horizen emphasizes privacy, Kusama supports experimental innovation, and Cartesi simplifies blockchain programming through familiar coding languages.

- Development Flexibility:

The broader scope of the top five platforms attracts a diverse developer community, offering greater flexibility in developing decentralized applications (dApps). Their ecosystems allow developers to experiment across multiple sectors and use cases.

The specialized nature of the smaller platforms, however, provides targeted optimization-tools and features finely tuned for specific scenarios. For instance, Cartesi bridges traditional and blockchain development by enabling programming in common languages such as Linux, Python, and C++, reducing the technical barrier for new developers entering the blockchain field.

4.3.2. Market Position and Recognition

- Mainstream Service Providers vs. Niche Innovators:

The top five blockchain projects are viewed as cornerstones of decentralized application infrastructure, forming the foundation on which countless dApps are built. This central role has earned them widespread recognition and adoption.

Conversely, projects such as Horizen and Kusama, though innovative, are positioned within narrower contexts; Horizen in privacy enhancement and Kusama in experimental blockchain development.

- Brand Recognition and Trust:

The trust and brand awareness established by the top-tier group facilitate partnerships, integrations, and even regulatory dialogue, reinforcing their position as industry leaders. Their name recognition often translates into market dominance and greater institutional confidence.

The smaller platforms, meanwhile, typically build their reputations within focused communities or specialized industry niches. Their credibility grows more gradually, supported by distinct technological contributions rather than mass adoption.

4.3.3. Adoption and Adaptation

- Broader Adoption and Ecosystem Development:

The widespread adoption of platforms such as Ethereum, Solana, and Cardano has led to the creation of rich ecosystems encompassing everything from Decentralized Finance (DeFi) and Non-Fungible Tokens (NFTs) to supply chain management solutions.

This extensive utilization has generated powerful network effects that significantly increase the platforms' value and usability.

In contrast, the more focused approach of the five smaller platforms has resulted in limited but intense adoption within specific industries or use cases, potentially restricting the breadth of their network effects while deepening their impact within chosen sectors.

For instance, Kusama does not aim to become a large-scale blockchain project; instead, it targets experienced and specialized developers who experiment with high-risk innovations. The narrow size of this target audience inherently limits Kusama's growth potential but strengthens its technical relevance within that niche.

- Community Participation and Growth:

The top-tier platforms benefit from larger and more diverse communities, which drive innovation and adoption through numerous initiatives and decentralized applications.

The smaller group, while supported by smaller but highly specialized communities, contributes meaningfully to niche advancements in blockchain application and development. Their targeted engagement creates deep expertise rather than broad mainstream appeal.

4.3.4. Technological Approach and Focus

- General Services vs. Specialization:

The technological frameworks of the top five platforms are designed to be highly adaptable, capable of supporting a wide range of functionalities and use cases.

In contrast, the smaller platforms adopt the opposite strategy - their architectures are specifically tailored to address focused problems and the needs of smaller market segments.

- Innovation in Response to Challenges:

Both groups exhibit strong innovation capacity, yet their areas of focus differ.

The major platforms aim to resolve the three foundational challenges of blockchain technology-scalability, security, and decentralization-on a macro scale.

Meanwhile, the smaller platforms tend to innovate as responses to more targeted challenges, such as enhancing transaction privacy, reducing energy consumption, or integrating blockchain technology into existing business processes.

Conclusion

This book first examined platform economies and then focused on smart contract platforms operating within one such ecosystem -blockchain technology.

The study identified that the blockchain platforms under examination utilize smart contracts across a variety of industries: Smart contracts are applied in finance to automate payments and develop decentralized finance (DeFi) applications; in supply chain management to track product journeys and ensure authenticity; in real estate to facilitate property transactions; in healthcare to securely manage patient data; in insurance to automate claim processing; and in legal services to execute and enforce agreements automatically. These applications demonstrate the versatility of smart contracts in automating transactions, reducing fraud, and eliminating intermediary costs.

Among the platforms analyzed in this book, the top five by market capitalization -Ethereum, Solana, Cardano, Avalanche, and Polkadot- have effectively set industry standards in areas such as security, transparency, scalability, interoperability, and decentralization. Their high market valuations, extensive client bases, active community participation, and foundational roles within the blockchain ecosystem serve as strong evidence of their industry leadership. The breadth of services they offer, combined with speed and scalability, positions these organizations as broad-service providers capable of meeting the needs of a general blockchain user base.

In contrast, the second group -Kusama, Cartesi, VeThor Token, Horizen, and Aergo- presents specialized solutions designed to address specific challenges within the blockchain field. From enhancing privacy and security to integrating blockchain with traditional development environments and enterprise systems, these platforms illustrate how blockchain technology can adapt to serve diverse and focused needs.

Although the contributions of this second group may appear more limited in scope, their innovative nature makes them highly significant. Moreover, smaller organizations inherently possess greater flexibility and freedom to experiment, allowing them to test new approaches and implement innovations at a pace that larger entities often cannot match.

In the case study section of this research, ten smart contract platforms officially listed on the U.S.-based Coinbase exchange were analyzed in depth. These ten blockchain projects were compared across identical parameters. The analysis revealed that core value-creating factors -including decentralization, transparency, security, interoperability, energy efficiency, tokenization, scalability, and speed- have a profound impact on the success and market positioning of these platforms.

Key Findings

- **Decentralization emerged as the cornerstone of success for blockchain projects.** The distributed structure was found to enhance system resilience. Leading platforms utilize decentralization to prevent monopolization of control by a single entity, thereby fostering trust among users and developers.
- **Transparency was identified as a fundamental feature of blockchain technology and a critical factor in attracting users and developers.** It forms the basis of robust decentralized economies by enabling verifiable, secure exchanges of information and value.
- **Security was emphasized as one of the top priorities of blockchain platforms.** The examined projects were observed to make significant investments in cryptographic techniques and validation mechanisms to safeguard against fraud and cyberattacks.

These three factors-decentralization, transparency, and security-were consistently observed as indispensable prerequisites for blockchain platforms.

- **Interoperability was determined to be crucial for the widespread adoption of blockchain technology.** Platforms that enable seamless communication and value exchange between different blockchain networks are laying the foundation for a more connected and efficient blockchain ecosystem. As the number of blockchain platforms increases, interoperability-initially an absent feature-has evolved into a key criterion of success within the industry. With the growing number of blockchain platforms, interoperability -which did not exist as a success criterion in the early stages of blockchain development -has evolved into a key determinant of market competitiveness.

- **Energy efficiency has gained prominence amid rising concerns about the environmental impact of blockchain operations.** Platforms prioritizing energy-efficient validation mechanisms contribute to sustainability while also attracting environmentally conscious users and developers. Moreover, energy efficiency was found to influence cost and pricing structures. A high cost blockchain is not only environmentally detrimental but also non-competitive. Therefore, reducing energy expenses to enable competitive pricing has been identified as another critical success factor.
- **Tokenization has revolutionized asset management and ownership.** The digital representation of assets has opened new avenues for investment, trade, and ownership transfer. All examined platform economies utilize their native tokens both to create value and to facilitate internal transactions, reward mechanisms, and ecosystem governance. The ability to sustain a self-sufficient ecosystem through token use was observed as another measure of success in independent blockchain creation.
- **Scalability and speed were identified as critical to user experience and operational efficiency within blockchain networks.** Leading platforms have invested heavily in research and experimentation to overcome the challenges of scalability and transaction throughput, enabling high-volume and high-speed applications. Competing with traditional payment systems such as Visa and Mastercard and meeting the real-time financial needs of billions of users globally, requires scalability and speed to be treated as central performance parameters in blockchain innovation.

In conclusion, it has been emphasized that for blockchain platforms to achieve success within the platform economy, they must adopt a multidimensional strategic approach. The study found that successful platforms have achieved strong market positions by focusing on core factors such as decentralization, transparency, security, interoperability, energy efficiency, tokenization, scalability, and speed.

As blockchain technology continues to evolve, these value-creating elements will remain pivotal in shaping the future of decentralized digital economies, providing essential pathways for innovation and sustainable growth in a rapidly transforming environment.

The comparative analysis of ten blockchain platforms, divided into two groups based on their fundamental objectives and operational scopes, revealed

key distinctions as well as shared traits that underscore their respective contributions to the blockchain ecosystem.

The first group -Ethereum, Solana, Cardano, Avalanche, and Polkadot- represents a broad-based, infrastructural approach aimed at fostering a versatile environment for decentralized applications (dApps) across multiple sectors. These platforms serve as general-purpose blockchains, enabling a wide range of applications-from smart contracts and decentralized finance (DeFi) to non-fungible tokens (NFTs). Regarded as the foundational pillars of the blockchain domain, these projects have attained strong market presence by building robust network effects through widespread adoption and ecosystem development.

In contrast, the second group -Kusama, Cartesi, VeThor Token, Horizen, and Aergo- focuses on addressing specialized challenges or serving niche market segments within the blockchain landscape. This group distinguishes itself through targeted technological innovations -for example, Horizen's zk-SNARKs implementation to enhance transaction privacy or Cartesi's Linux-based virtual machine for smart contract execution-serving needs such as privacy enhancement, enterprise blockchain integration, and developer accessibility.

Despite their innovative contributions, these platforms generally exhibit more limited market visibility, often functioning as complementary components within the broader blockchain ecosystem.

The fundamental differences between these two groups lie in operational scale and scope, market positioning and recognition, and the nature of their adoption and network effects. While the first group supports a wide spectrum of blockchain applications and benefits from extensive market visibility, the second group provides specialized depth, focusing on solving particular technical or sectoral challenges.

In summary, this analysis elucidates the complementary dynamics between broad, infrastructural blockchain platforms and those focused on niche or specialized use cases. Together, they form a diverse and comprehensive blockchain ecosystem, serving both general-purpose applications and specialized needs, thereby reflecting the multifaceted evolution and cross-sector adaptability of blockchain technology.

Answers to the Research Questions

At the beginning of this study, several research questions were outlined. Their answers, based on the findings and analyses presented throughout the research, are summarized below:

1. Key Value-Enhancing Factors in Blockchain-Based Platform Economies

Blockchain-based platform economies differentiate themselves through several key value-enhancing factors, including decentralization, transparency, security, interoperability, scalability and speed, energy efficiency, and tokenization.

- **Decentralization:** Unlike traditional digital ecosystems, blockchain platforms operate within decentralized networks that reduce dependence on central authorities and intermediaries. This structure enhances trust among participants and significantly lowers transaction costs.
- **Scalability and Speed:** Blockchain technology offers substantial scalability potential by increasing transaction capacity and speed. This allows blockchain networks to process large volumes of transactions rapidly, ensuring users can complete operations without delays. Transaction speed and scalability are particularly critical for blockchain's applicability in sectors requiring real-time responsiveness, such as finance and trade.
- **Transparency:** Blockchain provides a unique form of transparency through verifiable and immutable transaction records. On permissionless networks, data can be viewed by all participants, on permissioned ones, by authorized entities. This transparency increases trust and accountability across the ecosystem.
- **Security:** Advanced security mechanisms intrinsic to blockchain -such as cryptographic hashing and consensus algorithms- protect against fraud and unauthorized access, strengthening the integrity of the system.
- **Interoperability:** Many blockchain platforms are designed to enable seamless interaction and value exchange across different blockchain networks. Platforms that fail to achieve interoperability risk becoming obsolete in a rapidly integrating digital environment.
- **Energy Efficiency:** Blockchain technologies have the potential to provide more environmentally friendly alternatives to traditional financial systems by optimizing energy consumption and sustainability. Energy-efficient consensus mechanisms such as Proof of Stake (PoS) significantly reduce large-scale energy usage, lowering blockchain's carbon footprint and promoting a more sustainable digital ecosystem.

- **Tokenization:** Blockchain enables the digital representation of assets -a process known as tokenization- which facilitates transactions, enhances liquidity, and enables new forms of economic modeling and innovation.

2. Competitive Advantages and Constraints in Blockchain-Based Platform Economies through Porter's Five Forces Model

Within the context of Michael Porter's Five Forces Model, blockchain-based platform economies exhibit unique competitive advantages as well as structural constraints that distinguish them from traditional digital platforms.

- **Threat of New Entrants:**

In both platform and blockchain technologies, significant barriers to entry exist. For platforms, the challenge lies in achieving sufficient user and content scale, while for blockchain, barriers include the need for qualified technical expertise, high infrastructure costs, and complex technological requirements. Additionally, factors such as differing legal regulations across countries and the importance of brand recognition further heighten entry barriers for new players.

- **Threat of Substitutes:**

Technological innovations and price-performance ratios shape the potential for substitute products and services. In blockchain, the ease or cost of switching between platforms influence the likelihood of substitution, while differentiation in design and performance constrains users' switching behavior.

- **Bargaining Power of Suppliers:**

This factor is particularly relevant in relation to hardware providers and blockchain validators. An increase in supplier power could potentially undermine the decentralized and distributed nature of blockchain networks by concentrating control or creating dependency on specific technological suppliers.

- **Bargaining Power of Buyers:**

Transparency and differentiation directly influence buyers' decision-making power in both platform and blockchain economies. Blockchain technology empowers users by reducing dependency on centralized intermediaries, enhancing user trust and choice compared to traditional systems.

- **Intensity of Rivalry:**

The competitive intensity within blockchain markets is defined by factors such as differentiation, innovation, and strategic alliances. These dynamics are

critical for firms seeking to maintain or strengthen their competitive positions. Consequently, blockchain and platform technologies reshape industry dynamics and strategic behavior, creating high adaptation barriers for new entrants.

3. Framework for Evaluating the Impact of Blockchain on Platform Performance and User Outcomes

To evaluate how blockchain's value-enhancing factors affect platform performance and user outcomes, a comprehensive evaluation framework should include the following components:

- **Technical Assessment:**

Evaluation of the underlying blockchain technology, including scalability, transaction speed, interoperability, and the type of consensus mechanism employed.

- **Economic Models:**

Analysis of economic incentives, tokenomics, and the mechanisms through which value is distributed among participants.

- **Governance Structures:**

Examination of decision-making processes, dispute-resolution mechanisms, and the management of protocol updates or structural changes within the platform.

- **User Engagement and Network Effects:**

Metrics to assess user adoption, community participation, and the resulting network effects that enhance platform value and resilience.

- **Legal Compliance and Risk Management:**

Analysis of the regulatory frameworks governing the platform, and the strategies employed to manage operational, legal, and financial risks.

4. Contribution to Platform Ecosystem Performance

The identified value-enhancing factors collectively contribute to the performance of blockchain-based platform ecosystems by improving efficiency, fostering innovation, and attracting a wider user base.

Decentralization and transparency build trust while reducing operational costs. Security features appeal to users concerned about data integrity and privacy. Interoperability expands the platform's utility and attractiveness by enabling cross-platform services and collaborations. Tokenization facilitates new business models and asset classes, unlocking novel economic opportunities. These factors

are most effective in environments that prioritize trust, security, and open collaboration, forming the backbone of competitive blockchain ecosystems.

5. Comparative Analysis of Blockchain-Based Platform Ecosystems

Different blockchain platforms exhibit varying strengths depending on their strategic focus.

Some prioritize speed and efficiency (e.g., *Solana*), while others emphasize privacy (e.g., *Horizen*) or interoperability (e.g., *Polkadot*). For effective platform strategy and management, it is crucial to clearly define the unique value proposition, understand the target user base, and maintain competitiveness through continuous innovation. Strategic partnerships and adherence to regulatory standards are also vital for long-term success.

Theoretical and Practical Implications of the Research

The examination of the value-enhancing factors of blockchain technology reveals significant theoretical and practical implications for the design and management of digital ecosystems.

From a theoretical perspective, trust - the cornerstone of blockchain's appeal - transcends traditional dependence on centralized authorities by fostering a decentralized environment in which transactions and interactions are transparent and immutable. This decentralization strengthens security by distributing data across numerous nodes, reducing single points of failure. At the same time, it empowers users with greater control over their digital assets and interactions, thereby embodying the theoretical ideals of a democratized digital infrastructure.

From a practical standpoint, the implementation of blockchain technology requires substantial investment in technological infrastructure. This necessity extends beyond the mere conceptual adoption of blockchain; it involves the deployment of high-performance, scalable solutions capable of meeting the demands of a growing user base and the complexity of modern digital applications. Blockchain architecture must be resilient to various threats and capable of handling increased transaction volumes -a hallmark of successful platforms.

Additionally, the development of clear and well-structured economic incentives emerges as a crucial practical consideration. Blockchain ecosystems depend on active participation, which is largely influenced by incentive structures. Such economic models, often expressed through token economies, must be designed to align the interests of all stakeholders, users, developers, validators, and investors. By offering tangible rewards for contribution and

engagement, platforms can maintain continuous participation and drive sustainable growth.

Community engagement is another critical determinant of practical success. In the digital era, active communities not only contribute to the technical development and security of platforms -through activities such as code review and consensus participation- but also play a central role in governance. Vibrant communities advocate for the platform, attract new users, and contribute to its evolution through feedback and innovation. Hence, fostering an interactive and active community is essential to maintaining dynamism and relevance in the rapidly evolving blockchain landscape.

Scalability and regulatory compliance also present both challenges and opportunities.

Scalability ensures that as a platform expands, it can continue to deliver fast and cost-effective services without compromising on security or user experience.

Meanwhile, navigating the complex legal landscape surrounding digital assets and blockchain requires continuous dialogue with regulatory authorities. Compliance not only mitigates legal risks but also enhances credibility among users and institutional partners.

When developing a blockchain platform's value propositions, it is essential to tailor its offerings to meet specific market needs while leveraging blockchain's intrinsic capabilities.

Aligning the platform's technological strengths with market demands -whether through privacy features, financial services, supply chain solutions, or other applications- enables blockchain platforms to position themselves as indispensable instruments within the digital economy.

In conclusion, by adhering to these principles, stakeholders within the blockchain ecosystem can optimize their strategies and promote environments that are technologically advanced, secure, user-centered, scalable, and legally compliant. Such a balance ensures long-term success and sustainability in the evolving global digital landscape.

Suggestions for Future Research

Future research on blockchain can significantly enhance our understanding of its potential, limitations, and impacts across different industries. Given the continuous evolution of blockchain and the expansion of its application areas, further in-depth investigations are required to fully unlock its potential and address emerging challenges.

Particular attention should be given to blockchain-based currencies, decentralized finance (DeFi) platforms, and stablecoins, which represent some of the most transformative and rapidly developing domains.

- **Comparative Analysis of Blockchain Currencies:**

Future studies could focus on the design, governance models, scalability solutions, and market adaptation of various blockchain-based currencies. Such research would offer valuable insights into the factors contributing to their success or challenges in achieving widespread use and long-term stability.

- **Decentralized Finance (DeFi) Platforms:**

In-depth exploration of DeFi systems represents another promising research direction. Future studies could analyze their impact on traditional financial systems, assess their risks and regulatory challenges, and investigate how DeFi innovations can enhance financial inclusion, transparency, and security.

- **Stablecoin Mechanisms and Their Impact:**

Research on stablecoin mechanisms and their effects on both the cryptocurrency market and traditional financial systems is critical. Studies could examine different stabilization strategies, evaluate their efficiency in reducing volatility, and explore their roles in facilitating transactions and regulatory compliance.

- **Interoperability Among Blockchain Platforms:**

Research focusing on interoperability issues and solutions across blockchain networks could yield valuable insights. This includes examining technical challenges, data-sharing mechanisms, and security considerations related to cross-chain transactions.

- **Blockchain in Supply Chain Management:**

The application of blockchain in supply chain management presents a rich area for future inquiry. Studies could evaluate blockchain's real-world impact on transparency, efficiency, and traceability in supply chains across different industries.

- **Blockchain for Social Applications:**

Investigating blockchain's potential to address social and environmental challenges is another important research avenue. Possible areas include digital identity verification, voting systems, renewable energy trading, and philanthropy.

- Privacy and Security in Blockchain Systems:

As privacy and security remain global concerns, future studies could examine advanced cryptographic techniques, privacy-preserving tools, and evolving security protocols within blockchain networks, contributing to the development of safer and more private blockchain solutions.

- Adoption and User Behavior in Blockchain Ecosystems:

Understanding the factors influencing blockchain adoption and user behavior can provide critical insights for developers, businesses, and policymakers. This research area could explore user motivations, adoption barriers, and how user interface design influences engagement and participation.

- Economic Models of Blockchain Networks:

Studies on token economics represent another key direction for future inquiry. This research could investigate how tokens drive behavior, encourage participation, and sustain the long-term growth and viability of decentralized networks.

By addressing these topics, scholars and practitioners can contribute to the responsible advancement of blockchain technology and ensure its sustainable development across the global economy.

Moreover, this research extends beyond academia - serving as a critical resource for policymakers and industry leaders seeking to understand blockchain's broader implications and to design regulatory environments that foster secure, decentralized, and innovative technologies.

In essence, this book represents a significant academic effort to unravel the complexities of blockchain within platform economies. The findings and perspectives presented here offer a valuable roadmap for blockchain entrepreneurs, users, and researchers, guiding future exploration and implementation within this transformative technological domain.

Sources

- Abra (N.D.). *The world's computer*. Access Address: <https://www.abra.com/resources/worlds-computer/>. Access Date: 24 February 2024
- Adams J. (2023). *Scalability challenges in cardano (ada): addressing growth issues*. Access Address: <https://www.doubloin.com/learn/cardano-scalability-challenges>. Access Date: 24 February 2024
- Adams, M. (2024). *Crypto.com review 2024*. Access Address: <https://www.forbes.com/advisor/investing/cryptocurrency/crypto-com-review>. Access Date: 24 February 2024
- Adelakun, A. (2020). Should porters five forces have value in businesses today. *Computing for Business (BSC)*, 3.
- Admin (2018). *Do you really know the difference between smart contracts and dapps?* Access Address: <https://webcomsystem.net/blog/smart-contracts-and-dapps/>. Access Date: 24 February 2024
- Aergo Home page. (2019). *Home page*. Access Address: <https://www.aergo.io/>. Access Date: 24 February 2024
- Aergo Community (2024). *Expand network aergo community*. Access Address: <https://www.aergo.io/community>. Access Date: 24 February 2024
- Aergo Comparison (2024). *Comparing to other blockchain*. Access Address: <https://www.aergo.io/>. Access Date: 24 February 2024
- Aergo Consensus Algorithm (2024) *Consensus algorithm*. Access Address: <https://aergo.readthedocs.io/en/2.1/specs/consensus.html>. Access Date: 24 February 2024
- Aergo Home Page. (2024). *What is possible with aergo. 2024* Access Address: <https://www.aergo.io/>. Access Date: 24 February 2024
- Aergo SQL (2024). *SQL*. Access Address: <https://aergo.readthedocs.io/en/2.2/smart-contracts/sql>. Access Date: 24 February 2024
- Aergo White Paper. (2019). *Aergo white paper*. Access Address: <https://whitepaper.io/coin/aergo>. Access Date: 24 February 2024

- Ahmed, M., Sharif, L., Kabir, M. & Al-Maimani, M. (2012). Human errors in information security. *International Journal*, 1(3), 82.
- Akansha (2023). *Ipr implications in the world of digital currency*. Access Address: <https://www.globalipconvention.com/blog/ipr-implications-in-the-world-of-digital-currency>. Access Date: 24 February 2024
- Alchemy (2023). *List of 25 decentralized exchanges (dexs) on solana*. Access Address: <https://www.alchemy.com/list-of/decentralized-exchanges-dexs-on-solana>. Access Date: 24 February 2024
- Alchemy Avalanche Alternatives (2024). *Avalanche alternatives-factors to consider when choosing an alternative to avalanche*. Access Address: <https://www.alchemy.com/alternatives/avalanche>. Access Date: 24 February 2024
- Ammous, S. (2016). Blockchain technology: what is it good for. *SSRN 2832751*, 1.
- Anderson, C. (2007). Chris Anderson, “The Long Tail: How Endless Choice is creating Unlimited Demand. The New Economics of Culture and Commerce.” Random House Business Books, 2006. *Journal of Cultural Economics*, 31(3), 235-237. <https://doi.org/10.1007/s10824-007-9038-7>
- Anderson, C. (2010). *Free: how today's smartest businesses profit by giving something for nothing*. Random House, New York, ISBN 190521149X, 9781905211494.
- Andriotis, K. (2004). Revising Porter's five forces model for application in the travel and tourism industry. *Tourism today*, 4(1), 131-145.
- Antier (2024). Top 5 real-life blockchain use cases in supply chain in 2024. Access Address: <https://www.antiersolutions.com/top-5-real-life-blockchain-use-cases-in-supply-chain-in-2023/>. Access Date: 24 February 2024
- Antolin M. (2023). *What is proof-of-authority? it's a consensus system that allows only authorized entities to validate transactions in a blockchain network*. Access Address: <https://www.coindesk.com/learn/what-is-proof-of-authority/>. Access Date: 24 February 2024
- Arun, J. S., Cuomo, J. & Gaur, N. (2019). *Blockchain for business*. Addison-Wesley Professional, 33.
- Atomic Wallet (2024). *What is avalanche (avax) and what are the benefits?* Access Address: <https://atomicwallet.io/academy/articles/what-is-avalanche-avax-and-what-are-the-benefits>. Access Date: 24 February 2024
- Avalanche Home page. (2020). *Home page*. Access Address: <https://www.avax.network/>. Access Date: 24 February 2024
- Avalanche AVAX. (2020). *Avalanche white paper*. Access Address: <https://whitepaper.io/coin/avalanche>. Access Date: 24 February 2024
- Avalanche Chains (2024). *What are the differences between the x, p, and c-chains?* Access Address: <https://support.avax.network/en/articles/6077308->

- what-are-the-differences-between-the-x-p-and-c-chains. Access Date: 24 February 2024
- Avalanche Consensus (2024). *Avalanche consensus*, Access Address: <https://docs.avax.network/learn/avalanche/avalanche-consensus>. Access Date: 24 February 2024
- Avalanche DeFi (2024). *Decentralized finance (defi), your guide to decentralized finance (defi) on avalanche*. Access Address: <https://www.avax.network/decentralized-finance-defi>. Access Date: 24 February 2024
- Avalanche Ecosystem (2024). *Explore the ecosystem*. Access Address: <https://www.avax.network/community/#Explore-The-Ecosystem>. Access Date: 24 February 2024
- Avalanche P-C-X Chains (2022). *Avalanche: what is p-chain, c-chain and x-chain?*. Access Address: <https://www.altcoinbuzz.io/spotlight/avalanche-what-is-p-chain-c-chain-and-x-chain/>. Access Date: 24 February 2024
- Avalanche White Paper (2024). <https://www.avalabs.org/whitepapers>, Access Date: 24 February 2024.
- Avax Network Community (2024). *learn, earn & grow in the avalanche community*. Access Address: <https://www.avax.network/community>. Access Date: 24 February 2024
- Avax Validators (2024). *Keep avalanche. secure. earn avax*. Access Address: <https://www.avax.network/validators>. Access Date: 24 February 2024
- Axelsen, H., Jensen, J. R. & Ross, O. (2022). When is a dao decentralized? *Complex Systems Informatics and Modeling Quarterly (CSIMQ)*, Article 176, Issue 31, June/July 2022, 51–75.
- Baburaj, Y. & Narayanan, V. K. (2016). Five forces framework. *m. augier, & d. teece, The Palgrave Encyclopedia of Strategic Management*. Stanford: Palgrave Macmillan, 3.
- Back, A. (1997). *Hashcash*. Access Address: <http://www.hashcash.org>. Access Date: 24 February 2024
- Barney N. & Lawton, G (2023). *Definition smart contract*, tech target. Access Address: <https://www.techtarget.com/searchcio/definition/smart-contract>. Access Date: 24 February 2024
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120.
- Belgem.io (2019) *Bankalararası kart merkezi, ödüllü blokzincir uygulamasıyla sektöre ilham vermeye devam ediyor*. Access Address: https://bkm.com.tr/wp-content/uploads/2015/06/basari_hikayesi_belgemio.pdf. Access Date: 24 February 2024

- Beltran, L. (2021). *Coinbase's ipo lived up to the hype. here's how it did*. Access Address: <https://www.barrons.com/articles/coinbase-alkami-set-to-open-for-trading-today-51618410683>. Access Date: 24 February 2024
- Berg, N. & Knights, M. (2021). *Amazon: how the world's most relentless retailer will continue to revolutionize commerce*. Kogan Page Publishers, 2.
- Binance Aergo (2019). *Aergo an enterprise blockchain platform optimized for hybrid deployments*. Access Address: <https://www.binance.com/en/research/projects/aergo>. Access Date: 24 February 2024
- Binance Cartesi (2024). *project value proposition*. Access Address: <https://www.binance.com/en/research/projects/cartesi>. Access Date: 24 February 2024
- Bitcoin Magazine (2018). *The genesis files: hashcash or how adam back designed bitcoin's motor block*, Access Address: <https://www.nasdaq.com/articles/the-genesis-files:-hashcash-or-how-adam-back-designed-bitcoins-motor-block-2018-06-04>. Access Date: 24 February 2024
- Bitdegree (N.D.). *what is transactions per second (tps)*. Access Address: <https://www.bitdegree.org/crypto/learn/crypto-terms/what-is-transactions-per-second-tps>. Access Date: 24 February 2024
- Blockchain Council Avalanche (2024). *avalanche advantages (avax)*. Access Address: <https://www.blockchain-council.org/blockchain/what-is-avalanche-avax/>. Access Date: 24 February 2024
- Blockchain Interoperability (2023). *Understanding the challenges and opportunities of blockchain interoperability*. Access Address: <https://blog.bingx.com/insights/bingx-insights/understanding-the-challenges-and-opportunities-of-blockchain-interoperability/>. Access Date: 24 February 2024
- Blockchain Türkiye (2019). *BKM blockchain uygulaması ile sektöre ilham veriyor*. Access Address: <https://bctr.org/bkm-blockchain-uygulamasi-ile-sektore-ilham-veriyor-10315/>. Access Date: 24 February 2024
- Blocko (2024). *Introduction to blocko*. Access Address: <https://en.blocko.io/about-us/> Access Date: 24 February 2024
- Boogard A. V. D. (2024). *Kusama: everything you need to know-benefits of kusama*. Access Address: <https://weareblox.com/en-eu/kusama>. Access Date: 24 February 2024
- Boom Social: Enes Batur (2024). *Enes Batur*. Access Address: <https://www.boomsocial.com/YouTube/Kanal/@newdaynewgame>. Access Date: 24 February 2024
- Boom Social: Tarkan (2024). *Tarkan*. Access Address: <https://www.boomsocial.com/Instagram/Hesap/tarkan-351508>. Access Date: 24 February 2024
- Borsa İstanbul (2018). *Türkiye'nin ilk finansal blockchain projesi borsa istanbul bilişim teknolojileri ekibi tarafından hayata geçirildi*. Access Address: <https://www.borsaistanbul.com/tr/duyuru/1096/turkiyenin-ilk-finansal>

- blockchain-projesi-borsa-istanbul-bilisim-teknolojileri-ekibi-terafindan-hayata-gecirildi. Access Date: 24 February 2024
- Botsman, R. & Rogers, R. (2010). *What's mine is yours: the rise of collaborative consumption*. Collins: London, UK.
- Bruijl, D. G. H. T. (2018). The relevance of porter's five forces in today's innovative and changing business environment. *Available at SSRN 3192207*.
- Bybit Aergo (2024). *Aergo key features-scalability*. Access Address: <https://learn.bybit.com/blockchain/what-is-aergo-crypto>. Access Date: 24 February 2024
- ByBitLearn, (2023). *Nominated proof of stake (npos)*. Access Address: <https://learn.bybit.com/glossary/definition-nominated-proof-of-stake-npos/>. Access Date: 24 February 2024
- Cafferky, M. E. (2005). The porter's five-forces industry analysis framework for religious nonprofits: a conceptual analysis. Access Address: https://knowledge.e.southern.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1003&context=facworks_bus. Access Date: 24 February 2024
- Capaccioli, G. (2023). *European union: mica and its impact on blockchain and crypto assets*. affidavit blog. Access Address: <https://affidaty.io/blog/en/2023/06/european-union-mica-blockchain-assets>. Access Date: 24 February 2024
- Cardano Home page (2020). *Home page*. Access Address: <https://www.Cardano.org>. Access Date: 24 February 2024
- Cardano Computational Layer (2024). <https://why.cardano.org/en/introduction/cardano-computation-layer/> Access Date: 24 February 2024.
- Cardano Docs (2024). *Relevant research papers and specifications*. Access Address: <https://docs.cardano.org/explore-cardano/relevant-research-papers>. Access Date: 24 February 2024
- Cardano Docs Interoperability (2024). *Interoperability*. Access Address: <https://docs.cardano.org/new-to-cardano/why-use-cardano>. Access Date: 24 February 2024
- Cardano Foundation (2024). *Cardano foundation*. Access Address: <https://cardanofoundation.org>. Access Date: 24 February 2024
- Cardano Governance (2024). *Built for the community by the community*. Access Address: <https://cardano.org/governance/>. Access Date: 24 February 2024
- Cardano Ouroboros (2024). *Ouroboros, an environmentally sustainable, verifiably secure proof-of-stake protocol with rigorous security guarantees..* Access Address: <https://cardano.org/ouroboros/>. Access Date: 24 February 2024

- Cardano Voltaire (2024). *Why voltaire*. Access Address: <https://cardano.org/governance>. Access Date: 24 February 2024
- Cardano White Paper. (2020). *Cardano white paper*. Access Address: <https://whitepaper.io/coin/cardano>. Access Date: 24 February 2024
- Carr, C. T. & Hayes, R. A. (2015). Social media: defining, developing, and divining. *Atlantic Journal of Communication*, 23(1), 46.
- Carta Team (2023). *What is market cap*, Carta. Access Address: <https://carta.com/blog/what-is-market-cap/>. Access Date: 24 February 2024
- Cartesi About (2024). *Cartesi about*. Access Address: <https://cartesi.io/about>. Access Date: 24 February 2024
- Cartesi Home page (2018). *Home page*. Access Address: <https://cartesi.io>. Access Date: 24 February 2024
- Cartesi Compute (2024). *Overview cartesi compute, what is cartesi compute sdk*. Access Address: <https://docs.cartesi.io/compute/overview>. Access Date: 24 February 2024
- Cartesi Governance (2024). *Governance*. Access Address: <https://governance.cartesi.io>. Access Date: 24 February 2024
- Cartesi Governance and Grants (2024). *Governance and grants*. Access Address: <https://cartesi.io/governance>. Access Date: 24 February 2024
- Cartesi Node (2024). *Run a private node*. Access Address: <https://docs.cartesi.io/earn-ctsi/run-node>. Access Date: 24 February 2024
- Cartesi Overview (2024). *Overview, what is a blockchain rollup*. Access Address: <https://docs.cartesi.io/cartesi-rollups/overview/>. Access Date: 24 February 2024
- Cartesi White Paper (2018). *Scalability*. Access Address: https://cartesi.io/cartesi_whitepaper.pdf. Access Date: 24 February 2024
- Çelik, G. (2023). *Faruk fatih özer'e rekor ceza*, Access Address: <https://www.ntv.com.tr/turkiye/thodex-davasinda-karar-cikti-faruk-fatih-ozere-rekor-ceza>. Access Date: 24 February 2024
- Ceylan, O. & Isik, A. H. (2023). Blokzincir teknolojisi ve uygulama alanları. *Uluborlu Mesleki Bilimler Dergisi*, 6(1), 130.
- Chain Debrief (2023). *Blockchains with the highest developers count in 2023*. Access Address: <https://chaindebrief.com/blockchains-with-the-highest-developers-count-in-2023> . Access Date: 24 February 2024
- Chainalysis Team (2023). *\$197 Million stolen: euler finance flash loan attack explained*. Chainalysis. 2023, March 15. Access Address: <https://www.chainalysis.com/blog/euler-finance-flash-loan-attack>. Access Date: 24 February 2024

- Chaum, D. (1982). *Computer systems established, maintained and trusted by mutually suspicious groups*. Access Address: <https://evervault.com/papers/chaum>. Access Date: 24 February 2024
- Chavez-Dreyfuss, G. ve Price, M. (2021). *How hackers stole \$613 million in crypto tokens from poly network*. *reuters*. Access Address: <https://www.reuters.com/technology/how-hackers-stole-613-million-crypto-tokens-poly-network-2021-08-12>. Access Date: 24 February 2024
- Church, Z. (2017). *Blockchain explained, ideas to matter*, MIT Sloan. Access Address: <https://mitsloan.mit.edu/ideas-made-to-matter/blockchain-explained>. Access Date: 24 February 2024
- Clark, M. (2021). *Blocks? chains? how does this whole thing work? verge*. Access Address: <https://www.theverge.com/22654785/blockchain-explained-cryptocurrency-what-is-stake-nft>. Access Date: 24 February 2024
- Codementor (2022). *Blockchain scalability: challenges and recent developments*. Access Address: <https://www.codementor.io/blog/blockchain-scalability-5rs5ra8eej>. Access Date: 24 February 2024
- Cohen L. & Godoy J. (2023). *Sam bankman-fried convicted of multi-billion dollar ftx fraud*. Access Address: <https://www.reuters.com/legal/ftx-founder-sam-bankman-fried-thought-rules-did-not-apply-him-prosecutor-says-2023-11-02>. Access Date: 24 February 2024
- Coinbase (2023). *Our approach to preventing illicit activity in crypto*. Access address: <https://www.coinbase.com/blog/our-approach-to-preventing-illicit-activity-in-crypto>. Access Date: 24 February 2024.
- Coinbase (2024). *Coinbase money transmission and e-money regulatory compliance*. Access address: <https://help.coinbase.com/en/coinbase/privacy-and-security/other/coinbase-regulatory-compliance>. Access Date: 24 February 2024.
- Coinbase Categories (2024). *Categories*. Access Address: <https://www.coinbase.com/trade>. Access Date: 24 February 2024
- Coinbase Currencies (2024). *Currencies*. Access Address: <https://www.coinbase.com/trade/asset-categories/currencies>. Access Date: 24 February 2024
- Coinbase DeFi (2024). *DeFi*. Access Address: https://www.coinbase.com/trade/asset-categories/defi_assets. Access Date: 24 February 2024
- Coinbase Ethereum (2024). *Ethereum*. Access Address: <https://www.coinbase.com/price/ethereum>. Access Date: 24 February 2024
- Coinbase Help (2024). *How is my cash insured?* Coinbase. Access Address: <https://help.coinbase.com/en/coinbase/other-topics/legal-policies/how-is-coinbase-insured>. Access Date: 24 February 2024
- Coinbase Smart Contracts (2024). *Smart contracts*. Access Address: https://www.coinbase.com/trade/asset-categories/smart_contract_platforms. Access Date: 24 February 2024

- Coinbase Stablecoins (2024). *Stablecoins*. Access Address: <https://www.coinbase.com/trade/asset-categories/stablecoins>. Access Date: 24 February 2024
- Coinmarketcap Aergo (2024) Coinmarketcap aergo. Access Address: About Aergo <https://coinmarketcap.com/currencies/aergo/#About>. Access Date: 24 February 2024
- Coinmarketcap Ethereum (2024). *About ethereum*. Access Address: <https://coinmarketcap.com/currencies/ethereum/#About>. Access Date: 24 February 2024
- Coinmarketcap Horizen (2024). *About horizen*. Access Address: <https://coinmarketcap.com/currencies/horizen>. Access Date: 24 February 2024
- Coinmarketcap Kusama (2024). *Kusama*. Access Address: <https://coinmarketcap.com/currencies/kusama/#About>. Access Date: 24 February 2024
- Coinmarketcap VeChain (2024). *About vechain*. Access Address: <https://coinmarketcap.com/currencies/vechain/#About>. Access Date: 24 February 2024
- Cointelegraph (2024) *Proof-of-stake vs. proof-of-work: pros, cons, and differences explained*. Access Address: <https://cointelegraph.com/learn/proof-of-stake-vs-proof-of-work-differences-explained>. Access Date: 24 February 2024
- Cointurk News (2024) *Ethereum maintains leadership as smart contract platform while injective rises*. Access Address: <https://en.coin-turk.com/ethereum-maintains-leadership-as-smart-contract-platform-while-injective-rises>. Access Date: 24 February 2024
- Cooling S. (2024). Techopedia, *Genesis block*. Access Address: <https://www.techopedia.com/definition/genesis-block>. Access Date: 24 February 2024
- Cristopher, B. (2023). *Cryptocurrency governance in the united states: unraveling the regulatory tapestry*. Access Address: https://medium.com/@bfuller_13290/cryptocurrency-governance-in-the-united-states-unraveling-the-regulatory-tapestry-ac30b6772548. Access Date: 24 February 2024
- Crooks, N. (2023). *Practical use cases of NFTs*. Access Address: <https://www.theblock.co/learn/251481/practical-use-cases-of-non-fungible-tokens>. Access Date: 24 February 2024
- Crypto APIs Team (2022). *What are dapps and what can you do with them?* Access Address: <https://cryptoapis.io/blog/66-what-are-dapps-and-what-can-you-do-with-them>. Access Date: 24 February 2024
- Cryptoeq Polkadot (2023). *Use case*. Access Address: <https://www.cryptoeq.io/corereports/polkadot-abridged>. Access Date: 24 February 2024
- Cryptopedia Staff (2022). *The early days of crypto exchanges*. Access Address: <https://www.gemini.com/cryptopedia/crypto-exchanges-early-mt-gox-hack>. Access Date: 24 February 2024

- Cryptopedia Staff (2023). *Polkadot's (dot) ambitious vision for web 3.0 aims to leverage blockchain technology to create a more private, decentralized internet*. Access Address: <https://www.gemini.com/cryptopedia/polkadot-crypto-dot-coin>. Access Date: 24 February 2024
- Curran, B. (2018). *The history of the coincheck hack: one of the largest heists ever*. *Blockonomi*. 2018, December 21. Access Address: <https://blockonomi.com/coincheck-hack>. Access Date: 24 February 2024
- Cusumano, M. A., Gawer, A. & Yoffie, D. B. (2019). *The business of platforms: strategy in the age of digital competition, innovation, and power* (Vol. 320). New York: Harper Business.
- Dai, C. (2020). DEX: A dapp for the decentralized marketplace. *Blockchain and Crypt Currency*, 95.
- Dälken, F. (2014). *Are porter's five competitive forces still applicable? a critical examination concerning the relevance for today's business* (Bachelor's thesis, University of Twente).
- Davydov, V. & Khalilova, M. (2019). Business model of creating digital platform for tokenization of assets on financial markets. In *IOP Conference Series: Materials Science and Engineering* 2019, March. (497, 1, 012069). IOP Publishing.
- DeLisa, N. T. (2015). You (Tube). Me, and content id: paving the way for compulsory synchronization licensing on user-generated content platforms. *Brook. L. Rev.*, 81, 1275.
- Deniz, S. (2019). *Ripple teknolojisi kullanan Akbank, blockchain kullanan ilk Türk bankası oldu!* cointral, Access Address: <https://cointral.com/tr/ripple-teknolojisi-kullanan-akbank-blockchain-kullanan-ilk-turk-bankasi-oldu>. Access Date: 24 February 2024
- Derave, T., Prince Sales, T., Gailly, F. & Poels, G. (2021). Comparing digital platform types in the platform economy. In *International Conference on advanced information systems engineering 2021, June*. (pp. 417-431). Cham: Springer International Publishing.
- Devpost (2024). The Home for blockchain hackathons. Access Address: <https://devpost.com/c/blockchain>. Access Date: 24 February 2024
- Dewey, J. & Patel S. (2024). *Blockchain & cryptocurrency laws and regulations 2024 | USA*. Access Address: <https://www.globallegalinsights.com/practice-areas/blockchain-laws-and-regulations/usa>. Access Date: 24 February 2024
- Distributed Networks Institute (2022). *Wormhole hack: code vulnerability has led to \$325 million stolen*. Access Address: <https://hjkvfr.github.io/dn-institute/attacks/posts/2022-02-02-Wormhole>. Access Date: 24 February 2024

- Dobbs, M. E. (2012). Porter's five forces in practice: templates for firm and case analysis. In *Competition forum* (Vol. 10, No. 1, p. 24). American Society for Competitiveness.
- Docs.VeChain (2024). *Dual-token economic model*. Access Address: <https://docs.vechain.org/introduction-to-vechain/dual-token-economic-model>. Access Date: 24 February 2024
- Dunn, J. (2022). *4 blockchain real estate startups shaking up property investment*. Access Address: <https://espeo.eu/blog/blockchain-real-estate-startups>. Access Date: 24 February 2024
- Dyer, J.H. & Singh, H. (1998). The relational view: cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23(4), 660-679.
- Educative (2024). *What are blocks in blockchain technology*. Access Address: <https://www.educative.io/answers/what-are-blocks-in-blockchain-technology>. Access Date: 24 February 2024
- Einaste, T (2018). *Blockchain and healthcare: the estonian experience, e-estonia.com*. Access Address: <https://e-estonia.com/blockchain-healthcare-estonian-experience>. Access Date: 24 February 2024
- Emergen Research (2023). *Navigating decentralized finance (defi) market size 2023: share insights, future demand and forecast till 2032*. Access Address: <https://www.linkedin.com/pulse/navigating-decentralized-finance-defi-market-size-2023-tmxqf>. Access Date: 24 February 2024
- Emurgo Cardano Projects (2024). *6 Cardano projects to keep an eye on in 2024*. Access Address: <https://www.linkedin.com/pulse/6-cardano-projects-keep-eye-2024-emurgo-io-gkl1c>. Access Date: 24 February 2024
- Emurgo (2024). Access Address: <https://www.emurgo.io>. Access Date: 24 February 2024
- Enterpriseitworld (2018). *Blockchain startup healthereum raises \$15m healthcare project funding*, Access Address: <https://www.enterpriseitworld.com/blockchain-startup-healthereum-raises-15m-healthcare-project-funding>. Access Date: 24 February 2024
- Erbil, B. (2021). *Turkey arrests dozens in cryptocurrency fraud investigation*, The New York Times. Access Address: <https://www.nytimes.com/2021/04/23/business/cryptocurrency-fraud-turkey.html>. Access Date: 24 February 2024
- Ethereum Home page (2014). *Home page*. Access Address: <https://www.ethereum.org>. Access Date: 24 February 2024
- Ethereum Community (2024). *Community*. Access Address: <https://ethereum.org/en/community>. Access Date: 24 February 2024

- Ethereum Competitors (2024). Who are ethereum's competitors: are they really a threat. Access Address: <https://worldcoin.org/articles/ethereum-competitors>. Access Date: 24 February 2024
- Ethereum Improvement Proposals (2024). Access Address: <https://eips.ethereum.org>. Access Date: 24 February 2024
- Ethereum Virtual Machine (EVM) (2024). *Evm*. Access Address: <https://ethereum.org/developers/docs/evm>. Access Date: 24 February 2024
- Ethereum White Paper (2013). *Ethereum white paper*. Access Address: <https://whitepaper.io/document/5/ethereum-whitepaper> . Access Date: 24 February 2024
- Ethereum PoS (2024). *Proof of Stake (PoS)*. Access address: <https://ethereum.org/developers/docs/consensus-mechanisms/pos> Access Date: 24 February 2024.
- Evans, D. S. (2003). Some empirical aspects of multi-sided platform industries. *Review of Network Economics*, 2(3).
- Evans, D. S. & Schmalensee, R. (2016). *Matchmakers: the new economics of multisided platforms*. Harvard Business Review Press.
- Evans, G. E. & Neu, C. (2008). The use of strategic forces to understand competitive advantages provided by information technology. *Journal of international technology and information management*, 17(2), 5.
- Finley K. & Barber G. (2019). The wired guide to the blockchain. *Wired Magazine*.
- Fortune (2022). *The global data privacy software market size was valued at \$1.99 billion in 2022 & is projected to grow from \$2.76 billion in 2023 to \$30.31 billion by 2030*. Access Address: <https://www.fortunebusinessinsights.com/data-privacy-software-market-105420>. Access Date: 24 February 2024
- Frankenfield, J. (2023). *Gemini exchange: meaning, products, plans*. Access Address: <https://www.investopedia.com/terms/g/gemini-exchange.asp>. Access Date: 24 February 2024
- Geroni, D. (2021). *Blockchain scalability problem – why is it difficult to scale blockchain*. Access Address: <https://101blockchains.com/blockchain-scalability-challenges>. Access Date: 24 February 2024
- Gilbert, A. (2023). *Solana to focus on stability in 2023 after repeated outages*. Access Address: <https://thedefiant.io/solana-focus-stability-2023> . Access Date: 24 February 2024
- Github Avalanche (2024). *What is an Avalanche Community Proposal (ACP)?*. Access Address: <https://github.com/avalanche-foundation/ACPs>. Access Date: 24 February 2024

- Global Markets Insights (2023). *Green Technology and Sustainability Market Size*. Access Address: <https://www.gminsights.com/industry-analysis/green-technology-and-sustainability-market>. Access Date: 24 February 2024
- Groopman, J. (2023). *Top blockchain attacks, hacks and security issues explained*. Access Address: <https://www.techtarget.com/searchsecurity/tip/Top-blockchain-security-attacks-hacks-and-issues>. Access Date: 24 February 2024
- Grundy, T. (2006). Rethinking and reinventing michael porter's five forces model. *Strategic change*, 15(5), 213-229.
- Gupta, S., Singhal, A. & Kapoor, A. (2016, April). A literature survey on social engineering attacks: phishing attack. In *2016 International Conference on Computing, Communication and Automation (ICCCA) IEEE*, 537-540.
- Güven, E.A. (2024). *Which one is in a more advantageous position in 2024? bitcoin or ethereum?* qcp capital analysts answered. Access Address: <https://en.bitcoinsistemi.com/which-one-is-in-a-more-advantageous-position-in-2024-bitcoin-or-ethereum-qcp-capital-analysts-answered>. Access Date: 24 February 2024
- Haber, S. & Stornetta, W. S. (1991). *How to time-stamp a digital document*, Springer, Berlin, Heidelberg. (437-455).
- Hagiu, A. (2009). Two-sided platforms: product variety and pricing structures. *Journal of Economics & Management Strategy*, 18(4), 1011-1043.
- Hapskorea (2024). Understanding risk and innovation in blockchain networks: bitcoin and kusama. Access Address: <https://www.hapskorea.com/understanding-risk-and-innovation-in-blockchain-networks-bitcoin-and-kusama>. Access Date: 24 February 2024
- Hawlitshchek, F., Notheisen, B. & Teubner, T. (2018). The limits of trust-free systems: a literature review on blockchain technology and trust in the sharing economy. *Electronic commerce research and applications*, 29, 50-63.
- Helalabs Cardano Competitors (2024). *7 top cardano competitors and alternatives 2024*. Access Address: <https://helalabs.com/blog/7-top-cardano-competitors-alternatives-in-2024>. Access Date: 24 February 2024
- Higginson, M., Lorenz, J. T., Münstermann, B. & Olesen, P. B. (2017). *The promise of blockchain*. *McKinsey*. Access Address: <https://www.mckinsey.com/industries/financial-services/our-insights/the-promise-of-blockchain>. Access Date: 24 February 2024
- Horizen (2024). *Protocol to build your blockchain*. Access Address: <https://www.horizen.io> Access Date: 24 February 2024
- Horizen Academy SDK (2024). *Understanding blockchain software development kits: a comprehensive guide*. Access Address: <https://www.horizen.io/academy/software-developer-kits>. Access Date: 24 February 2024

- Horizen Academy Sidechains (2024). *Sidechains*. Access Address: <https://www.horizen.io/academy/sidechains/#sidechains---interoperable-blockchains>. Access Date: 24 February 2024
- Horizen Home page. (2019). *Home page*. Access Address: <https://horizen.io> . Access Date: 24 February 2024
- Horizen CCTP (2024). *The main components in zendoo*. Access Address: <https://www.horizen.io/academy/zendoo>. Access Date: 24 February 2024
- Horizen HCC (2022). *Horizen hcc*. Access Address: <https://www.horizen.io/HCC/HCC%20Whitepaper.pdf>. Access Date: 24 February 2024
- Horizen Sphere (2024). *Horizen sphere*. Access Address: <https://www.horizen.io/wallets/spherebyhorizen>. Access Date: 24 February 2024
- Horizen White Paper. (2019). *Horizen white paper*. Access Address: <https://www.horizen.io/assets/files/Horizen-White-Paper.pdf>. Access Date: 24 February 2024
- Horizen Zendoo (2024). *Zendoo, a zk-snark enabled verifiable cross-chain transfer protocol*. Access Address: <https://www.horizen.io/zendoo/>.
- Howell, J. (2022). *What is blockchain sharding?* Access Address: <https://101blockchains.com/what-is-blockchain-sharding>. Access Date: 24 February 2024
- IBM Blockchain (2024). *Ibm blockchainenable trusted data exchange and workflow automation beyond the boundaries with distributed ledger technology and enterprise blockchain*. Access Address: <https://www.ibm.com/blockchain>. Access Date: 24 February 2024
- IBM Smart Contracts (2024). *Smart contracts Defined*. Access Address: <https://www.ibm.com/topics/smart-contracts>. Access Date: 24 February 2024
- ICAEW (2024). *History of blockchain*. Access Address: <https://www.icaew.com/technical/technology/blockchain-and-cryptoassets/blockchain-articles/what-is-blockchain/history>. Access Date: 24 February 2024
- Input Output HK. (2024). *Leadership: executives*. Access Address: <https://iohk.io/en/leadership/#leadership=executives>. Access Date: 24 February 2024
- Intepat Interns (2020). *Paris convention vs patent cooperation treaty: pros and cons*. Access Address: <https://www.intepat.com/blog/paris-convention-vs-patent-cooperation-treaty-pros-and-cons> . Access Date: 24 February 2024
- Introduction to VeChain (2024). *a first introduction to vechain and the vechainthor blockchain*. Access Address: <https://docs.vechain.org/introduction-to-vechain>. Access Date: 24 February 2024
- Isabelle, D., Horak, K., McKinnon, S. & Palumbo, C. (2020). Is porter's five forces framework still relevant? a study of the capital/labour intensity

- continuumviamininganditindustries. *TechnologyInnovationManagement Review*, 10, (6).
- Kabeyi, M. J. B. (2018). Michael porter's five competitive forces and generic strategies, market segmentation strategy and case study of competition in global smartphone manufacturing industry. *IJAR*, 4(10), 39-45.
- Kamau, R. (2022). *What is bitcoin pizza day, and why does the community celebrate on may 22*. Access Address: <https://www.forbes.com/sites/rufaskamau/2022/05/09/what-is-bitcoin-pizza-day-and-why-does-the-community-celebrate-on-may-22>. Access Date: 24 February 2024
- Kamsky, A. (2023). *How does the bitcoin source code define its 21 million cap*. Access Address: <https://www.ccn.com/education/how-does-the-bitcoin-source-code-define-its-21-million-cap>. Access Date: 24 February 2024
- Kara, M. (2016). *Global miles: Türkiye'nin banka ve hava yolu şirketlerinden bağımsız ilk mobil mil programı*. Access Address: <https://webrazzi.com/2016/08/08/global-miles-turkiyenin-banka-ve-hava-yolu-sirketlerinden-bagimsiz-ilk-mobil-mil-programi>. Access Date: 24 February 2024
- Karjian R. & Sheldon R. (2024). *A timeline and history of blockchain technology*. Access Address: <https://www.techtarget.com/whatis/feature/A-timeline-and-history-of-blockchain-technology>. Access Date: 24 February 2024
- Kathan, W., Matzler, K. & Veider, V. (2016). The sharing economy: your business model's friend or foe. *Business horizons*, 59(6), 664.
- Keenan, M. (2023). *The best ecommerce marketplaces for selling globally*. Access Address: <https://www.shopify.com/enterprise/blog/global-ecommerce-marketplace>. Access Date: 24 February 2024
- Kendall, W. (2023). *Satoshi files: david chaum*. Access Address: <https://coinmarketcap.com/academy/article/satoshi-files-david-chaum>. Access Date: 24 February 2024
- Kenney, M. & Zysman, J. (2016). The rise of the platform economy. *Issues in science and technology*, 32(3), 61.
- Khomenko, A. (2023). *The downside of polkadot: 5 challenges facing the blockchain*. Access Address: <https://gncrypto.news/news/the-downside-of-polkadot-5-challenges-facing-the-blockchain/>. Access Date: 24 February 2024
- Khurram, A., Hassan, S. & Khurram, S. (2020). Revisiting porter five forces model: influence of non-governmental organizations on competitive rivalry in various economic sectors. *Pakistan Social Sciences Review*, 4(1), 1-15.
- Kiayias, A., Koutsoupias, E., Kyropoulou, M. & Tselekounis, Y. (2016). Blockchain mining games. In *Proceedings of the 2016 ACM Conference on Economics and Computation* (pp. 368).

- Konst, S. (2000). Secure log files based on cryptographically concatenated entries. *Technische Universität Braunschweig*. Konst, S. (2000). Secure log files based on cryptographically concatenated entries. *Technische Universität Braunschweig*, 25-46.
- Konstantinidis, I., Siaminos, G., Timplalexis, C., Zervas, P., Peristeras, V. & Decker, S. (2018). Blockchain for business applications: a systematic literature review. In *Business Information Systems: 21st International Conference, BIS 2018, Berlin, Germany, July 18-20, 2018, Proceedings 21* (pp. 384-399). Springer International Publishing.
- Korhonen, H. M., Still, K., Seppänen, M., Kumpulainen, M., Suominen, A., & Valkokari, K. (2017). The core interaction of platforms: how startups connect users and producers, *Technology Innovation Management Review*, September 2017 (Volume 7, Issue 9).
- Kovalenko, B., Temnova, N., Kolyshkin, A. & Iakovleva, T. (2020). Digital economy platforms: from bilateral markets to joint consumption economy. *European Proceedings of Social and Behavioural Sciences*, 103.
- Kraken Avalanche (2024). What is avalanche (avax) avalanche (avax) explained. Access Address: <https://www.kraken.com/learn/what-is-avalanche-avax>. Access Date: 24 February 2024
- Kraken Ethereum (2024). What is ethereum. Access Address: <https://www.kraken.com/prices/ethereum>. Access Date: 24 February 2024
- Kraken Kusama (2024). *What is kusama*. Access Address: <https://www.kraken.com/learn/what-is-kusama-ksm>. Access Date: 24 February 2024
- Kraken Solana (2024). *What makes solana unique*. Access Address: <https://www.kraken.com/prices/solana>. Access Date: 24 February 2024
- Kriptomat (2024). *Conclusion*. Access Address: https://kriptomat.io/cryptocurrencies/kusama/what-is-kusama/#What_Makes_Kusama_KSM_Unique. Access Date: 24 February 2024
- Krishnan, S., Balas, V. E., Julie, E. G., Yesudhas, H. R., Balaji, S. & Kumar, R. (Eds.). (2020). *Handbook of research on blockchain technology*. Academic Press.
- Krumholz, J., Mahony, I. G. & Colandreo, B. J. (2018). Blockchain and intellectual property: a case study. *Blockchain & Cryptocurrency Regulation*. Global Legal Group Ltd. London.
- Kuhn, D. (2023). *Remembering hal finney on the 14th anniversary of the first bitcoin transaction*. Access Address: <https://www.coindesk.com/consensus-magazine/2023/01/12/remembering-hal-finney-on-the-14th-anniversary-of-the-first-bitcoin-transaction>. Access Date: 24 February 2024
- Kusama Home page (2020). *Home page*. Access Address: <https://kusama.network>. Access Date: 24 February 2024

- Kusama Explore (2024). *Kusama explore*. Access Address: <https://guide.kusama.network/docs/explore-index>. Access Date: 24 February 2024
- Kusama Grants Programme (2024). *Grant programme*. Access Address: <https://guide.kusama.network/docs/grants>. Access Date: 24 February 2024
- Kusama Guide (2024). *Governance*. Access Address: <https://guide.kusama.network/docs/learn-governance>. Access Date: 24 February 2024
- Kusama Guide Interoperability (2024). *Interoperability*. Access Address: <https://wiki.polkadot.com/kusama/kusama-getting-started/> Access Date: 24 February 2024.
- Kusama Parachains (2024). *Blockchains that don't break down walls*. Access Address: <https://kusama.network/parachains>. Access Date: 24 February 2024
- La Monica, P.R. (2021). *Coinbase goes public with a nearly \$100 billion valuation*. Access Address: <https://edition.cnn.com/2021/04/14/investing/coinbase-stock-direct-listing/index.html>. Access Date: 24 February 2024
- Lashkari, B. & Musilek, P. (2021). *A comprehensive review of blockchain consensus mechanisms*. *IEEE Access*, 9, 43622.
- Lawrence, D. (2023). *How is fragmented blockchain interoperability solved by layerzero protocol?* Access Address: <https://www.cryptopolitan.com/fragmented-blockchains-fixed-layerzero>. Access Date: 24 February 2024
- Leadbeater, C. (2010). *We-think: mass innovation, not mass production*. Profile Books.
- Levine, B. N., Shields, C. & Margolin, N. B. (2006). A survey of solutions to the sybil attack. *University of Massachusetts Amherst, Amherst, MA*, 7, 224.
- Lewis, G. (2010). (Note on) *Basics about cloud computing*. Software Engineering Institute Carnegie Mellon University, Pittsburgh.
- Liao, R. (2022). *Shanghai gives nod to nft trading platforms*. Access Address: <https://techcrunch.com/2022/07/13/china-shanghai-blockchain-nft>. Access Date: 24 February 2024
- Lucero, S. (2016). *Iot platforms: enabling the internet of things. white paper*. Access Address: <https://cdn.ihs.com/www/pdf/enabling-IOT.pdf>. Access Date: 24 February 2024
- Luther, W. J., Peirce, H. & Klutsey, B. (2016). Reframing financial regulation: enhancing stability and protecting consumers. *chapter regulating bitcoin: on what grounds*, George Mason University, 396.
- Macrinici, D., Cartoceanu, C. & Gao, S. (2018). Smart contract applications within blockchain technology: a systematic mapping study. *Telematics and Informatics*, 35(8), 2337-2354.

- Malynovskyi, V. (2023). *Top 15 blockchain grants to fund your web 3.0 product in 2024*, 4irelabs. Access Address: <https://4irelabs.com/articles/top-15-blockchain-grants-to-get-funding>. Access Date: 24 February 2024
- Maresova, P. & Kuca, K. (2014). Porters five forces on medical device industry in europe. *Military Medical Science Letters*, 83(4), 134-144.
- Marr, B., (2024). *Blockchain: a very short history of ethereum everyone should read*. Access Address: <https://bernardmarr.com/blockchain-a-very-short-history-of-ethereum-everyone-should-read>. Access Date: 24 February 2024
- McGrath, R.G. (2013). Transient advantage. *Harvard Business Review*, 91(6), 62-70.
- Mert, G., Yağmur, Y. & Erkasap, A. (2022). blockchain and organizational structures, mert g. karagöz s. ve yılmaz, o. içinde *Blockchain innovative business processes and long-term sustainability*, 27-28, Ankara, Nobel Bilimsel Eserler.
- Messari Project Cardano (2024). *Cardano Summary*. Access Address: <https://messari.io/project/cardano>. Access Date: 24 February 2024
- Mirkovic, J. & Reiher, P. (2004). A taxonomy of ddos attack and ddos defense mechanisms. *ACM SIGCOMM Computer Communication Review*, 34(2), 40.
- Moazed, A. (2016). *Platform business model–definition | what is it? explanation*. Applico. Access Address: <https://www.applicoinc.com/blog/what-is-a-platform-business-model>. Access Date: 24 February 2024
- Moazed, A. & Johnson, N. L. (2016). *Modern monopolies: what it takes to dominate the 21st century economy*. St. Martin's Press.
- Mugo, P. (2020). Porter's five forces influence on competitive advantage in telecommunication industry in kenya. *European Journal of Business and Strategic Management*, 5(2), 30-49.
- Murray, M. (2019). Tutorial: a descriptive introduction to the blockchain. *Communications of the Association for Information Systems*, 45(1), 25.
- Nagase, T., Fukui, T. & Hatano, K. (2023). *blockchain & cryptocurrency regulation 2024: japan chapter*. Access Address: <https://www.mondaq.com/fin-tech/1386476/blockchain--cryptocurrency-regulation-2024-japan-chapter>. Access Date: 24 February 2024
- Nakamoto, S. (2008). *Bitcoin whitepaper*. Access Address: <https://bitcoin.org/bitcoin.pdf>. Access Date: 24 February 2024
- Newberry, E. (2021). Should you (or anyone) *buy cardano, cardano pros and cons*. Access Address: <https://www.fool.com/the-ascent/buying-stocks/articles/should-you-or-anyone-buy-cardano>. Access Date: 24 February 2024

- Nicolosi, J. (2023) *Revolutionizing global trade: how vechain (vet) is transforming supply chains with blockchain and iot*. Access Address: <https://medium.com/buzzen/revolutionizing-global-trade-how-vechain-vet-is-transforming-supply-chains-with-blockchain-and-0b3cbb44289f>. Access Date: 24 February 2024
- Nikita, S. (2023). *Iot and cloud computing: how do they work together*. Access Address: <https://www.cloudpanel.io/blog/iot-and-cloud-computing>. Access Date: 24 February 2024
- Nonaka, I. (1991). The knowledge-creating company. *Harvard Business Review*, 69(6), 96-104.
- Northcrypto (2024). *What is ethereum*. Access Address: <https://www.northcrypto.com/about/ethereum>. Access Date: 24 February 2024
- Notomoro (2024). *Exploring solana proof of history: revolutionizing transactions*. Access Address: <https://webisoft.com/articles/solana-proof-of-history>. Access Date: 24 February 2024
- Nouwens, M., Griggio, C. F. & Mackay, W. E. (2017). Whatsapp is for family; messenger is for friends' communication places in app ecosystems. 2017, May. In *Proceedings of the 2017 CHI conference on human factors in computing systems*, 727.
- Olanrewaju, V. (2023). *What are privacy coins and are they legal*. AmbCrypto. Access Address: <https://ambcrypto.com/how-chainlink-filecoin-are-keeping-networks-in-check-amid-torrid-market>. Access Date: 24 February 2024
- Onar, A. & Subaşı, E. (2024). *Blockchain & cryptocurrency laws and regulations 2024 turkey/türkiye*. Access Address: <https://www.globallegalinsights.com/practice-areas/blockchain-laws-and-regulations/turkey-trkiye>. Access Date: 24 February 2024
- Opinyu, (2022). *Türkiye'de blockchain kullanan şirketler*. Access Address: <https://opinyu.com/opinyu/turkiyede-blockchain-kullanan-sirketler/>. Access Date: 24 February 2024
- Orcutt, B. (2018, July 25). *Three technologies transforming the legal field*. American Bar Association. Access Address: https://www.americanbar.org/groups/law_practice/resources/law-technology-today/2018/3-technologies-transforming-legal/
- Öztürk, S. (2024). *Solana ecosystem: impact, innovation, and the road ahead*. Access Address: <https://serayozturk99.medium.com/solana-ecosystem-impact-innovation-and-the-road-ahead>. Access Date: 24 February 2024
- Papuççuyan, A. (2018). *İsim değiştirerek proofstack olan copyrobo'nun yeni yol haritası*, webrazzi. Access Address: <https://webrazzi.com/2018/03/14/isim-degistirerek-proofstack-olan-copyrobonun-yeni-yol-haritasi>. Access Date: 24 February 2024

- Patairya, D. K. (2023a). *Proof-of-stake vs. proof-of-work: Pros, cons, and differences explained*, June 7, 2023. <https://cointelegraph.com/learn/articles/proof-of-stake-vs-proof-of-work-differences-explained>, Access Date: 24 February 2024
- Patairya, D. K. (2023b). *An overview of the cryptocurrency regulations in Japan*. Access Address: <https://cointelegraph.com/learn/crypto-regulations-in-japan>. Access Date: 24 February 2024
- PayPal Editorial Staff (2023). *Payments as a platform: why are they the future of payments*. Access Address: <https://www.paypal.com/us/brc/article/why-platforms-are-future-of-payments>. Access Date: 24 February 2024
- Polkadot 1.0 (2024). *Polkadot 1.0*. Access Address: <https://wiki.polkadot.network/docs/polkadot-v1>. Access Date: 24 February 2024
- Polkadot Home page. (2020). *Home page*. Access Address: <https://polkadot.network/>. Access Date: 24 February 2024
- Polkadot Architecture (2024). *Architecture*. Access Address: <https://wiki.polkadot.network/docs/learn-architecture>. Access Date: 24 February 2024
- Polkadot Bridges (2024). *Bridges*. Access Address: <https://wiki.polkadot.network/docs/learn-bridges>. Access Date: 24 February 2024
- Polkadot Developer Growth (2022). *Polkadot maintains developer growth with strong q2 metric*. Access Address: <https://polkadot.network/newsroom/press-releases/polkadot-maintains-developer-growth-with-strong-q2-metrics>. Access Date: 24 February 2024
- Polkadot Forum (2024). *The polkadot forum*. Access Address: <https://forum.polkadot.network/t/polkadot-hubs-uniting-the-community-worldwide-through-physical-spaces/3420>. Access Date: 24 February 2024
- Polkadot Interoperability (2024). *Polkadot is a heterogeneous multichain with shared security and interoperability*. Access Address: <https://wiki.polkadot.network/docs/learn-architecture>. Access Date: 24 February 2024
- Polkadot Network (2024). *Get your web3 ideas to market fast with economics that work for you*. Access Address: <https://polkadot.network>. Access Date: 24 February 2024
- Polkadot OpenGov (2024). *Introducing the first decentralized, unstoppable, open governance platform, polkadot opengov, where the polkadot community is in full control of the network*. Access Address: <https://polkadot.network/features/opengov>. Access Date: 24 February 2024
- Polkadot Parachains (2024). *Parachains are advanced, next-generation layer-1 blockchains that transcend the limitations of legacy networks*. Access Address: <https://polkadot.network/features/parachains>. Access Date: 24 February 2024

- Polkadot Technology (2024). *A Scalable, interoperable & secure network protocol for the next web*. Access Address: <https://polkadot.network/features/technology>. Access Date: 24 February 2024
- Polkadot White Paper. (2020). *Polkadot white paper*. Access Address: <https://whitepaper.io/coin/polkadot>. Access Date: 24 February 2024
- Polkadot's Canary Network (2024). *Interact with kusama, polkadot's canary network*. Access Address: <https://guide.kusama.network/docs/kusama-getting-started>. Access Date: 24 February 2024
- Popescu, A. D. (2020). Decentralized finance (defi)–the lego of finance. *Social Sciences and Education Research Review*, 7(1), 321-349.
- Porter, M. E. (1979). The structure within industries and companies' performance. *The review of economics and statistics*, 214-227.
- Porter, M. E. (1980). *Competitive strategy: techniques for analyzing industries and competitors*. New York: Free Press.
- Porter, M. E. (1985). *Competitive advantage: creating and sustaining superior performance*. New York: Free Press.
- Proofstack Home page, (2024). <https://proofstack.io/> Access Date: 24 February 2024.
- Pros and Cons of Polkadot (2024). *Pros and cons of polkadot*. Access Address: <https://webisof.com/articles/cosmos-vs-polkadot>. Access Date: 24 February 2024
- Qin, K., Zhou, L., Livshits, B. & Gervais, A. (2021). Attacking the defi ecosystem with flash loans for fun and profit. In *International conference on financial cryptography and data security* (pp. 3-32). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Rasheed, S. A. R. S. A., Sati, U. S. U. & Bano, F. B. F. (2022). The gig economy work and workers life balance issues a phenomenological approach. *Periodicals of Management Studies*, 2(2), 82.
- Reeves M., Moose, S. & Venema T. (2014). *BCG classics revisited, the growth share matrix, perspectives*. Access Address: https://web-assets.bcg.com/img-src/BCG_Classics_Revisited_The_Growth_Share_Matrix_Jun_2014_tcm9-84453.pdf. Access Date: 24 February 2024
- Reillier, L. C. & Reillier, B. (2017). *Platform strategy: how to unlock the power of communities and networks to grow your business*. Taylor & Francis.
- Proof-of-Stake (2024). *The drawbacks of proof-of-stake*. Access Address: <https://river.com/learn/proof-of-work-pow-vs-pos-proof-of-stake/#the-drawbacks-of-proof-of-stake>. Access Date: 24 February 2024
- Roberts, S. (2023). *Advantages and disadvantages of ethereum*. Access Address: <https://www.theknowledgeacademy.com/blog/advantages-and-disadvantages-of-ethereum>. Access Date: 24 February 2024

- Rodeck, D. & Curry, B. (2022). *What is blockchain*. forbes. www. forbes. com/ advisor/investing/cryptocurrency/what-is-blockchain/(22 May 2022).
- Rodriguez, J.A.J. (2023). *Intellectual property rights in the world of cryptocurrencies*. Access Address: <https://www.ecovis.com/honduras/intellectual-property-rights-in-the-world-of-cryptocurrencies>. Access Date: 24 February 2024
- Rosencrance, L. (2023). *Definition stablecoin*, techtarget, Access Address: <https://www.techtarget.com/whatis/definition/stablecoin>. Access Date: 24 February 2024
- Rosic, A. (2020). *Blockchain consensus: a simple explanation anyone can understand*, Access Address: <https://blockgeeks.com/guides/blockchain-consensus>. Access Date: 24 February 2024
- Rosic, A. (2024). *What is cryptocurrency: 21st-century unicorn – or the money of the future?*, blockgeeks, 9 February Access Address: <https://blockgeeks.com/guides/what-is-cryptocurrency>. Access Date: 24 February 2024
- S., L. (2015). *Who is satoshi nakamoto, the economist*. Access Address: <https://www.economist.com/the-economist-explains/2015/11/02/who-is-satoshi-nakamoto>? Access Date: 24 February 2024
- Safari, N., Farhang, M. & Rajabzadehyazdi, E. (2016). The study on the competitive status of construction companies based on michael porter's five competitive forces (case study: armeno project development and management company). *European Online Journal of Natural and Social Sciences: Proceedings*, 5(3 (s)), pp-74.
- Sahu, M. (2022). *blockchain technology use cases you should know in 2024*. Access Address: <https://www.upgrad.com/blog/blockchain-technology-use-cases>. Access Date: 24 February 2024
- Schar, F. & Berentsen, A. (2020). *bitcoin, blockchain, and cryptoassets: a comprehensive introduction*. MIT Press, 34.
- Schumpeter, J. A. (1942). *Capitalism, socialism, and democracy*. Harper & Brothers.
- Schweiger, A., Nagel, J., Böhm, M. & Krcmar, H. (2016). Platform business models. *Digital Mobility Platforms and Ecosystems*, 66.
- Sedlmeir, J., Lautenschlager, J., Fridgen, G. & Urbach, N. (2022). the transparency challenge of blockchain in organizations. *Electronic Markets*, 32(3), 1779-1794.
- Sedwick, K. (2019). *Bitcoin history part 16: the first mt. gox hack*. bitcoin. Access Address: <https://news.bitcoin.com/bitcoin-history-part-16-the-first-mt-gox-hack>. Access Date: 24 February 2024
- Shannon, M. (2023). *The challenges and opportunities for avalanche in the defi market*. Access Address: <https://blog.coinshares.com/the-challenges-and-opportunities-for-avalanche-in-the-defi-market-f108b8677cb5>. Access Date: 24 February 2024

- Shaver, M. (2022). *Binance has \$570 million of bnb tokens stolen in crypto hack*. shacknews. Access Address: <https://www.shacknews.com/article/132595/binance-bnb-stolen-hack>. Access Date: 24 February 2024
- Sheikh, H., Rahima M. A., & Rizwan F. (2018). Proof-of-work vs proof-of-stake: a comparative analysis and an approach to blockchain consensus mechanism. *International Journal for Research in Applied Science & Engineering Technology* 6.12 (2018): 789.
- Sigalos, M. (2021). *Bitmart ceo says stolen private key behind \$196m hack*. coindesk. Access Address: from <https://www.coindesk.com/tech/2021/12/06/bitmart-ceo-says-stolen-private-key-behind-196m-hack>. Access Date: 24 February 2024
- Silva, J. E. (2003). An overview of cryptographic hash functions and their uses. *SANS Institute, GIAC*, 6.
- Simons, H. (2009). *Case study research in practice*. Sage Publications, 18.
- Sofi (2022). *Advantages and disadvantages of vechain (vet)*. Access Address: <https://www.sofi.com/what-is-vechain-vet>. Access Date: 24 February 2024
- Solana Home page. (2020). *Home page*. Access Address: <https://www.Solana.com>. Access Date: 24 February 2024
- SolanaDaily (2021). retrieved from Solana's official Twitter account on January 27, 2024, https://twitter.com/solana_daily/status/1442474189525434370/photo/1
- Solana Foundation. (2024). *Solana Foundation*. Access Address: <https://solana.org>. Access Date: 24 February 2024
- Solana Grants (2023). *Solana foundation introduces convertible grants and investments to support solana ecosystem*. Access Address: <https://solana.com/news/solana-foundation-convertible-grants-investments>. Access Date: 24 February 2024
- Solana Labs. (2024). *Solana labs*. Access Address: <https://solanalabs.com>. Access Date: 24 February 2024
- Solana White Paper. (2020). *Solana white paper*. Access Address: <https://whitepaper.io/coin/solana>. Access Date: 24 February 2024
- Solana Wormhole (2024). *Wormhole, interoperability protocol powering the seamless transfer of value and information across 17 high value chains with just one integration*. Access Address: <https://solana.com/ecosystem/wormhole>. Access Date: 24 February 2024
- Solana.com. (2024). *Proof of history*. Access Address: <https://solana.com/news/proof-of-history>. Access Date: 24 February 2024
- Soriano, J. (2023a). *Top 10 solana competitors and alternatives you shouldn't miss*. Access Address: <https://helalabs.com/blog/top-10-competitor-of-solana-you-shouldnt-miss>. Access Date: 24 February 2024

- Soriano, J. (2023b). *Top 7 polkadot competitors and alternatives to consider in 2024*. Access Address: <https://helalabs.com/blog/7-top-polkadot-competitors-to-consider-in-2024>. Access Date: 24 February 2024
- Stake, R. E. (1995). *The art of case study research*, Sage Publications, 7.
- Stanoevska-Slabeva, K. & Wozniak, T. (2009). Cloud basics—an introduction to cloud computing. in *grid and cloud computing: a business perspective on technology and applications* (pp. 47-61). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Steem.com (2024). *Home page*. Access Address: <https://steem.com/> Access Date: 24 February 2024
- Stevens, R. (2023). *What are privacy coins and are they legal*. Access Address: <https://www.coindesk.com/learn/what-are-privacy-coins-and-are-they-legal>. Access Date: 24 February 2024
- Subramanian, H., Mitra, S., & Ransbotham, S. (2021). Capturing value in platform business models that rely on user-generated content. *Organization Science*, 32(3), 804-823.
- Sultan, K, Umar R. & Rubina L. (2018). Conceptualizing blockchains: characteristics & applications. 11th IADIS International Conference Information Systems 2018, *Arxiv Preprint Arxiv:1806.03693* (2018).
- Surowiecki, J. (2005). *The wisdom of crowds*. Anchor Books, NY. ISBN: 0-385-72170-6
- Swan, M. (2015). *Blockchain: blueprint for a new economy*. O'Reilly Media, Inc.
- Szabo, N. (2005). *Bit gold*. Access Address: <https://nakamotoinstitute.org/bit-gold>. Access Date: 24 February 2024
- Tadejko, P. (2015). Application of internet of things in logistics—current challenges. *Ekonomia i Zarządzanie*, 7(4), 54.
- Takyar, A. (N.D.). *A detailed overview of vechain blockchain*. Access Address: <https://www.leewayhertz.com/vechain-blockchain>. Access Date: 24 February 2024
- Tamplin, T. (2023). Investment platforms, *finance strategist*. Access Address: <https://www.financestrategists.com/wealth-management/investment-management/investment-platform>. Access Date: 24 February 2024
- Tapscott, D. & Tapscott, A. (2016). *Blockchain revolution: how the technology behind bitcoin is changing money, business, and the world*. Penguin.
- Täuscher, K. & Laudien, S. (2018). Understanding platform business models: a mixed methods study of marketplaces, *European Management Journal*, 36(3), 319–329.
- Teece, D.J., Pisano, G. & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.

- Tekiner, E., Acar, A., Uluagac, A. S., Kirda, E. & Selcuk, A. A. (2021). Sok: cryptojacking malware. In *2021 IEEE European Symposium on Security and Privacy (EuroSecP)*, September 2021, 120.
- Tincq, B. (2016). *Digital networks and platform business models, master's class*. Access Address: <https://www.slideshare.net/btincq/digital-networks-platform-business-models-masterclass>. Access Date: 24 February 2024
- Tokenomicshub Polkadot (2024). *Polkadot value creation*. Access Address: <https://tokenomicshub.xyz/polkadot>. Access Date: 24 February 2024
- Tokenterminal Kusama (2024). *Kusama competitive landscape*. Access Address: <https://tokenterminal.com/terminal/projects/kusama/competitive-landscape>. Access Date: 24 February 2024
- Tretina, K. (2021). An introduction to the NASDAQ stock exchange. 2021, August 12. Forbes. <https://www.forbes.com/advisor/investing/nasdaq-stock-exchange/>
- Ullrich, J. (2023). *Binance.us* review, investopedia. Access Address: <https://www.investopedia.com/binance-us-review-5214161>. Access Date: 24 February 2024
- Uniswap (2024). *Swap anytime, anywhere*. Access Address: <https://app.uniswap.org>. Access Date: 24 February 2024
- Uphold Aergo Interoperability (2024). *Why does aergo have value*. Access Address: <https://uphold.com/prices/crypto/aergo>. Access Date: 24 February 2024
- Ural, O. (2014). Uncovering porter's five forces framework's status in today's disruptive business context (Bachelor's thesis, University of Twente), 3.
- Vallas, S. & Schor, J. B. (2020). What do platforms do? understanding the gig economy. *annual review of Sociology*, 46, 274.
- VeChain (2020). *Vechain introduces new blockchain-enabled sustainability solution to power "green business" for enterprises*. Access Address: <https://www.prnewswire.com/in/news-releases/vechain-introduces-new-blockchain-enabled-sustainability-solution-to-power-green-business-for-enterprises>. Access Date: 24 February 2024
- VeChain Home page. (2020). *Home page*. Access Address: <https://www.vechain.org/> Access Date: 24 February 2024
- VeChain Economic Model (2024). *Economic model*. Access Address: <https://www.vechain.org>. Access Date: 24 February 2024
- VeChain Governance (2024). *How does vechain leverage on-chain governance*. Access Address: <https://docs.vechain.org/introduction-to-vechain/about-the-vechain-blockchain/governance>. Access Date: 24 February 2024
- VeChain Thor (2024). *Vechain thor*. Access Address: <https://www.vechain.org/vechainthor>. Access Date: 24 February 2024

- VeChain Tool Chain Platform Values (2024). *Vechain toolchain platform values*. Access Address: <https://vechain.com/home>. Access Date: 24 February 2024
- VeChain White Paper. (2020). *Vechain white paper*. Access Address: <https://whitepaper.io/coin/vechain>. Access Date: 24 February 2024
- Vidal, F. R., Gouveia, F. & Soares, C. (2020). Blockchain application in higher education diploma management and results analysis. *Adv. Sci. Technol. Eng. Syst*, 5, 871-882.
- Wang, Q., Li, R., Wang, Q. & Chen, S. (2021). Non-fungible token (NFT): Overview, Evaluation, Opportunities And Challenges. *arXiv preprint arXiv:2105.07447*.
- Wang, V., Zhao, Xinyao, Wang, E. & Chen L. (2024). *Blockchain 2023 china, trends and developments*. Access Address: <https://practiceguides.chambers.com/practice-guides/blockchain-2023/china/trends-and-developments>. Access Date: 24 February 2024
- Wearablox Cartesi (2024). *Cartesi: everything you need to know about ctsi-benefits of cartesi*. Access Address: <https://weareblox.com/en-eu/cartesi>. Access Date: 24 February 2024
- Webcom System. (2024). Smart contracts and dApps. <https://webcomsystem.net/>, [blog/smart-contracts-and\(dApps\)](https://webcomsystem.net/blog/smart-contracts-and(dApps)) Access date: 24 February 2024.
- What Is Blockchain Interoperability? (2023). *What is Blockchain Interoperability*. Access Address: <https://chain.link/education-hub/blockchain-interoperability>. Access Date: 24 February 2024
- Willson, M. (2021). History of Blockchain, June 3, 2021, <https://www.blockchain-council.org/blockchain/a-detailed-history-of-blockchain-from-the-establishment-to-broad-adoption/>, Access Date: 24 February 2024.
- Wilson, T. & Howcroft, E. (2022). *Explainer: ronin's \$615 million crypto heist*. Reuters. Access Address: <https://www.reuters.com/technology/ronins-615-million-crypto-heist-2022-03-30>. Access Date: 24 February 2024
- Woodcock, J. & Graham, M. (2019). *The gig economy. a critical introduction*. Cambridge: Polity.
- Woodside, A. (2010). *Case study research*. Emerald Publishing, 16. ISBN: 978-1-84950-922-0
- Wu, K. (2019). An empirical study of blockchain-based decentralized applications. *arXiv preprint arXiv:1902.04969*.
- Wu, K., Ma, Y., Huang, G. & Liu, X. (2021). A first look at blockchain-based decentralized applications. *Software: Practice and Experience*, 51(10), 2033.

- Xue, C., Tian, W. & Zhao, X. (2020). The literature review of platform economy. *Scientific Programming*, 2020, 1-7.
- Yaga, D., Mell, P., Roby, N. & Scarfone, K. (2019). Blockchain technology overview. *arXiv preprint arXiv:1906.11078*, 49.
- Yalçın, F. G. (2023). *Blockchain tabanlı projelere yatırım yapan slash ventures, webrazzi.xyz’te tanıtıldı*. Access Address: <https://fintechtime.com/2023/05/blockchain-tabanlı-projelere-yatırım-yapan-slash-ventures-webrazzi-xyzte-tanitildi>. Access Date: 24 February 2024
- Yanık, M. (2018). *Türkiye’nin ilk blockchain projesi hayata geçiyor*. Access Address: <https://turkishtimedergi.com/teknoloji/turkiyenin-ilk-blockchain-projesi-hayata-geciyor>. Access Date: 24 February 2024
- Yin, R. K. (2018). *Case study research: design and methods*. Sage Publications, 39.
- Zagalsky, A., Feliciano, J., Storey, M. A., Zhao, Y. & Wang, W. (2015, February). the emergence of github as a collaborative platform for education. In *Proceedings of the 18th ACM conference on computer supported cooperative work & social computing* (pp. 1906-1917).
- Zakir, J., Seymour, T. & Berg, K. (2015). Big data analytics. *Issues in Information Systems*, 16(2).
- Zanescu, A., Lajeunesse, M. & French, M. (2021). Speculating on steam: consumption in the gamblified platform ecosystem. *Journal of Consumer Culture*, 21(1), 34-51.
- Zarrin, J., Wen Phang, H., Babu Saheer, L. & Zarrin, B. (2021). Blockchain for decentralization of internet: prospects, trends, and challenges. *Cluster Computing*, 24(4), 2841-2866.
- Zhao, Y., Von Delft, S., Morgan-Thomas, A. & Buck, T. (2020). The evolution of platform business models: exploring competitive battles in the world of platforms. *Long Range Planning*, 53(4), 101892.
- Zhen, S., Ranganathan, V. & Howcroft, E. (2022). *Ftx hit by rogue transactions, analysts saw over \$600 million outflows*. reuters. Access Address: <https://www.reuters.com/technology/collapsed-crypto-exchange-ftx-hit-by-rogue-transactions-2022-11-12>. Access Date: 24 February 2024
- Zheng, Z., Xie, S., Dai, H. N., Chen, W., Chen, X., Weng, J. & Imran, M. (2020). An overview on smart contracts: challenges, advances and platforms. *Future Generation Computer Systems*, 105, 475-491.
- Zhou, Y., Sun, J., Ma, F., Chen, Y., Yan, Z. & Jiang, Y. (2024). Stop pulling my rug: exposing rug pull risks in crypto token to investors. *ICSE’24*, Lisbon, Portugal, 1.
- zK-SNARKs vs zK-STARKs (2024). *Zk-snarks vs zk-starks*. Access Address: <https://www.horizen.io/academy/zk-snarks-vs-zk-starks>. Access Date: 24 February 2024

Gaining Competitive Advantage in Blockchain-Based Platform Economies

Melih Arat

Digital platforms have become one of the defining forces of the modern economy. With the rise of blockchain technology, a new generation of decentralized platforms is transforming how value is created, exchanged, and governed in digital ecosystems.

Gaining Competitive Advantage in Blockchain-Based Platform Economies explores the strategic and technological factors that determine success in blockchain platform ecosystems. Through comparative case studies of ten smart-contract platforms listed on the Coinbase exchange, the book identifies key drivers of competitive advantage, including innovation, scalability, network effects, and ecosystem development.

By integrating platform economy theory with established strategic frameworks such as Porter's Five Forces, the book provides a structured perspective on how blockchain platforms compete and evolve in the digital economy.

Author Bio

Dr. Melih Arat is an entrepreneur, academic, and author specializing in innovation, entrepreneurship, and digital platform economies. He holds a Master's degree from Harvard University and a doctoral degree in Business Administration, with research focused on entrepreneurship and platform ecosystems.

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