

Exploring the Role of Blockchain Technology in Bike-Sharing Schemes

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Preface

I hereby claim that this dissertation is original, independent and unpublished work. It is submitted as a final project of the undergraduate study European Studies four-year program at The Hague University of Applied Sciences.

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Executive Summary

The disruptive rise of the sharing economy has revolutionized the field of consumption of things and influenced many associated areas. Participation in these social innovations is an important phenomenon and people are exploring and expanding the further possibilities of the sharing economy with emerging technologies such as blockchain. The potential of blockchain technology is widely acknowledged as a process of significant value co-creation. This dissertation aims to explore the benefits of blockchain technology for bike-sharing schemes (BSSs), specifically its adaptive capabilities. Therefore, the central question of this study is: ***What possible theoretical implications does blockchain technology have for optimizing bike-sharing schemes?***

The dissertation addresses the question by cross-over analysis of the mechanism and functions of blockchain and the current development of bike-sharing systems. The literature review focused on background information on the sharing economy, bike-sharing and blockchain technology. In addition, four bike-sharing and rental platforms were studied to see how existing BSSs perform. Case studies were examined of blockchain technology operating in practice in the real business world. Questionnaires and interviews were used to discover how customers and industry experts evaluate blockchain-based bike-sharing schemes. This has generated a better understanding of enabling factors that can be enhanced by the development of blockchain.

The findings have demonstrated that blockchain technology offers unprecedented potential for optimizing bike-sharing systems. Bike-sharing schemes are a sustainable and convenient means of transport. However, efficiency, costs and a more widely distributed network are crucial factors that are still capable of improvement. Blockchain, by its nature, eliminates the involvement of intermediaries and third parties. Moreover, smart contracts allow a self-executed process to verify information and agreements, payment clearance and communication, using a high-level security algorithm. Thus, in theory at least, the application of blockchain technology can add value to bike-sharing schemes.

This dissertation tentatively measures the economic impact of a blockchain scenario in bike sharing in the Dutch market. It is recommended that the economic, social and customer aspects of the adaptation of blockchain be the subject of in-depth studies on the further development of the shared bikes industry. Research into other markets is also suggested, to obtain more customers' perspectives and identify further possible applications of blockchain to other fields of economic activity.

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Chapter 1: Introduction

1.1 Research background

1.1.1 The rise of crowd-based capitalism

“The adoption of future Internet technology, and in particular of its most challenging components like the Internet of Things (IoT) and Internet of Services, can constitute the basic building blocks to progress towards unified information and communication technology platforms for a variety of applications” (Chianese et al.)ⁱ.

The sharing economy phenomenon has lately raised a great deal of attention across the globe, and shared economy applications have proven to be sustainable and productive. A wide variety of organizations have created internet-based platforms, based on the concept of “sharing” underutilized assets (Belk, 2014; Möhlmann, 2015). The “sharing economy” relies on a virtual platform to connect multiple parties in different forms, utilizing information technology as a springboard to allow providers to monetize their assets and users to find alternatives to ownership (Alcácer et al., 2016). It involves owner/providers and user/renters through platforms such as consumer-to-consumer (e.g., Airbnb, Uber) or business-to-consumer (e.g., Mobike, Zipcar). Such businesses have been thriving in various industry sectors at both global and local levels (Knight and Cavusgil, 2004). Other terms such as “crowd-based capitalism” (Bartlett and Ghoshal, 2002), “collaborative consumption” (Botsman and Rogers, 2010), and “access-based economy” (Bardhi and Eckhardt, 2012) have also appeared to characterize this flexible, social-interactive economy model.

As a result of the growing sharing economy and initiatives to lessen the environmental impacts of human activity, sharing transport systems, more specifically, bike-sharing systems (BSSs) have proliferated (Sundararajan, 2016). Ideas about reducing fuel-driven transport activities and improving the first mile/last mile connection to other methods of transit have existed for almost half a century. However, bike-sharing schemes have only recently been developed as a form of sustainable transport (Wang, 2017). The number of cities that have adopted BSSs has increased from 12 in 2004 to 855 as of 2014 (Fishman, 2016). Different types of bike-sharing systems have been designed to suit various markets. For example, schemes have been developed that offer bikes that can be picked up and returned to designated privately or publicly owned docking stations, with a price charged for the duration of use (Parkes et al., 2013). However, contemporary IT technologies allow programme management and operations to be more flexible and efficient. For instance, the development of smartphone apps enables online check-out and return; and global positioning system (GPS) and geographic information system (GIS) units are adopted in some BSSs to allocate and track bikes. The social, environmental and health benefits of using such advanced technologies are significant (Wang, 2017).

1.1.2 Blockchain blueprint

Blockchain, the technology that underpins the cryptocurrency Bitcoin (BTC), first came to prominence in 2009 as a medium of exchange. Melanie Swan, the author of *Blockchain Blueprint*, believes that blockchain is revolutionary, unique and full of potential, with far-reaching consequences for all aspects of modern society. Moreover, it is potentially capable of upgrading the coordination of human activity on a much larger scale than has been known hitherto. A compressive information technology, which may have many applications, optimizes asset registry, money, intangible assets management and much more. This innovation is now available for the exploitation, valuation and refinement of the transfer of all quanta in anything (Swan, 2015).

Blockchain technology is a method of generating an open source, transparent, secure and robust ledger. It is based on a software that has the capability of coordinating a market (Hayek, 1948), the governance properties of a commons (Ostrom, 1990) and the constitutional properties of a nation-state (Brennan & Buchanan, 1985). Such a system inevitably has benefits for businesses and other applications, as discussed here.

1.1.3 Problem statement

Bike-sharing schemes require a safer and more efficient method to achieve an upgrade than has hitherto been available (European Cyclists' Federation), and blockchain may be the solution. Don Tapscott, the author of *Blockchain Revolution*, believes that blockchain is one of the most promising technologies for the future. Blockchain provides a decentralized, code-based and autonomy-oriented ledger, which secures the exchange of objects of value with high efficiency and affordability (Swan, 2015). The underused and spare capacity of the privately-owned bicycle are waiting to be explored to strengthen the sharing economy further. This paper explores how the bike-sharing system can benefit from blockchain technology.

The current bike-sharing system needs transformation, being subject to a wide range of problems, including sustainability (artificial bike damage), scalability and privacy. Many business analysts believe that blockchain technology is a decentralized, autonomy-oriented and trustworthy system capable of bringing a completely fresh perspective and dimension to bear on this industry.

1.2 Research questions and theoretical framework

For the reasons outlined above, the main research question that this dissertation will attempt to answer is:

What possible theoretical implications does blockchain technology have for optimizing bike-sharing schemes?

To answer the central question, the following sub-questions will be addressed:

1. What is blockchain technology and what are its key contributions and applications?
2. How do current bike-sharing schemes sit within the sharing economy, and how do they operate within an existing sharing transport system?
3. To what extent can blockchain technology be adopted to provide better value in a bike-sharing system at a business and corporate level?
4. How do costumers evaluate and weight bike-sharing schemes and what are the factors that influence them?
5. How do the target users and bike sharing industry react to the insertion of blockchain technology?

Table 1 below presents the theoretical framework for this study, with key definitions and discussions of three components, namely social innovation, bike-sharing schemes within a sharing economy and blockchain technology. This will be further discussed in the literature review chapter.

<i>Topic</i>	<i>Related research in Literature Review</i>
Sharing Economy	Definition of Sharing Economy Applications of Sharing Economy Features of Sharing Economy Categorization of business models in Sharing Economy
Bike-sharing Schemes	Definition of Sharing Economy History of Bike-sharing Impacts of Bike-Sharing Models of Provision
Blockchain Technology	Definition of Blockchain Technology History of Blockchain Technology Understanding of Blockchain Economies Blockchain Implementation European Regulations Blockchain Applications Potential of Blockchain Technology Limitation of Blockchain Technology

Table 1. Focus of Literature review

1.3 Research structure

The research presented in this dissertation will be structured in such a way, as to study the implementation and development of blockchain to allocate relevant key factors, and then look at the cases of the current bike-sharing scheme in an effort to determine which elements can be enhanced by

adaptation of blockchain technology. This project of research is structured as figure 2.

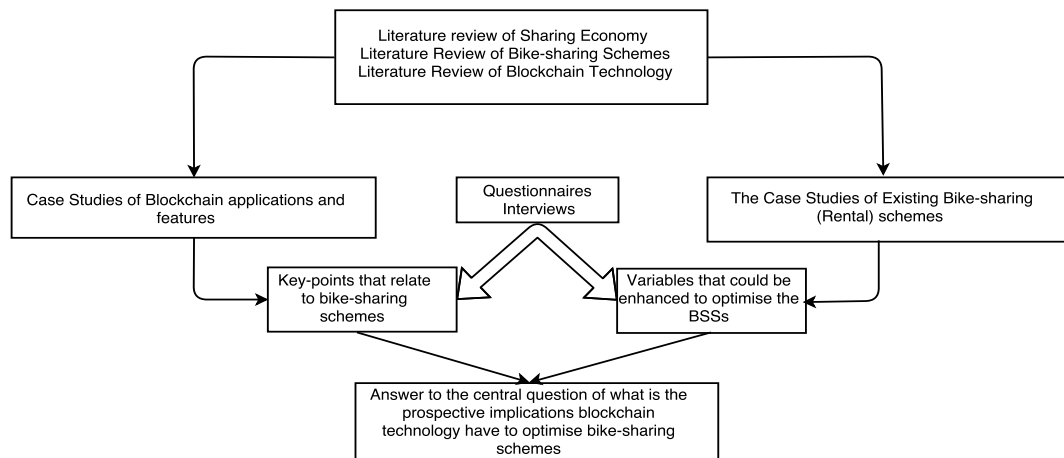


Figure 2. Structure used in this research by the author

1.4 Research scope

This research aims to investigate the current development of blockchain and its relationship with the sharing economy, particularly bike-sharing, and to consider its impact on the business world in general, as an aid to business planning and the development of bike-sharing schemes. Because blockchain contains various concepts and functionalities, in this paper “blockchain” is interpreted to refer to a public distributed ledger with a transaction and data transfer function.

Chapter 2: Literature review

This section outlines the conceptual findings contributing to the understanding of the project referring specifically to the sharing economy, blockchain technology and bike-sharing schemes. It includes analysis of related research and a literature review. The section is structured as follows. Section 2.1 defines the sharing economy and how it affects the global economy, discussing also its history, development, applications and impacts. Section 2.2 demonstrates the basic mechanism of blockchain technology, as a key support to further research.

2.1 Sharing Economy

2.1.1 Definition of Sharing Economy

The sharing economy is nothing new. According to the Old Testament, in Biblical times, the laws of the land demanded that farm owners distribute the part of the harvest that fell along the boundaries of their fields, and 'gleaning' behaviour on the part of peasants was considered normal in Britain until a few hundred years ago. Although the sharing economy is nowadays interpreted and practised differently, the principle remains the same.

There is no consensus today on precisely what actions constitute the sharing economy. Taeihagh (2017) asserts that the sharing economy is a mutual socio-economic ecosystem that allows people to share underused resources directly with others, collectively known as peer-to-peer markets. This definition implies that a sharing economy enables fee-based and access-based asset-sharing consumption (Huckle, Bhattacharya, White, & Beloff, 2016). The sharing economy is a transformative and disruptive economic model, in which the use and consumption of all assets, including physical goods and services, is carried out through leasing, exchange or sharing, using IT for these transactions without the necessity of any permanent transfer of ownership. This business model is ideal when the price of a specific asset is high and the owners of the assets do not fully utilize them (Bogner, Chanson, & Meeuw, 2016). In the last few years, the sharing economy has become a significant driver of economic growth, producing some of the fastest-growing start-ups, such as Airbnb and Uber.

This emerging trend has led to a culture shift. Consumers have become aware that being an accessor is easier and cheaper than being an owner. Ownership of the products is no longer a dominant concept in the consumer market.

However, the idea of the sharing economy has been criticised for implying that non-reciprocal social behaviours enhance societal trust and expand cooperation between individuals, whereas in fact the services involved have become monetized and are often used primarily for economic benefit (Belk, 2014; Eckhardt & Bardhi, 2015; Hamari et al., 2015).

2.1.2 Applications of Sharing Economy

The sharing economy is still a new concept in the market. However, as Taihagh (2017) observes, the number of people partaking in it has increased tremendously lately. The model has been developed to cover a diverse range of sectors, from start-ups to competitive, large hotel chains and car rental services. Huckle et al. (2016) note that the current applications of the sharing economy include service industries, bike-sharing schemes, task outsourcing and car rental.

2.1.3 Features of Sharing Economy

The sharing economy has the following critical features:

- It is transformative and disruptive of conventional business models. Traditional industries such as those in the transport and tourism sectors have experienced the impact in terms of the nature of work and ownership (Guttentag, 2015; Ikkala & Lampinen, 2015; Cannon & Summers, 2014).
- Rental, sharing and exchange. These modes of consumption and use of assets, goods or services improve the utilization rate (Goudin, 2016).
- It is heavily IT-reliant. Online platforms with digital devices are normally used to connect, identify and aggregate relevant individuals and businesses with information on products, services and usage. IT thus enables reductions in transaction costs and increases the reachability of the sharing economy (Gansky, 2010; Belk, 2014; Goudin, 2016).
- According to Gold (2004), people are the core of the sharing economy, being active participants in an organization, community or society, to which they all add and from which they all gain (Gold, 2004). Additionally, people in a shared economy create, produce, pool and disperse resources peer-to-peer (P2P).
- The nature of the engagement, e.g. transfer of ownership, is solely temporary (Belk, 2014).
- Sharma (2014) asserts that, in a sharing economy, individuals, communities or businesses co-produce or produce merchandise or services collaboratively or communally. Thus, production is accessible to all those who aspire to produce.
- The sharing economy represents a hybrid economy involving a wide range of exchanges, inducements and value creation. Value is not only seen in financial terms but also in terms of broader social value and environmental value (Huckle et al., 2016). The sharing economy relies on social rewards and supports the most proficient use of resources.

- Bogner et al. (2016) assert that distribution represents a fundamental aspect of the sharing economy. People distribute and redistribute resources through a system that is both useful and equitable on a domestic, national, regional and international scale.
- The sharing economy directly engages with the public and intermediaries. Economic activities are carried out through either crowd-based online services or intermediaries, e.g. Uber, Airbnb (Hamari et al., 2015).

2.1.4 Categorization of business models in Sharing Economy

In their book, Botsman and Rogers (2011) propose that companies' value proposition provide a means to categorize business models in sharing economy. They claim that when creating fundamental value propositions based on collected information and companies' positioning, three business models emerge, namely marketplace, access-based, and on-demand service provider (Botsman & Rogers, 2011). Marketplace model complements supply and demand sides through an online platform, aiming to achieve a redistribution of used or pre-owned assets and property. Access-based provides access to tangible assets via an online platform, whereas on-demand service provider model facilitates an on-demand amenity or service through an online platform (Botsman & Rogers, 2011).

Gao and Zhang (2016) also apply the approach used by Botsman and Rogers (2011) to propose a method of subcategorizing business models in sharing economy based on the value proposition. They subcategorize these models into the pure marketplace, service marketplace, and community marketplace (Botsman & Rogers, 2011). In a pure marketplace model, a company controls exchange between the clients, but the key operations are done through an online platform with no external involvement prerequisite (Botsman & Rogers, 2011). Service marketplace model enables a business to provide supplementary services to one or both sections of the consumer subdivision, which are vital to the company (Gao & Zhang (2016). Contrastingly, the community marketplace model enables a firm to provide its customers a variety of benefits for being part of a community, involving the sharing of non-physical assets such as time, space, skills.

2.1.5 Social Impacts of Sharing Economy

The social impacts of sharing economy have been hotly contentious both in the academic word and in the media because it is an emerging concept. Frenken and Schor (2017) suggest that advancements in internet applications make sharing of goods or services with strangers more attractive, thereby expanding an existing exercise to a broader social scale. They claim that on some internet platforms unknown persons can meet up face-to-face following a matching process. Thus, through such encounters, new social links emerge. According to Frenken and Schor (2017), sharing economy has a potential to increase social mixing.

Another research by Sharma (2014) indicates that sharing economy enables people to meet new friends and get to know others better. The researcher notes that a site that has been most effective at spawning

new social connections is Airbnb (Sharma, 2014). This online hospitality service allows people to let out or rent lodging facilities on a short-term basis. Sharma (2014) claims that through the site hosts have been able to socialize, share meals, travel with their guests, and in other cases become friends with them. He notes that some people say the platform assisted them to create new social ties they can depend on and provided them the chance to meet persons they would have never come in contact.

It is also probable that sharing economy may be detrimental to social structures as indicated by existing social ties. Belk (2014) suggests that these platforms economize private properties enabling people to hire out or monetize any idle asset. This act in itself does not impact social relations, but while the redundant facility was accessible to family and relatives for free, Belk (2014) expresses concern about the feasibility of non-monetized sharing, going into the future, as people have a preference of earning money. He notes that in one interview, a host accounted being sad about accommodating her in-laws because of the money she missed (Belk, 2014).

2.2 Bike-Sharing Schemes

2.2.1 Definition of Bike-Sharing

The definition of the concept of "bike-sharing" as it discussed in this paper has not been determined yet in academia (G, Yu, 2017). Discussed cases such as Ofo, Velib refer to a process through online application software to connect manufactured bicycles and people, given the theory of "sharing a bike" and "sharing economy. Establish a business model to offline provides bike rental service (G, Yu, 2017).

According to Vogel (2016), bike sharing represents an innovative mobility program that avails bicycles for shared use to people on a short-term period for a fee. The service is suitable for short distance point-to-point journeys, providing individuals with the capability to select a bicycle at one self-serve bike stage and return it at any other bike stage situated within the system's service vicinity.

2.2.2 History of Bike-sharing

Demaio (2009) claims three generations of bike-sharing schemes have existed in the last five decades. He argues that the 1st generation emerged on July 28, 1965, in the city of Amsterdam, Netherlands. The program used the contemporary bicycles painted white and availed for mass consumption. Demaio (2009) notes that through this scheme, a customer could locate a cycle, use it, and in the end leave it for the next customer at a specified destination. However, the program failed because as some people threw the bicycles into the canals while others appropriated them for private use (Demaio, 2009). Thus, the scheme failed within days after its inauguration.

The 2nd generation of bicycle sharing program emerged in 1991 in Grenå and Farsø, Denmark (Demaio, 2009). However, he suggests that these programs were undersized with only twenty-six bicycles in four stations. The researcher notes that it was only after 1995 that the first major 2nd generation bicycle sharing program began in Copenhagen, Denmark, under the brand Bycyklen (Demaio, 2009). The designers of these shared bicycles intended them for utilitarian usage, and they had wheels with promotion plates and hard and thick rubber tires. Demaio (2009) claims that the users could pick the bicycles and return them at particular locations situated in the central city at a fee. The improvements in these programs gave way to the 3rd generation of bicycle sharing.

According to (Demaio, 2009), the 3rd generation bike-sharing scheme emerged in 1996 at Portsmouth University, England, under the brand Bikeabout. The program required students to have a magnetic stripe card to use the bicycles at a cost. The technological advancements have smartened the subsequent 3rd generation of bike-sharing programs with electronic locks, onboard computers, and telecommunication systems (Demaio, 2009). However, it was only after 2005 that 3rd generation bike-sharing programs emerged during the launch of Velo'v in Lyon. The program had over 1,500 bikes with nearly 15,000 members. Demaio (2009) claims that by early 2008, there were around sixty 3rd generation programs globally and by 2009 there were approximately one hundred and twenty programs.

2.2.3 Impacts of Bike-Sharing

Bike-sharing programs have profound impacts on encouraging a larger population of bicycle users, increasing transit use, lessening greenhouse gases, and enhancing the quality of public health. Vogel (2016) notes that the program has had the impact of growing bike mode share of for up to 3% in a metropolis with pre-existing low cycling usage. The author claims that bicycle mode share rate in Barcelona was 0.75% during 2005 and improved to 1.76% in 2007 after the launch of a bike-sharing program (Vogel, 2016). In Paris, the sharing rate increased from 1% in 2001 to 2.5% in 2007 after the start of bike-sharing programs in 2016.

Glover (2017) claims that bike-sharing programs boost transit use in urban centers and improve connectivity to other types of transit because of its first mile/last mile solution model intended to decrease personal vehicle trips. According to Glover (2017), some bike-sharing trips have substituted some trips formerly made on other types of transit by up to 50% like in Lyon after the launch of Velo'v. Paris recorded 50 million bicycle trips in the first two years of Vélib's operations. Glover (2017) alleges that in 2008 nearly 28% of Paris residents reported that they were less probable to utilize their personal vehicle, and in 2009 the rate rose to 46%.

Chen (2017) argues that bicycle sharing programs play a huge role in environmental protection. The author points out that a bicycle sharing program called Bixi has saved more than 3,000,000 pounds of greenhouse emissions since the start in 2009. Another bicycle sharing program called Lyon has saved up to 18,600,000 pounds of green gas emissions since its launch in 2005. According Chen (2017), the public health advantages of these programs are yet to be assessed.

2.2.4 Models of Provision

Ever since the inception of bike-sharing programs, there have been numerous models of provision. Demaio (2009) claims that bike-sharing models have comprised governments, universities, quasi-governmental transport organizations, non-profit agencies, advertising firms, and for-profit companies.

Demaio (2009) claims the government model manages the bike-sharing program as it would do to any other transit program. The government of Spain and Burgos operates such systems. In this model, the government has a more significant influence on the program's operations (Yue & Li, 2017). With the transport agency approach, a supposedly-governmental agency facilitates the service. Its patrons are jurisdiction, states, or countries and examples of such a model are "Deutsche Bahn" from Germany and "Stationnement de Montréal" from Canada (Yue & Li, 2017).

According to Demaio (2009), the university version has a college body providing the service in a campus setting. The programs operated by the University of Portsmouth in England and the St. Xavier University in Chicago are the best cases of such a model (Demaio, 2009). The non-profit version has a company or organization that was either mainly created for the service or one that operates the bike-sharing as a complement to its existing interests (Yue & Li, 2017). Programs like "City Bike Foundation" in Copenhagen and "Nice Ride Minnesota program" in Minneapolis are illustrations of such models.

2.3 Blockchain Technology

2.3.1 Definition of Blockchain Technology

Boucher (2017) defines blockchain technology as a digital ledger that facilitates decentralized and transparent and decentralized means of recording catalogs of transactions. De Sevres (2017) refers blockchain technology as the usage of a "distributed and decentralized ledger" to verify and record transactions. He asserts that this innovative technology enables users to send, receive, and document information or value using peer-to-peer computer networks (De Sevres, 2017).

2.3.2 History of Blockchain Technology

Asharaf and Adarsh (2017) provide a succinct chronology of blockchain technology. The authors claim that the first creations of a cryptographically-secured chain of blocks were illustrated by Scott Stornetta and Stuart Haber in 1991. In 1992, Stornetta and Haber integrated Merkle trees into a blockchain as an effective development to allow them to collect multiple documents into a single block (Asharaf & Adarsh, 2017). However, Satoshi Nakamoto became the first person to conceptualize the "distributed blockchain" in 2008 (Asharaf & Adarsh, 2017). In 2009, Nakamoto realized a fundamental constituent of the digital currency, Bitcoin, which acts as a public ledger for every transaction. By exploiting the use of a peer-to-peer computer network and a "distributed time-stamping server," this technology's database can be managed autonomously (Asharaf & Adarsh, 2017). Bitcoin became the first digital legal tender to address the issue of double spending with no prerequisite for a trusted administrator. In the year 2014, "Blockchain 2.0" emerged, and it referred to all new applications that utilized the concept of the "distributed blockchain" database (Asharaf & Adarsh, 2017). By early 2016, economists and organizations like Harvard Business Review pointed out that blockchain is an innovative and disruptive technology that needs to be further analyzed (Asharaf & Adarsh, 2017).

2.3.3 Blockchain Technologies Technical Concepts

Though the blockchain was designed to sustain Bitcoin ecosystem, Sebastian (2017) claims that literature mentions numerous technical concepts associated with this technology, which does not necessarily relate to bitcoin, and they are:

- The blockchain is a data system, which facilitates the generation of an electronic transaction ledger on a non-centralized network (Pazaitis, Filippi, & Kostakis, 2017).
- Block: it is a page in a record-keeping book or a ledger. They are files that permanently store unalterable data associated with the network (Allen, 2017).
- Distributed & Central Ledger: is a contract of mutual, replicable and coordinated data spread across numerous networks, across multiple computers (Lee, 2017).
- Mining is a word that refers to the process of identifying and solving blocks in a blockchain. A person who solves this algorithm by extending the chain is rewarded with a prize (Rosov, 2015).
- A node: refers to a computer linked to a network. It validates and relays transactions and receives a copy of the full blockchain (Drescher, 2017).

- P2P: also, called Peer-to-Peer, and refers to a computing distributed application structure that distributes tasks among peers. It completes all interactions on the blockchain (Flynt, 2016).
- Smart contract: it is an unchangeable contract stored on the blockchain, which has an exact logic operation similar to the real-world agreement. Once signed, it is unalterable.

2.3.4 Smart Contracts

Summers (2016) defines smart contracts as computer programs, which may continuously be implemented by a network of shared distrusting nodes, with no the mediation of a trusted authority. They are very alluring in scenarios that involve transfers of money such as financial and gaming industries because of their immunity to tampering. Summers (2016) alleges that in the last few years' numerous platforms applying smart contracts have been proposed and executed. Since they exist inside the blockchain, they have a unique address. Users generate them by addressing transactions on them (summers, 2016). They then execute them automatically and autonomously in a prearranged method, on all nodes in the network, based on the data that was incorporated during the triggering transaction (summers, 2016).

Panisi (2017) indicates that the primary aim of a smart contract is to allow two anonymous users to trade and transact business with one another, usually via the internet, with no the necessity for a middleman. The whole procedure is automated and may act as a replacement or a complement for legal agreements, where the terms and conditions of the smart contract are documented and stored in a computer language in the form of instructions Panisi (2017).

2.3.5 Blockchain Applications

Ever since the emergence of Bitcoin, researchers have been exploring other fields where the technology might be of great importance. Pilkington (2016) asserts that the feature of the blockchain technology can enable the growth of a variety of diverse applications. Currently, more engineers and designers are building interesting applications of the blockchain. According to Pilkington (2016), the technology shows potential to be used in many different fields, including domain registration, cloud storage, insurance, healthcare, car sharing, bike sharing, gambling industry, voting, and crowdfunding.

Concerning bike-sharing, startups install every bicycle with a lock system that can only be unlocked using a smartphone (Sundararajan, 2017). Commuters use the services, and when they are done, they pay their charges automatically using a Bitcoin-like payment scheme immediately they engage the lock system. The security device saves the payment until the cycle earns sufficient cash and sends a notification to bicycle retailers (Sundararajan, 2017). The company can use the money to purchase new bicycles and to expand their network. In this way, the bike sharing program can multiply.

A blockchain implementation could result in quick and transparent transactions, faster resolutions, and enhanced evidence gathering. Mir (2017) identifies four stages of blockchain implementation that are applicable across all industries. The first phase involves the identification of a case and scoping out a technology plan. In the second stage, the company proofs the concept (Mir, 2017). The third phase is

the field experimentation. In the fourth step, the organization rollouts the blockchain application into production.

Other than that, more and more companies started up as blockchain-based to explore more possibilities. Such as UbiGo and MaasS Ecosystem. First, UbiGo is a Swedish startup company established in 2013 (UbiGo, 2017). The firm uses blockchain technology to combine numerous modes (transit, car-sharing, bicycle-sharing, taxis, and car rental) into a single and comprehensive service (UbiGo, 2017). After a triumphant pilot project in Gothenburg, the company is planning to relaunch its services in Stockholm in early 2018 in collaboration with Fluidtime, platform provider (UbiGo, 2017). The SME has attracted massive interest internationally, and it aims to expand its innovation to support likeminded companies in urban areas across the globe.

Likewise, MaaS Ecosystem is a system developed by a Swedish company, MaaS Global, in 2016 to assists different transport providers to match their options into a single mobile service, eliminating one-off payments (Maas Global, 2017). It provides a carefree and environmentally ideal substitute for owning a car. The system provides users with the best alternative for every journey regardless of the means of transport (Maas Global, 2017). From office travels to weekend retreats, it enables people to manage their everyday travels smartly.

2.3.6 European Regulations

As cryptocurrencies, notably bitcoin, increase in their value and become progressively more appealing to the public, blockchain regulations have become pressing concerns for most governments internationally (Boucher, 2017). Halpin and Piekarska (2017) allege that whereas China has of late banned cryptocurrency transactions, the European Union has, in fact, become the world's most progressive region by adopting the technology. However, the EU agrees that the technology may present numerous legal and regulatory concerns, including consumer protection methods, enforcement approaches, tax evasion possibilities, and the trade of illegal goods (Boucher, 2017). The European Parliament recognized these challenges and other issues when they passed a motion that emphasized on the adoption of the technology outside the finance sector and called for the need to develop a balanced regulatory approach capability and skills (Boucher, 2017).

Seebacher & Schüritz (2017) argue that the significant obstacle hampering the implementation of blockchain technologies is regulations. Regulatory bodies usually lag behind in technology innovation aspects, and that is the case with this technology (Seebacher & Schüritz, 2017). There are numerous applications of blockchain transactions nearly in every industry, but presently there are no rules on how to write the transactions (Seebacher & Schüritz, 2017). Though blockchain guarantees transparency and audit-ability, highly regulated industries like banking sector should develop new regulations before adopting the technology.

2.3.7 Potential of Blockchain Technology

The mode that blockchain-based cryptocurrency transactions create quick, inexpensive and safe public

records implies that they apply to numerous non-financial everyday jobs, including voting and eliminating documents' forgeries (Boucher, 2017). The technology is ideal for situations that necessitate ownership histories. For instance, they could assist in better management of supply chains to assure that diamonds or gold are morally sourced, that apparel is not sourced from sweatshops, and that champagne is authentic (Boucher, 2017). They could also resolve the issue of video and music piracy while ensuring people purchase legitimate digital media contents. They also provide opportunities in other sectors like healthcare and welfare payments (Boucher, 2017).

2.3.8 Limitation of Blockchain Technology

Morabito (2017) suggests that the adoption of blockchain technology is not without flaws because of its fundamental principles. The first issue pointed out by the researcher is the privacy concern. He argues that even with the present encryption security solutions, cyber security fear is the leading factor that affects public's choices on sharing private information using blockchain systems (Morabito, 2017). Another limitation of this technology is software vulnerability (Morabito, 2017). Even though there are huge and speedy advancements in information technology, people are the authors of software, such as blockchain, and they will at all times be imperfect (Morabito, 2017). Therefore, if leading financial institutions adopt the technology and a significant attack occurs on its networks, it would cause catastrophic damages. Another limitation highlighted by (Morabito, 2017) that affects the technology is that a few people understand its operations, consequently limiting its adoption.

Chapter 3: Methodology

This chapter explains how this research has been conducted, including the design of research process, discussion of methodologies used and the rationales for using such means. It is structured as following each sub-question corresponding with its explanation of research methods chosen.

3.1 Designing research structure

Prior to initiating a research, a research structure should be developed. This research structure is established to systematize the correlation between the elements discussed in the literature review and case studies. In order to answer the question, ‘What possible implications does blockchain technology have for current bike-sharing schemes?’, the research has been carried out as follows.

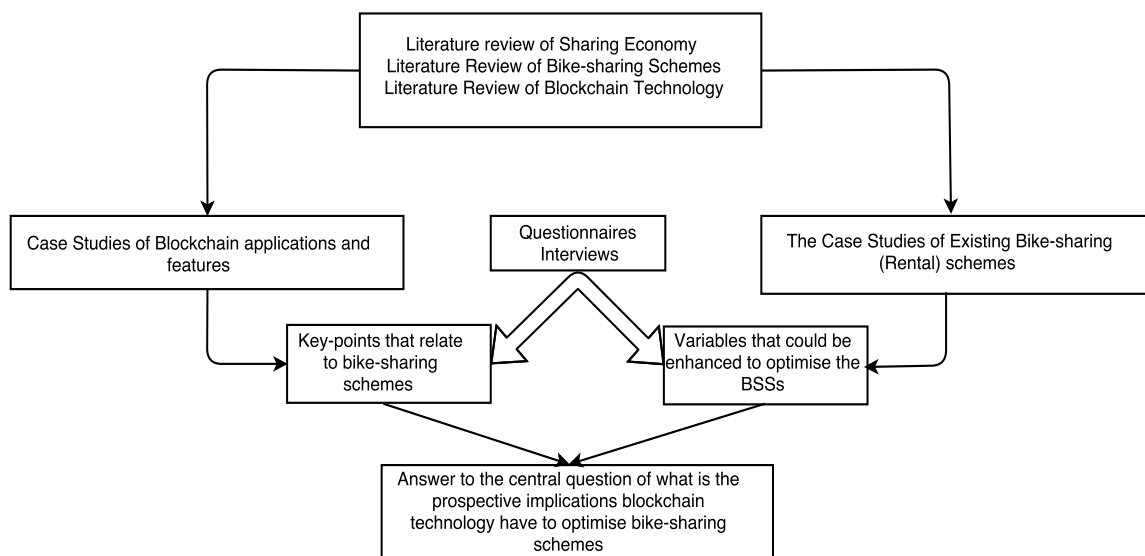


Figure 1 Research structure by the author

3.2 Research methodology

Both quantitative and qualitative methods of data collection have been used. To present a clearer overview of different methodologies applied to each sub-question, each of the latter will be discussed in turn.

-What is blockchain technology and what are its key contributions and applications?

Desk research and case studies were used to understand what blockchain technology is and the latest main developments in its implementation. Qualitative research was used to study the complex technical aspects of the technology and its applicability to this topic. However, a qualitative approach was used to gain more descriptive and in-depth information from specialists, technicians, relevant companies and authorities. For example, academic reports were used as sources of definitions of and theories about

blockchain, such as the writings of H. Kakavand and colleagues at Stanford University. Blockchain is an extremely complex technology, involving computer algorithms and digital systems. However, secondary research using books, online literature, journals and other academic sources provides clearer comprehension and background information relevant to this thesis, as well as terms and terminologies related to its applications.

-How do current bike-sharing schemes sit within the sharing economy, and how do they operate within an existing sharing transport system?

Secondary research including desk research and case studies was mainly used to collect information about the current development of bike-sharing schemes. This involved studying four cases of bike-sharing or rental schemes with different models and systems, namely OV-Fiets in the Netherlands, Mobike and Ofo in China, and Vélib in Europe. Comparable information was obtained about the schemes, such as the context of the companies, the products (bikes), operational methods and prices. The sources mainly included annual reports, papers produced by the companies for public consumption and their official websites.

- To what extent can blockchain technology be adopted to provide better value in a bike-sharing system at a business and corporate level?

This question was designed to gain an overview of what can be done to improve a business situation, based on some primary data on evaluation of the bike-sharing system. The definitions of ‘business’ and ‘corporate’ level were established. Reference was made to books, research reports, articles and journals.

- How do customers evaluate bike-sharing schemes and what are the factors that influence them?

Self-administered questionnaires were used to answer this question. The questionnaires were delivered by hand to each of the respondents and manually collected on completion (Research Method for Business Students, 2009). Two groups of subjects were included in this survey: sharing bike users and city commuters. The purpose was to discover how users evaluate certain elements of bike use and commuting that affect their behaviour.

The purpose of the survey and its confidential nature were explained to potential respondents, all of whom gave their consent to participation. The questionnaires were distributed to Dutch sharing-bike users in Rotterdam and The Hague, specifically around Stationsplein in Rotterdam Centraal Station and Rotterdam Blaak Station and The Hague Central Station and Holland Spoor Station. The reasons for choosing these locations were, first, that Rotterdam is the second-largest city in the Netherlands, with 630,000 inhabitants (Afanasyev, 2016). Moreover, the sheer prevalence of cycling is staggering. The cycle-friendly urban infrastructure has enabled the use of bicycles to increase by 60% over the past

decade, and 80% of people now possess a bicycle. Second, there are numerous bike rental outlets based in Rotterdam, and the residents are more likely to be familiar with bike-sharing (fiestsfan010, n.d.).

- How do the target users and the bike-sharing industry react to the insertion of blockchain technology?

Interviews and questionnaires were chosen as the primary methods to answer this question. Semi-structured interviews were used, so that interviewees could expand on their answers as they deemed relevant or necessary. Before each interview started, interviewees signed informed consent forms.

Two interviews with experts were conducted. The first was with blockchain inspirer Mrs Krullm, and was conducted via Skype. This interview provided generic information about the mechanism of the technology, as well as how it could help to grow and develop a business. The second interview was with Ronald Haverman, who introduced the Chinese Mobike scheme, a leading bike-sharing platform, into the Netherlands and is the current director of Mobike International. The interview was conducted in person and provided historical information and context on the development of bike-sharing in the Netherlands. He also provided some insights into customers' reactions to the market penetration of Mobike into the Netherlands.

Additionally, a questionnaire was used to answer partially this question to see how customers would be interested in the idea proposed by the research project.

3.3 Limitation

This section presents the limitations of the research on which this dissertation is based.

First, the constraints of scalability and coverage could lead to unclear and inaccurate interpretations of the results obtained. Second, the currency mentioned in this dissertation was mainly electronic money such as Bitcoins.

A third critical limitation remained the inability to connect with the company Slock.it, which has rich experimental data that may have been more precise than the data used in this study. Slock.it operates a smart contract run by Ethereum in a lock that can serve a wide range of industries within the framework of the sharing economy, including sharing mobility and transport services.

Fourth, the conclusion is based on current theories and development of blockchain, which means that extrapolating it to the future would be speculative. Moreover, there has been little empirical research done on the possible implications of employing blockchain in bike-sharing schemes, and therefore the present implications are hypothetical, generalized and potentially inaccurate.

Chapter 4: Case Studies

This chapter begins with the overall picture of four bike-sharing platforms to catch a gleam of these the bike-sharing industry, to outline how the bike-sharing schemes are being developed and presented. Then it continues to study the key contribution of blockchain which is practiced on lock and its system attached.

4.1 Case Studies of existing bike-sharing platforms

This section is to discuss four different bike-sharing or rental systems, namely OV-Fiets in the Netherlands, Mobike and Ofo in China and Vélib in France. They are selected to represent three different systems with station-based system, dock-free system and terminal-based system respectively. Thus, several identical factors are discussed, which are company general information, bike design model, price, and use process. By studying these bike-sharing platforms, it could be acknowledged certain significant information, such as what model is being adopted by different platforms, how easy is the payment system, and the logistic system behind it, etc. Moreover, to motivate the choices of these platforms is they represent three markets that are vital for the topic. The Dutch market is deemed to be the possible target market to trial the thesis and the location of the distribution of questionnaire. Mobike and Ofo are the biggest bike-sharing platforms and makes China a significant market to look at. Last, Vélib is one of the most well-known private bike-rental project in the region of European market as the pioneer and progressive role on bike-sharing.

4.1.1. Dutch bike-rental - OV-Fiets

Company description

According to Niches (2016), OV-Fiets is a public bicycle sharing program launched in 2002 in the Netherlands. It is one of the very first bike rental system in the world (Haverman, 2017). Its primary objective is to increase the number of customers of the NS Railway operator, by expanding the public transport system and cycling available in around one hundred rail stations. It predominantly targets rail users who are in need of bicycles when they alight from the rail stations on their route to their workplaces (Niches, 2016), addition to that, white-collar workers, businessmen or Dutch tourists are also a majority of its target users (Slats, 2008). OV-Fiets is a typical station-based bike rental business that relies heavily on human for management and distribution of the bikes (Heaverman, 2017).

Bicycle design



Figure 1. Bike model of OV-Fiets

OV-Fiets is designed with the colour of the combination of blue and yellow. Compare to the original version of OV bicycle, a lightweight of aluminium frame with an integrated headlight is used, saddle is improved and bigger baggage rack is added. (NS, 2017). The design is intentionally simplified to control the cost of production (Haverman, 2017). Besides, no GPS or any Internet of things is involved

with the bicycle design, thus, traceability is impossible within the process. They are allocated and distributed in or close to all the major railway stations.

To access the service, a fee of 2,75 euros will be charged per day (maximum duration 20 hours), payment is automated by means of scanning the bar code found on the pass. By the year 2006, the company had over 23,000 users accessing their services (NS, 2017). In order to rent a bike, users need to register with NS railway company and subscribe to the service for a cost of 10 euros yearly. After that, they get an OV-Fiets card that allows them to pick the bicycles from an automated system at the stations (NS, 2017).



Figure 2. Scanning process to verify personal info

Initiative/design	Stakeholders/set-up	Operation/management
NGO Stitching OV-Fiets	NS, Nederlandse Spoorwegen Railway operator, subsidiary OV-Fiets, NPC Consultancy	NS Railway operator, subsidiary OV-Fiets

Table 3. Organization of the NS OV-Fiets system

This system was found by Stitching OV-Fiets which is a small non-profit association, and has been a subsidiary of Dutch national railways NS (Nederlandse Spoorwegen). In general, OV-Fiets are allocated in the bike parking centres run by NS-Fiets, who is responsible for maintaining the part of the existing bike parks. The advantages of this approach are to reduce costs and make the OV-Fiets location easy to find and raise accessibility. The programme of OV-Fiets is not profitable due to the low rental price, and the funding of the platform is from the city and provinces to justify by the gains in terms of emissions of CO₂, health, congestion, etc. (Dutch Ministry of Transport, in: Pucher and Buehler, 2007, p.4).

The major strength of OV-Fiets is that NS offers an automatic, affordable, and visible system which offers door to door transport in combination of train and bicycle. However, the complexity of the subscription system is deemed to be the present defect, the initiative subscription requires several forms and days to process.

All in all, OV-Fiets is a government-supported programme that cooperates with the national railway to offer a convenient alternative mean of transportation. The bikes provided do not involve with any technology utilization, that is to say, the bikes are untraceable, offline, and fixed with return time and location. The use process engages with personal register with the national railway company to deposit individual information to show the qualification of renting a bike. The mobility and accessibility of this system is considered weak.

4.1.2 China Bike-sharing - Mobike and Ofo

This section is intended to look at the two biggest bike-sharing platforms in China; Mobike and Ofo. The reason is twofold; firstly, China has long been a “kingdom of Bicycle”. However, the importance of bicycle has declined significantly since last two decades as a means of transportation, due to China’s economic development and increasing of private car (Y,Wu, 2017). Nowadays, Smart bike-sharing platforms such as Mobike and Ofo brought back the bikes to the cities. Thus, China is going through a revolutionary process in which bike-sharing is growing incredibly big.

Secondly, the bike-sharing battle between two of them is in full heat in China. Mobike and Ofo, both practice an unprecedented bike sharing model, the dock-free model. It is different from traditional public bike rental; bikes do not need to be returned to a designated area, but in all public space without affecting public traffic. This model expands the ride range and remove the restraints of time and concept of the return location. Mobike being the world’s first and largest bike-share operator (Mobike, 2017); and Ofo another prominent Chinese bycucle sharing company, it is notable to look at these two companies to gain more insight of the current implementation and development within bike-sharing industry.

4.1.2.1 Mobike

Company description

Mobike is a bike-sharing start-up platform founded in 2015. It uses full station-free bike sharing system in China and the largest smart bike sharing scheme in the world (Mobike, 2017). Currently Mobike centrally bases on Shanghai with over 100,000 bikes launched, which made the city of Shanghai the top bike sharing city in the world. Furthermore, Mobike operates in more than 50 major cities in China, oversea market including Singapore, London, and Rotterdam. The company has over 8.651 million everyday active users (Mobike, 2017). and they have collected up to \$ 1 billion from their revenues (Mobike, 2017). The table below is made to demonstrate and summarize the business model of Mobike.

Key Partner	Key Activities	Advantage	Customer segments
1. Government 2. VC investors 3. Mobil payment providers: Alipay and Wechat	1. Design and produce bikes 2. Bike sharing service 3. Operation and customer management 4. Credit data	Product innovation	1. Office workers 2. College students 3. Inhabitants with open mind-set for new things
Value Proposition Provide an efficient, convenient and sustainable transportation means of short distance urban trips while reducing congestion and carbon footprint.		Channels 1. Mobike APP 2. Wechat application	

Figure 4. Business model canvas

Bicycle design

Mobike has quite a distinctive colour design with bright orange with silver. The newest design model, mobike lite, uses a low-resistance solid tyre, equipped with a solar panel fixed in the basket to be self-supplied on electricity to the lock device, automated gear shifting is integrated, redesigned the frame and handlebars and given an adjustable seat. Also, the new model is given an internal chain transmission that better protects the users' pants and legs, by providing a more reliable and durable chain so lower the rate of chain falling off. Moreover, Internet connection is needed to access to the service. Within the Mobike



Figure 5. Mobike Lite

App, user can locate and trace the bikes by the GPS navigation embedded, maximum of 15 minutes' reservation, etc.

Use process and price



Figure 6. Payment system in Mobike

In able to access to the service, users need to download the Mobike mobile application. The process of pick up and drop off is easy with Mobike. Within the Mobike App, user can allocate and find an available bike and make a reservation. Open the App and scan the QR code placed under the seat, the lock will be automatically opened. To terminate the ride, press the peddle to lock it so within few seconds, ride will automatically end

displaying the distance, price and related information. The price is set based on the model; the old version of the is 1RMB per 30mins, and 0.5RMB for the new model.

4.1.2.2 Ofo

Company description

Another prominent Chinese bicycle sharing company is Ofo. The company was established in 2014 and has around 9.651 million daily active users (Ofo, 2017). Like Mobike, it targets the last mile city commuters. The company's mission is to make bicycles accessible to all potential users anytime and wherever (Ofo, 2017). In its strategy, it aims to connect bicycle manufactures internationally with users, encouraging the growth of bicycle manufacturing industries (Ofo, 2017). The idea was initiated in Peking University to provide students cheap and easy way to move around the campus. Now it expanded to 34 cities in China as the second biggest platform with the fastest user growth and series C funding of US\$ 130 million completed (OFO Whitepaper, 2017).

Originality of station-free bike sharing system

The number of self-service public or private bike-sharing schemes has increased aggressively in recent years. Cities like Paris, Stockholm, Shanghai, are all targeted as where bicycle-sharing schemes became so popular. However, the requirements of docking stations along with bikes provided, make it difficult for users to access to the services. Picking up and dropping off have been restricted in certain times and locations. Also, it required substantial funding from the public sectors to maintain the infrastructure of the system, which significantly hinder the development.

Therefore, Ofo initiated the "non-docking" bike-sharing system. It proposed the bicycle sharing model which eliminates the instalment and need of docking stations for users to pick up and drop off. It combines the smart phone to Internet technology, initiated a true concept of shared bicycle-on-demand without the restraints of time and location (Ofo, 2017).

“Ofo for all, all for Ofo”

“Ofo for all, all for Ofo” is one of the central values of Ofo, proposing a new concept that bicycle owners who are willing to contribute their bikes to the platform are given all free access to all of the Ofo bike available (Ofo, 2017). It integrates the current existence of bikes to present a more sustainable bicycle sourcing. Therefore, the sources of Ofo’s bikes are from university students and staff to contribute their bikes, abandoned bicycles in the campus, and a number of “seed bicycles” manufactured and provided by Ofo in its initial stage of development on campus, in accordance of the actual demand, in order to raise the sharing bike awareness (Ofo, 2017). Moreover, Ofo started a bicycle enterprises sharing project which allows bicycle brands and manufacturers to integrate and provide their bicycle to the platform, to avoid investing too much resources on developing and manufacturing bikes (Ofo, 2017).

Bicycle model



Figure 7. Bike model of Ofo

models available in the market (Ofo, 2017).

The latest model of Ofo bike is designed and coloured distinctively as bold yellow. All the bike is equipped with grip shifters, hydraulic saddle, 60% adjustable stem, electric hub, a basket, dynamo light, anti-theft pedal, solar-powered light, 3-speed adjustor, roller brake, aluminium crank, solid rubber tyre, and a smart lock. However, Ofo’s bicycle have been remodelled and placed into the market several times, thus there are different

Use process and price

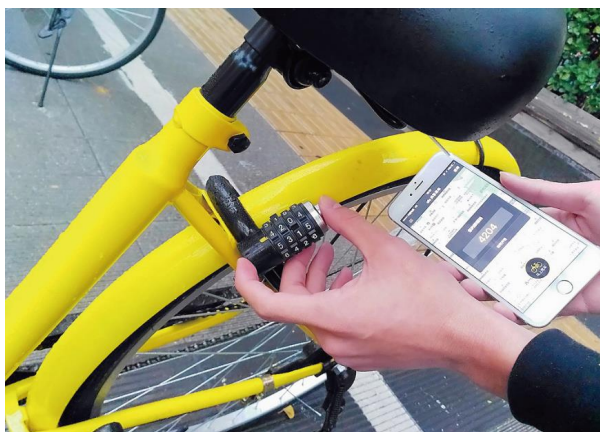


Figure 8. Pick up and drop off process

To use a bike from Ofo, first need to enter the four-digital bicycle ID number with ofo APP and wait for the PIN code. Once the unlock code is received, it needs to manually enter to the lock so the bike can be unlocked.

After completing the ride, simply leave it in any bike parking spaces, and discontinue the ride in the APP. Then repress the locking button and change at least one of the digital number to disorder the code.

Ofo prices itself based on user categories, certified student and school staff pay 0.5RMB per hour; and others pay 1RMB p/h.

Lock design

The lock mechanism designed aims to provide high endurance, fast unlocking, and great performance fits for all-weather. It uses Bluetooth to pairing the bike with the decide via Bluetooth connection for hassle free unlocking. GPS is also installed as the functionality to allow users to locate Ofo bikes by checking the APP. To lock the bike, it requires manual action to push the becket (OFO Whitepaper, 2017).



Figure 9. Ofo's bicycle lock

Issues of Mobike and Ofo

With the leading idea of dock-less bike sharing, adaptation of several crucial technologies making it exceptionally convenient and economical, these two companies have reached massive successes in China. However, three major issues have been controversial for both the public and government. This emerging means of mobility service and transportation is flooding the street, occupying and blocking the public space (BBC, 2017). The services allow customers to return bikes carelessly and often in unauthorised areas, instead of only in designated racks. According to the notice realised by Shanghai's municipal transportation bureau on August. 18, 1.5 million sharing bikes have been placed on the streets, about one bike for every 16 residents. This over-loaded bicycle situation led to a strict regulation addressing to the refrain from any adding more bikes (Quartz, 2017). Moreover, disorderly parking of bicycle also raised as a major issue as it affects the townscape and cause potential dangers. Thus, the regulation demands that companies are responsible for relocation of the bikes parked and scattered carelessly. Otherwise, fines will be made accordingly (Horwitz, 2017). Furthermore, the problems of thefts and sabotage also remain as critical issues for the companies. Said Ofo's chief Public Relations Officer in a local news report, in average of more than 100 shared bikes are reported daily as damaged, sabotaged by competitors, users with illegal intentions, or other reasons. (DGXW, 2017). The spoilage and damage rate reached 10% with high cost for repair and restoration (Rong360, 2017).

4.1.3 European Bike-sharing - Vélib

Company description

Paris' Vélib' (Abbreviation for "Velo Liberte": Bike Freedom) is a leading self-service bicycle rental system launched in July 2007 (Bikeoff project, 2008). The Vélib scheme is operated in Paris, French. Its mission is to achieve city freedom for everybody via thousand of self-service bikes (Bikeoff project, 2008). It is operated by the JCDecaux Development Services, Cyclocity bike Division who supplies system and hardware. The scalability of Vélib' scheme reaches over 20,000 bicycles in circulation in more than 1451 stations in France, with around 86,000 daily users. Vélib is a terminal-based bike rental company. It targets at city commuter and tourists. Vélib (2017) suggests the company targets city commuters. Vélib' operates as a concession by JCDecaux, which is an advertising company (Velib, 2017).

Use process and price



Figure 10. Bicycle terminal of Vélib

To access to service of Vélib, users must subscribe online by providing credit card details and a deposit of €150. Users have the option to choose on short or long terms bases: for the short-term subscription, user can buy from the service point at the bike rental stations. For the long term, €1,70 1day, €8 1week or €29 1year subscriptions are provided, with a subscription, every first half hour is free and additional time incurs a charge of €1-4 for each 30mintue period. (Velib, 2017).

Time	30 min	1 h	1h 30	2h	5h
Rate	Free	€1	€3	€7	€31

To get a bike from the station, first users need to identify the ID by scanning the membership card to the reader or entering the subscription code into the keypad. After personal information is loaded, users enter the pre-set PIN code to finish the authorization. Then select the bike using the number available in the station. The bike selected will be opened and can be used (Bikeoff project, 2008).

To return the bike, the bike must be placed to the bike post, with verification of the light to indicate if the bike is properly fixed. After the correct placing of the bike, the system will automatic terminate the journey. All terminals of Vélib provide information in 8 languages (Bikeoff project, 2008).

Design model

Vélib is coloured in champagne and equipped with automatic lights powered by dynamos, a front basket, a stand and regular setup. All bicycle is secured via individual lock. The bikes have three speeds, internal hubs and brakes are given. They are Notably, Vélib's bikes include a big infor mation signage on the handlebar area, with attention notes written (Velib, 2017).

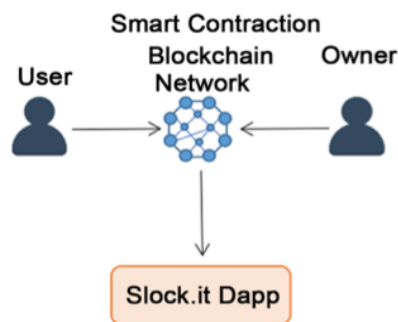
4.2 Case Study of Key Contribution of Blockchain Technology

Presented are examples of distributed applications in the context of the architecture of blockchain technology. To be more specific, Slock.it, a German blockchain-based technology start-up company, and IOTA, a newly introduced open-source distributed ledger technology, will be analyzed as to further understand the practices of the theories of blockchain.

4.2.1 Slock.it

This case is intended to demonstrate the integration application of a blockchain-tied lock and how smart contract contributes to such development constructed by the DAO's principles.

Slock.it is a German star-up company that specializes in blockchain applications (Slock.it, 2017). It sells smart locks that operate based on Ethereum blockchain. The company disrupts the very lucrative



distribution industry by allowing anyone to sell, share, or rent their properties without intermediaries (Slock.it, 2017). With Slock.it, bicycle sharing is made easy because users will use their system via their smartphone to unlock the cycle and pay for their charges without the need for the owners to physically facilitate the services (Slock.it, 2017).

Figure 3. Slock.it Dapp illustration

4.2.2 Smart contracts

The company links the blockchain technology with the physical world by making enforceable smart contracts by using a decentralized app (DAPP) with a smart contract on the Ethereum. Smart contract as discussed before, it enables users to enroll and lease out assets with no contribution of third parties, the revelation of any private information, or any sign up to the platform (Bogner et al., 2016). It is a network of computers that run the blockchain can be self-executing, self-supervised by embedding and storing codes in the blockchain system, ensuring credibility, transparency, and understanding among parties. Therefore, it can be summed up that smart contracts are a pre-written computer program as the law of the entire blocks that execute commands based on the codes given.

DAO

One more significant organization that Slock.it operates from is the DAO. DAO stands for a “Decentralized Autonomous Organization” (Slock.it, 2017). Its primary objective is to codify the regulations and decision-making system of a company, eradicating the necessity for testimonials and people in prevailing and generate a structure with decentralized management. Slock.it conceived of and implemented the idea behind the operation of DAO on April 2016 (Slock.it, 2017). Its designers launched it on the Ethereum blockchain, and it had no customary management composition or board of

directors. It was stateless, and not related to any specific nation or state. On June 2016, some users took advantage of a weakness in the DAO's code to allow them to drain off a third of the company's funds to an auxiliary account (Slock.it, 2017). The leading exchanges like Poloniex delisted the firm from trading with them during late 2016.

4.2.3 IOTA

This section discusses the case of IOTA; the focus will be on its structure, consensus mechanism, capability, and its significant features. The relevance of the thesis is that IOTA focuses clearly on the Internet of Things, especially in smart cities, infrastructure and smart grids, supply chains, transport, and mobility. In addition, IOTA practices micro-payment without fee and secure data transfer and data anchoring, supporting any settlement of P2P transactions which may play important role in bike-sharing schemes.

IOTA is a revolutionary **open-source distributed ledger protocol** to facilitate a more effective transaction and data transfer system, focused on serving as the backbone of the emerging **Internet of Things (IoT)** (The Tangle, 2017). This new core application is developed and accommodated based on the original blockchain protocol, to a new generation of public distributed ledger, so-called 'Tangle' (Dominik. S, 2017). The IOTA is embedded on Tangle as a quantum-proof data structure and based on a Directed Acyclic Graph. Tangle resolves the problem of inefficiencies in the existing blockchain design and enables a new approach to accomplish a consensus on decentralized peer-to-peer systems. Transaction through IOTA does not require payment of fees, which is unprecedented (Dominik. S, 2017). Moreover, there is no fixed limit on how many or how much transactions can be confirmed every second within the network. Interestingly, the network grows faster with the growth in conjunction with activity in the network. Tangle, as such it eliminates the role of miners. Thus IOTA has no separation between users and validators, unlike blockchain architecture. Validation is self-provoked along with the activities as an automatic and intrinsic act of using the ledger. However, similar to the original blockchain protocol, decentralization remains as the essential value in IOTA (The Tangle Whitepaper, 2017).

IOTA data structure

Tangle utilizes Directed Acyclic Diagrams (DAGs), rather than a continuously chained architecture, where blocks are appended periodically (The Tangle Whitepaper, 2017). With DAG, IOTA enables high transaction throughput (through parallel verification) and does not charge for transaction fees (The Tangle Whitepaper, 2017). With the continuous development of Tangle, more and more participants will initiate the transaction. The whole system will also become safer and faster. The confirmation time will be shortened, and the transaction will be completed in a faster manner (The Tangle Whitepaper, 2017).

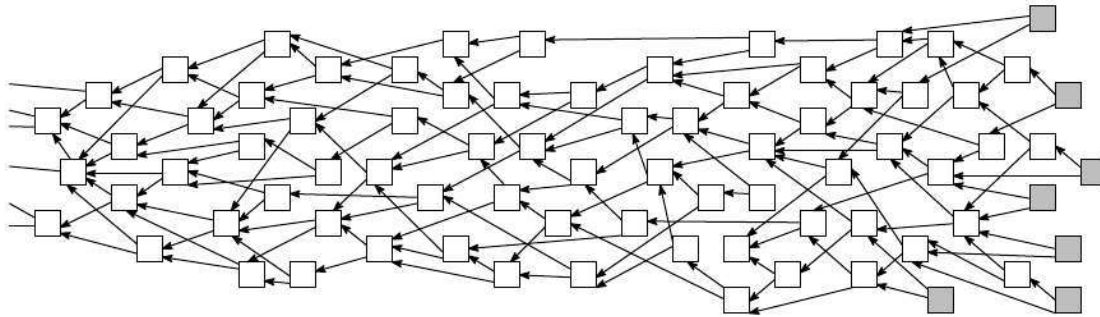


Figure 2. Data structure of Directed Acyclic Diagrams (DAGs) (*The Tangle Whitepaper, 2017*)

IOTA features

IOTA presents a range of unique features enabled due to its architecture. Firstly, the scalability, IOTA allows high transaction throughput is owing to the parallelized validation of transactions with an infinite number of transactions that can be processed in a certain interval (Dominik. S, 2017). Second, a transaction fee is not required. Furthermore, a transaction is done by all participant in the network to actively participate in the consensus. Thus miner is not needed. Thus, it can be said that IOTA is more decentralized by distributing the validation party even more open (Dominik. S, 2017). The last notable feature is that IOTA is quantum immune backed up by a trinary hash function “Curl” with Winternitz signatures (Dominik. S, 2017).

IOTA consensus mechanism innovation

Blockchain consensus is realized through a very rigorous mechanism (The Tangle Whitepaper, 2017). Adding the next block to the blockchain requires multiple parties to compete to obtain rewards or transaction fees as incentives (the concept of Bitcoin). Because of this, consensus and generation of the transaction are separated and done by a small group of people on the network, often setting a higher threshold (just like bitcoin), which leads to phasing possible centralization (The Tangle Whitepaper, 2017).

In the IOTA system, every participant on the network can trade and actively participate in consensus. More specifically, you position two transactions directly (master and branch) and indirectly locate other transactions in child tangle. In this way, verification can be synchronized, the network remains fully decentralized, does not require miners to pass on trust, and does not need to pay for transaction fees.

IOTA transaction fee free

This is achieved through IOTA's unique consensus approach (David, Sønstebo, 2017). Often the transaction fee is payable for the transaction to be validated and included in the next block, but there is no miner or certifier in the IOTA system (to do this, so there is no need to pay a handling fee). The IOTA consensus is completely decentralized, with each member of the network initiating a transaction that directly or indirectly confirms the past transaction (David.S, 2017). It is because of the inherent

characteristics of this consensus (trading terminal selection and calculation of demand), one does not need to pay the fee.

IOTA quantum-immunity

IOTA uses hash signatures instead of elliptic curve cryptography (ECC) (The Tangle Whitepaper, 2017). Hash signing not only outperforms ECC faster but also greatly simplifies the entire protocol (signing and validation). IOTA is able to achieve quantum-immunity because of the signature of the Wennitz is adopted. The ternary hash function of IOTA is called Curl (programming language). (The Tangle Whitepaper, 2017).

IOTA utilities

The current IOTA can do two things well: transaction settlement (especially micro-payment) and data integrity (Dominik. S, 2017). Most of the use cases that are derived from these two capabilities are significant and, in most cases, only via IOTA. More features (such as Oracles and smart contracts, etc.) are already in our development plans and will be officially added shortly.

IOTA focuses on the Internet of Things (IoT) and pays for resources, services or licenses through its machines. Use cases, including smart cities, smart grids, infrastructure, and supply chains, are all possible IOTA targets (Dominik. S, 2017).

Total IOTA supply was $(3^{33}-1) / 2$ or 2,779,530,283,277,761. All IOTAs are created in the initial block, the total number of unchanged, without exploitation, IOTA is non-inflationary. For simplicity, IOTA is measured using the SI system (International System of Units) (Dominik. S, 2017).

Total amount			
2 779 530 283 277 761			
System of Units			
PI	Peta Iota	1.000.000.000.000.000	10^{16}
TI	Tera Iota	1.000.000.000.000	10^{12}
GI	Giga Iota	1.000.000.000	10^9
MI	Mega Iota	1.000.000	10^6
KI	Kilo Iota	1.000	10^3
I	Iota	1	1

Figure 3. Total amount of IOTA

Chapter 5: Questionnaire results and analysis

5.1 Design of the questionnaires

As the research formulated, the goal of the survey was twofold. First, for purpose of serving better as a basis for evaluation of current bike-sharing schemes, the first part of the questions was assigned to sort the degree of importance of most relevant elements that influence people using bike-sharing or rental services, or would motivate them to use the services. The questions engaged with, namely, influence actors and pros and cons of bike-sharing. Secondly, it aims to sketchily examine the customer readiness towards the researched project, to see how willing people to adapt the new technology. The last part of the survey is demographic of the respondents. The questions list and data collected in an Excel form are shown in the Appendix.

In total, 250 of copies were printed as my initial variables. However, 225 participants completed the survey. Since in-person survey distribution method was used, all 225 surveys are valid; the completion rate is 90%.

A trial version of the questionnaire was printed and distributed to a small sample of fellow students (20 cases unrelated to the 250 cases described above) to pretest the questionnaire. These questions were refined three times and the questionnaire was reviewed by both supervisor and fellow students for clarity of research direction, discretions, and the validity of language and terminology. The final version of the questionnaire was printed as paper-based and contained introduction with 14 questions. The average time counted for this group to complete every individual questionnaire was averagely 5 minutes.

General information of the questionnaire design	
Main Purposes of questionnaires	- Defining the level of influential factors on user behavior on bike-sharing - Measuring the general opinion towards bike-sharing or rental schemes - To examine the customer readiness towards the researched project
Target group	- Users of bike sharing or rental services - City commuter
Amount of respondents	225 valid outcomes

Table 1 Summary chart to Questionnaire designing

5.2 Findings of the questionnaire

Participant demographics

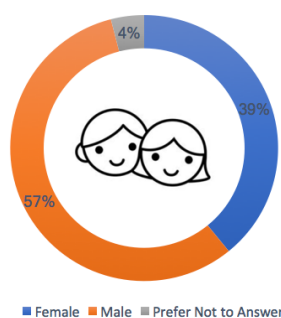


Figure 4 Gender

The survey was conducted with 225 individuals, which were relatively equalized to both gender. 128 of whom were male (57%) and 88 of whom were female.

Most of the respondents' age is within 31 to 50 (67%). About 27% of the respondents' age is below 30. Only a small number of respondents' age is above 50. The question of

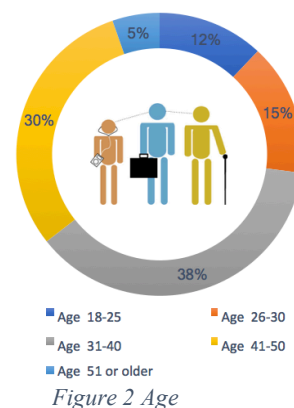


Figure 2 Age

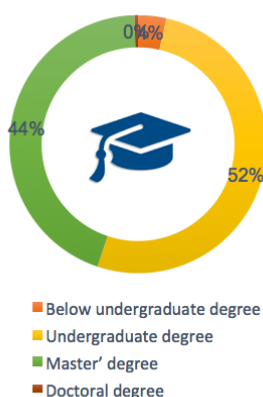


Figure 3 Education level

Speaking of education, as shows in figure 3, among these 225 samples, 52% of the respondents possess undergraduate degree, 44% of the respondents have a master's degree. Respondents with degree below undergraduate are insignificant with just 4%. None of the respondent has a doctoral degree.

The result gained from these questions suggest that the majority of the customer group of shared-bike is in both gender, in their middle-aged and has a relatively high education background.

Usage of bike-sharing and frequency

Questions regarding the usage, usage frequency, and purpose have been asked. Among all respondents, 68% of the them reported having used platforms to access bike sharing or rental services before, while 32% of the respondents claimed that they have never used the schemes. Among those who used bike sharing platform, 40% reported they used the service 1-2 times a week. About 22% of the respondents report they used bike sharing services without a fixed frequency. Only 15% of the respondents report they used bike sharing services every day.

Purpose

To see what were the purposes of people using bike sharing or rental services, this question was proposed to offer several common reasons for respondents to choose from. Significantly, school and work are the top reasons as it acquired 79% as total, followed by travel (15%), leisure and entertainment (5%), and the least significant as it says that people normally do not use sharing bike for exercise.

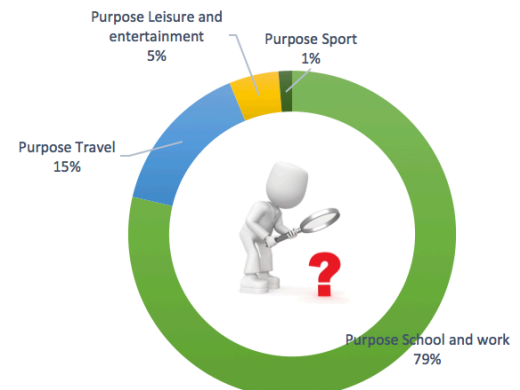


Figure 4 Purpose people use bike sharing

Cognitive Factors in Choosing Various bike-sharing platforms

In respond to the question “How influential are the factors attribute when choosing a platform to rent a bike?”, a range of responses was elicited. As it shows in figure 3, usage price ($M = 9.19$, $SD = 0.59$), time consumption ($M = 8.00$, $SD = 1.12$), safety and quality ($M = 7.99$, $SD = 0.84$) are strongly influencing the customers for their choices renting a bike from a platform. Accessibility ($M = 5.08$, $SD = 1.98$) and deposit to be paid ($M = 4.22$, $SD = 1.34$) are least reasons why customers choose a platform.

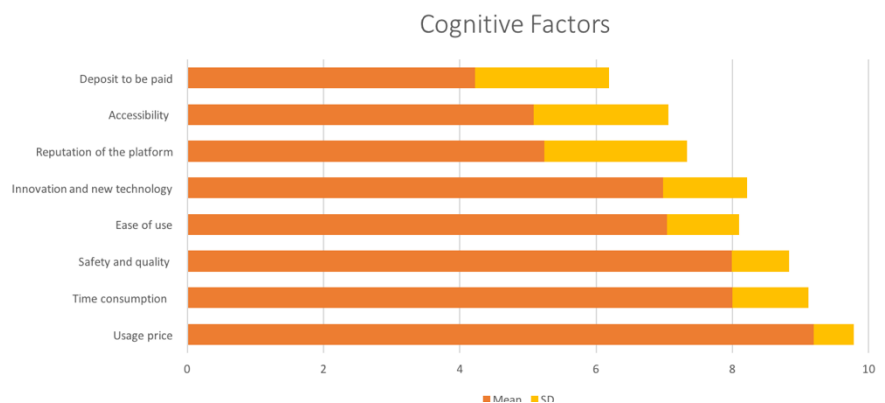


Figure 5 Influential Factors on platform choosing

Among above data, it can be concluded that affordability, time consumed (to initiate the bike, locate and unlock the bike) and safety are key for a company to become more competitive in the Dutch market. Thus, they become essential to be considered as the priority to improve. To get a closer look, the original price that OV-Fiets sets up is 3.85 euros per 2hrs which is the upper limit for customers to accept, thus it should be safe to enter the market with price below 3.85 euros per day. As for the time consumption, it relates to the general time consumers needed to spend on adopting the system. That is to say, bike sharing platforms ought to simplify and shorten the process so that people do not need to over spend time on it.

Advantages and disadvantages of bike-sharing

Respondents were asked, in question 8 and 9, to weight an order of importance to all given factors they consider as advantages and disadvantages of bike-sharing schemes. This question is designed to find out what is the general reaction people have towards the industry as a whole. From the finding revealed, it connects back to why people use the system and what influence it. Sustainability, convenience of pick up and parking, lost cost, new bike model, and other were listed as options. Most notably, environmental friendly (83%) is the most recognized advantage. Then next one is that they think convenience (77%) and low cost (67%) are the benefits of bike-sharing schemes. Last, customers pay relatively less attention about well-designed bike model (47%).

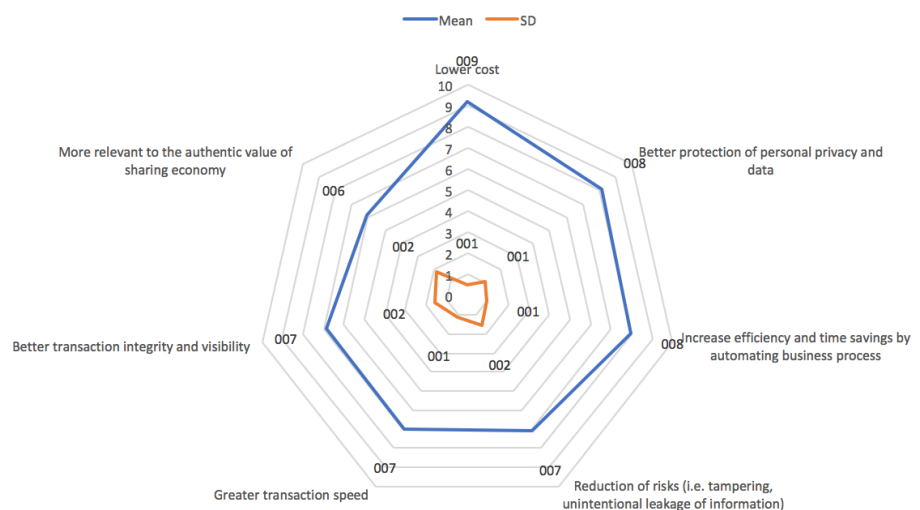
When it comes to disadvantages, the unease of allocating bike is ranked as the biggest disadvantage as 84% of customers stated that. Followed by 71% reported that the high deposit they need to pay ahead as one of the main obstacles for utilization of sharing bike. Moreover, a waste of resources to manufacture the bikes is also considered to be shortcoming of its industry (58%). Same as advantages, customers care less about the design of appearance of bikes (40%).

Enabling factors of participation to use bike sharing schemes

Factors that will encourage one to use bike sharing services can be seen from figure 6. Lower cost ($M = 9.19$, $SD = 0.59$), that can be connected back to the variable that most influences people choosing different platforms, is the strongest factor when

people utilize this mean of *Figure 6 Bike sharing service encouraging factors*

transportation. Besides, better protection of personal privacy and data ($M = 8.17$, $SD = 1.09$), increase efficiency and time savings by automating business process ($M = 7.98$, $SD = 0.97$) are also critical factors that will influence customers' encouraging usage. The relevance to the authentic value of sharing economy does not come to important for the decision making of using bike sharing scheme ($M = 6.10$, $SD = 1.87$).



Overview of Interests of Bike sharing services

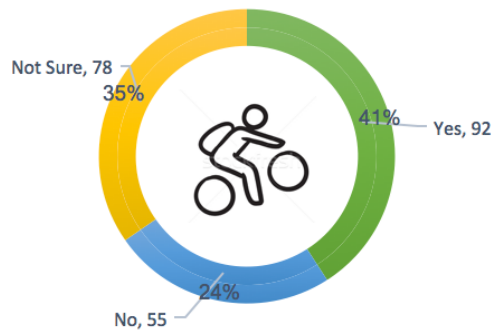


Figure 7 Willingness to rent out their private bike

41% of the respondents report that they are interested in renting out their bike in the future. However, 35% of the respondents are not sure, and 24% of respondents are not interested in renting out their bike. When speaking of rent someone else's bike, there is a 9% increase in interests in renting (49%). We also see a 10% decrease in not sure option (25%). While not interested in renting another people's bike remains similar (26%).

Respondents were asked to indicate if they were interested to rent out or rent other's people's bike by using the project researched. After introducing a scenario which describes a possibility in which using the lock supported by autonomously-governed smart contract in blockchain allows us to share, rent or rent out self-own bikes to another user on an online platform in a safe, flexible, sustainable manner,

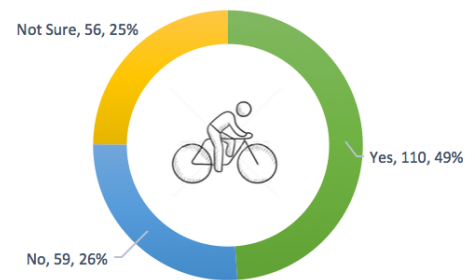


Figure 8 Willingness to use others' private bike

Bike possession status quo and unused status

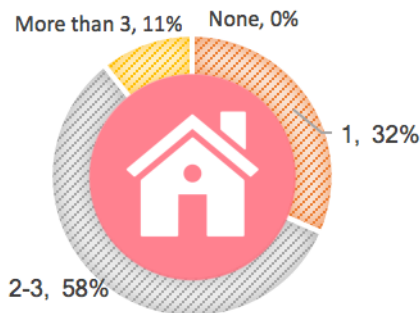


Figure 9 Possession of bike in household

respondents (77%) described the time their bike being unused is between 18 to 23 hours, 21% within 10-18 hours. However, it is unexpected to record 3 respondents claimed that they would use their bike for more than 23 hour per day. It goes without saying that most of the times bike are situated as vacant.

Status quo of current bike possession can be seen from table 5. More than half of the respondents possess more than one bike in their household (58%), followed up by 32 % of the sample having one bike and 11% of respondents have more than 3 bikes from a household perspective.

Respondents were also asked to state how many times that their bikes are being left unused. The majority of the

Chapter 6: Analysis

In this chapter, the results discussed in sections of literature review and case studies will be analyzed in order to conclude the research questions proposed. These constitute ‘*What possible theoretical implications do the Blockchain Technology have to optimise Bike-Sharing Schemes? To what extent it can provide better values for the bike-sharing system*’.

This analysis will mainly look at three aspects, existed bike-sharing platforms, customers’ evaluation, and key contributions of the blockchain. Based on the findings from the case studies of existed bike-sharing schemes and questionnaire results, three aspects of the bike-sharing system are extracted and considered to be crucial for further development, namely, efficiency, costs, and peer-to-peer connection. With this in mind, the case studies of blockchain discuss the solutions and alternatives to optimise the bike-sharing schemes in a business level.

Efficiency

First of all, the case studies of BSSs showed that for both public or private organizations of BSSs, the processes of accessing the services are lack of efficiency. For all the bike-sharing schemes, it costs times, money and human efforts to manage, coordinate and control all the execution and process, such as verification process, expense transaction, and bicycle organization. For example, OV-Fiets requires four steps to access the service, register online, authorize the service, pay the deposit, receive an OV Chipcard. This process takes about 3-4 working days and is considered to be excessive. Moreover, the efficiency of the course to pick up and drop off the bike is low. The location and time of pick up and return are fixed without a user-friendly method to inform the platform for later return. Likewise, Mobike’s authorization process needs about two days to verify the users. Also, the overmuch placement of bikes shows a low level of efficiency of bike management to match the demand for the services.

To this extent, using blockchain to automate and programme the clearance, payments, verifications, and records of bike sharing, hence efficiency could be improved. The application of blockchain in such a business environment eliminates the need for any intermedia thus reducing contact time and lapses. Also, decentralization is achieved through the assigning of public and private keys to the trader and buyer; both denoted as nodes in the system. In doing so, any of the nodes are allowed to make changes, carry out transactions and enforce contracts. Besides, blockchain has had a tremendous effect on speeds of transactions. To begin with, all details are recorded almost real-time to many computer users logged online at the time of the transaction. Being a publicly transparent, open-source ledger based on software, it enables market-like transactions within the press of a button.

Costs

Secondly, it goes without saying that costs are critical and influential for any business to grow, develop and make profits. There are two meanings implied with regard to costs. One is the costs and prices that customers pay. The other one is the operating costs companies need to control.

To start with the cost to the customer, as per the finding, low price is the top enabling reason that people choose to use the shared bike. Also from the questionnaire results, it is learned that the price setting is acceptable. The market price level for one hour of a shared or rental bike in the European market is between 1-2euros on average. However, it is significant cheaper in China 1-2 RMB (0,25Euro) per hour. Hence, the costs to the customer would not be considered problematic. However, traditionally, every transaction in a centralized system required transaction fee and other accompanying charges for the agents and third-party players. A parallel and simultaneous blockchain-based system, with Cryptocurrency used, on the other hand, allows global transactions with minimal side charges. Ron Mcfarland (2017) of opensource.com notes in his study that Transaction cost reduction could be achieved by micro-metering and micro-monetizing. In this regard, if a service, product or operation is metered in time and its costs determined in time, then payments for work done or service delivered could significantly be cut down and more efficiency on time and charged fees would be achieved.

Furthermore, the operating costs for the bike-sharing companies such as the cost for bikes loss, intentional damage, a lock for personal use, and sabotage, are currently unable to track back to the users who are responsible for it. The system could not oversee the activities with the complex and mass flow of users and usages. It is important to verify and require the authenticity, integrity, and reliability of both parties within the system to maintain a secure, low costs, and user-friendly services and journey. Blockchain provides just that. Since it is an open-source, consensus-based and immutable ledger, a track record is kept of all commodities and can easily be verified for authentication. All the connected users within the blockchain web act as witnesses and the permanent timestamps of the transaction and all other transactions within that set specific timeline are stacked together in a block for verification. Transaction history which is available can be viewed anytime from any place, and any updates are logged and are immediately visible to all participants

Peer-to-peer connections

As bike-sharing schemes part of the sharing economy activities, peer-to-peer connections remain to be the fascinating aspect to discuss. As blockchain being developed, it advances sharing economy approachability and make it easier to use, encourage and secure more participations and activities of sharing economy. The economic model in which people can freely share, monetize, manage their private assets to one another will be optimised by blockchain technology. The smart contract is one of

the essential applications within the distributed network of blockchain and the key to developing a P2P and info-trackable bike-sharing schemes. It automatizes a contract given customized and precise condition to execute and manage assets, such as money, the title of a property, data are all exchangeable. Such P2P connection uses a broadcast-based network to achieve communication, transactions, contracts making across networks using nodes.

To make it relevant to the sharing economy, such a network provides a digital, virtual marketplace where people accessed to all resources available and agreed to be shared. Bike's information with whose owner's personal data can be stored and managed via the blockchain in a digital contract system. Those data records are coded as digital assets and collected securely in the blockchain under a pseudonym, e.g., digital address. Users can allow other parties to view their property's information, in this case, is the bike. Further to require their private key enables access to the property. The record might contain information from purchase date, price, insurance status, models and rental history.

Better Data Protection

For what it is worth, data protection is also another crucial factor that customers pay attention to. For any business, protection of data against alteration or falsification is paramount. The business world is rife with dubious and underhand practitioners who, with the editing of a record or transaction figure or detail, seek to benefit unduly, at the expense of others. For the blockchain technology, immutability is the characteristic; editing of records is impossible since it involves editing every ledger record in every computer in the network. Unlike the centralized system where all records are kept at one location, which increases vulnerability, blockchain enables every user to keep a copy of the chain on their computer. This makes fraudulent editing or changing of records practically impossible. Furthermore, Cryptography techniques, of which blockchain is one, were initially devised for security systems (Saper, 2013) and can thus be trusted in the business world. Therefore, better protection of data remains to be an important implication to sharing economy as well as bike sharing schemes.

Chapter 7: Conclusion & Recommendation

Conclusion

What is blockchain technology and its key contributions and applications?

Blockchain technology is an innovative public distributed ledger that automates peer-to-peer connection to verify information, trade, transfer money, communicate and record transactions in a transparent, decentralized, and protected means. It has been aware of the universality of use of blockchain to various business practices when involving with asset management, money transaction, or public administration. Key applications engage mainly with Smart Contracts and Ethereum that support the self-execution and indemnification of its utilities. Main applications are Slock.it and IOTA. First, Slock.it has developed a lock that embeds blockchain as their grass-roots system which allows people to interact and manage their properties, assets and payment in a quick, cost-efficient, and safe environment. Moreover, IOTA is a newly invented micro-payment distributed ledger built upon blockchain and share the same principles. It thoroughly eliminates the need for any intermedia and uses Tangle as a quantum-proof database, so high safety is ensured.

What are the current bike-sharing schemes with the nature of sharing economy, and how they operate within the existed sharing transportation system?

The concept of bike-sharing schemes is delivered by a process, online or offline, of providing manufactured bicycles to the public for a small fee. Three existing bike-sharing or rental systems have been discussed in this paper in the context of four bike-sharing platforms. Public bike rental schemes have long existed in most countries with low technology utilization, mostly station-based with a manual lock system. On the other hand, the private terminal-based system comprises more modern methods and is equipped with GPS and an information panel. However, using a bike is a complex process involving many steps. The dock-free system presents a free-floating bike-sharing model in which bikes are personally and geographically trackable. It is highly flexible, allowing people to pick up and drop off in specific designated areas, and time-efficient, as a mobile application can allocate the bikes where and when they are needed. The scheme is conceived as an adjunct to conventional means of transport, such as train and bus. The case studies on bike-sharing platforms and questionnaires showed, however, that reliability and accessibility remain stumbling blocks to the further development of bike-sharing schemes.

To what extent blockchain technology can be adapted to provide better value for the bike-sharing system in a business and corporate level?

Blockchain in a business process or at corporate level has the advantage of eliminating the middleman and other intermediaries, thereby improving business efficiency, reducing transaction time and

complexity, enhancing services, minimizing process costs, increasing integrity and visibility and upgrading speeds. It further affords ways of refining data protection, especially in peer-to-peer connections and trading.

How costumers evaluate and weight bike-sharing schemes with certain influencing factors?

The results of the questionnaire showed that 83% of respondents recognize that bike-sharing is highly environmentally friendly and 77% judge it to be convenient for picking up and parking. However, respondents found that the process of allocating bikes was not easy (84%) and were displeased with the high price of rental and the high deposit (71%). It should be borne in mind that the bike-sharing schemes that these respondents have used have certain favourable characteristics. Lower cost, better protection of personal information and efficiency were three key points that customers identified as in need of improvement.

How do the target users and bike sharing industry react towards the impacts of blockchain technology application?

Less than one-third of the target users (questionnaire respondents) expressed no interest when asked if they were willing to rent out or share their bikes, utilizing a blockchain-based lock, or to rent others' bikes. Nearly half of the respondents gave positive answers to questions about whether the development of blockchain on shared bikes was a sustainable solution and a way of taking advantage of the bikes' underuse. Furthermore, the interviewee, Mr Haverman, was optimistic about the integration of blockchain into the bike-sharing system and its relevance for future business development. However, he observed that blockchain technology is not yet used by most bike-sharing companies, owing to the immaturity of the technology and the high cost of changing customer behavior.

Recommendation

Blockchain technology is a ground-breaking creation of the significantly trending cryptocurrency, Bitcoin. Although Dutch customers indicated positive attitudes to trying bike-sharing schemes based on the technology, the size of the market and the return on investment are holding back bike-sharing companies from further exploring it. Therefore, it is suggested here, first, that companies use the Netherlands as a trial market, with the idea of possibly expanding to other European countries.

Second, although this dissertation mainly focuses on bike-sharing because it is widely used, low-risk and low-cost, it is suggested that blockchain technology can be applied to other forms and activities of the sharing economy, such as house-sharing and car-sharing.

Third, more research is necessary to discover the attitudes of people in Asian and North American markets because the present research has explored the Dutch market only. Different behaviours and concepts, as well as the consequent market potential, are likely to pertain elsewhere.

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Appendices

Student Ethics Form

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Appendix 6.3 – Student Ethics Form

European Studies Student Ethics Form

Your name:

Supervisor:

Instructions/checklist

Before completing this form you should read the APA Ethics Code (<http://www.apa.org/ethics/code/index.aspx>). If you are planning research with human subjects you should also look at the sample consent form available in the Final Project and Dissertation Guide.

- a. ☒ Read section 3 that your supervisor will have to sign. Make sure that you cover all these issues in section 1.
- b. ☒ Complete sections 1 and, if you are using human subjects, section 2, of this form, and sign it.
- c. ☒ Ask your project supervisor to read these sections (and the draft consent form if you have one) and sign the form.
- d. ☒ Append this signed form as an appendix to your dissertation.

Section 1. Project Outline (to be completed by student)

(i) Title of Project:

(ii) Aims of project:

- (iii) Will you involve other people in your project – e.g. via formal or informal interviews, group discussions, questionnaires, internet surveys etc. (Note: if you are using data that has already been collected by another researcher – e.g. recordings or transcripts of conversations given to you by your supervisor, you should answer 'NO' to this question.)

YES / NO

If no: you should now sign the statement below and return the form to your supervisor. You have completed this form.

This project is not designed to include research with human subjects. I understand that I do not have ethical clearance to interview people (formally or informally) about the topic of my research, to carry out internet research (e.g. on chat rooms or discussion boards) or in any other way to use people as subjects in my research.

Student's signature _____ - date _____

If yes: you should complete the rest of this form.

Section 2 Complete this section only if you answered YES to question (iii) above.

(i) What will the participants have to do? (v. brief outline of procedure):

(ii) What sort of people will the participants be and how will they be recruited?

(iii) What sort stimuli or materials will your participants be exposed to, tick the appropriate boxes and then state what they are in the space below?

Questionnaires[] ; Pictures[] ; Sounds [✓]; Words[✓]; Other[].

(iv) **Consent:** Informed consent must be obtained for all participants before they take part in your project. Either verbally or by means of an informed consent form you should state what participants will be doing, drawing attention to anything they could conceivably object to subsequently. You should also state how they can withdraw from the study at any time and the measures you are taking to ensure the confidentiality of data. A standard informed consent form is available in the Dissertation Manual.

(vi) What procedures will you follow in order to guarantee the confidentiality of participants' data?

Student's signature:  date: 25/12/2017

Supervisor's signature (if satisfied with the proposed procedures): date:

Dear respondent,

This questionnaire is designed to help exploring the implications of the recently most-discussed innovation blockchain technology in bike-sharing schemes.

This questionnaire consists of 14 questions with less than 5 minutes to complete. Your responses will remain confidential and anonymously.

1. Have you ever used any platforms to access bike sharing or rental service?
Yes
No (if this is chosen, please skip question 2)
2. How often do you use bike-sharing service, in a weekly basis?
None
1-2 times
3-4 times
everyday
No fixed frequency
3. For what purpose, you used/or you would like to use a bike-sharing or rental service?
School and work
Travel
Leisure and entertainment
Sport
others
4. How influential to you are the following attributes when choosing a platform to rent a bike?
On a scale from 1 -10, from 1(least influential) to 10 (most influential)

[illegible]

5. What advantages do you acknowledge regarding bike-sharing? **(Please select all that apply)**

- Low cost
- Convenient of pick up and parking
- Environment-friendly
- Well-designed bike model
- Other ____

6. What disadvantages do you acknowledge regarding bike-sharing? **(Please select all that apply)**

- High price with high deposit
- Unease of allocating bike
- Waste of resources to manufacture the bikes
- Unpleasantly unified design of appearance
- Other ____

7. On a scale from 1 to 10, from 1 (least influential) to 10 (most influential), which of the following would encourage you to use bike sharing service? **(Please select all that apply)**

1 2 3 4 5 6 7 8 9 10

Increase efficiency and time savings by automating business process										
Better transaction integrity and visibility										
Greater transaction speed										
Lower cost										
Better protection of personal privacy and data										
Reduction of risks (i.e. tampering, unintentional leakage of information)										
More relevant to the authentic value of sharing economy										

Please read the following statement which describes a scenario of bike-sharing employed blockchain, so that chooses whether you are interested of utilizing the service.

One day, you commute to another city from your home city without bringing your own bike with you, and need a bike to travel a short distance. On a street, you see bikes equipped with smart locks. You find one that suits perfectly your height and you like the design of the bike. You now pull out your phone, scan the QR code placed on the lock, directly pay the deposit to the person who owns this bike and currently not in need of it. The lock is automatically opened and now you can ride it for a period of time entirely in your call. After you arrive at your destination, you place it responsibly, lock the bike, and off you go. The deposit is return minus the cost to you within the second you have the bike locked back

again.

This scenario describes a possibility in which using the lock supported by autonomously-governed smart contract in blockchain that allows us to share, rent or rent out our bikes to other user on an online platform in a safe, flexible, sustainable manner.

8. Would you be interested to rent out your own bike for a charge?
 - Yes
 - No
 - Not sure
9. Would you be interested in using (rent) someone else's bike for a small fee?
 - Yes
 - No
 - Not sure
10. How many bikes do you have, or your household possesses?
 - None
 - 1
 - 2-3
 - more than 3
11. How many times of a day that your bike is free and being unused, averagely?
 - More than 23 hours
 - 18-23 hours
 - 10-17 hours
 - 0-9 hours
12. What is your highest educational background?
 - Below undergraduate degree
 - Undergraduate degree
 - Master' degree
 - Doctoral degree
13. Gender
 - Male
 - Female
 - Prefer not to answer
14. Age
 - 18-25
 - 26-30
 - 31-45
 - Above 50

Thank you again for completing my survey! If you have any further questions or interested in reading about my results, please feel free to contact me via e-mail j.zhao@hotmail.com.

Interview transcript

Interview with Blockchain inspirer and expert

(I) Informed Consent Form

ES Guide for Final Project and Dissertation 2017-2018 | 2017-2018

Appendix 6.4 – Informed Consent Form

Informed Consent Form

- 1) Project Title
- 2) Project Description (1 paragraph)

If you agree to take part in this study please read the following statement and sign this form.

I am 16 years of age or older.

I can confirm that I have read and understood the description and aims of this research. The researcher has answered all the questions that I had to my satisfaction.

I agree to the audio recording of my interview with the researcher.

I understand that the researcher offers me the following guarantees:

All information will be treated in the strictest confidence. My name will not be used in the study unless I give permission for it.

Recordings will be accessible only by the researcher. Unless otherwise agreed, anonymity will be ensured at all times. Pseudonyms will be used in the transcriptions.

I can ask for the recording to be stopped at any time and anything to be deleted from it.

I consent to take part in the research on the basis of the guarantees outlined above.

Signed: Junjie Zhao Date: 15 Nov 2017

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Interviewee name: Manuela Krull-Mancinelli

Relation: The interviewee has been working professionally in IT in the financial service industry for 20 years and have been years a blockchain entrepreneur researching on blockchain applications in private sectors for its commercial and strategic uses.

Age: 42

[J: Zhao]

[K: Ms. Krull-Mancinelli]



J: Hi. Mrs. Krullm, nice to meet you. Thank you for agreeing to have this interview with me.

K: Hi, Jam, no problem, I am happy to help.

J: for starter, for the use of my thesis, I'm the recording this conversation. Please give me the permission to do so.

K: Yes. OK.

J: Then I will just start with introducing my topic so you will have a better overview of the questions. was just beginning. I was just simply indigenous myself first. My name is Zhao attorneys who is studying in The Hague the high school in European studies and now is my fourth year. So, I'm writing my thesis based on a topic that I have already told you. So. I'm going to just move on to introduce to you what my thesis is basically about my thesis is is to find out what kind of implication or impact that block Chan has on bike sharing scheme.

J: Yes. Yes. So basically, I just start with like what. Start analyzing what is broad trend and what is sharing economic and then narrow it down to what does it do to by sharing. And so basically this paper is to serve. A further market research of such products. Ha ha ha. In further way, I'm going to find out how what is the market share and what is markets are the BTP and how willing people will try this project or idea or product. So basically, this is what this is my thesis. So now I'm talking to you who are you obviously very experienced on what is a broad trend Margie and I'm still like researching and I know how it works but this is so complicated as I expect. It's so fascinating its technology. So, I'm just going to ask you something about how you define it or sicko or what kind of government support they have now. And some development. There will be that basically. So, can you just briefly introduce yourself and and how do you relate yourself to the field of block Chen technology.

K: Yes, sure. Thank you for your introduction. My name is. And I spent working as an I.T. manager for 21 years. Oh, and between patients and artes. So, I must understand both worlds do the technology and not have to understand the patients. Three years ago, I started to think that was the start of everything and I completely agree with you that's a fascinating technology. Immediately you know fascinated by the whole concept. Yeah I think that's you grace my introduction. Oh.

J: Can you place like explaining or defines blockchains by your own words? Despite all the information given and do you how do you distinguish this concept. And do you have any difference ideas about it than others. First

K: This question is quite like the situation if I would ask you what is the internet. The point is from which direction are you looking at this concept. So, I would ask you what is the Internet you could talk

about the business application or you could talk about a technique or you could talk about some other things that are related to Internet to saying the same for blockings. I usually explain a lot change from three perspectives and things started thinking to us in a short of financial form in this world of Bitcoin. This is where the actual financial perspective. Yes. There's a lot of this name tech not a technical perspective. And there's this peer to peer perspective. In this case, I would say it's the peer to peer perspective that you're looking at.

J: Yes, indeed. And, technical.

Yeah. Yeah it's related to how everything is communicated.

J: Okay. So, I'm just going to tell you about ones very importance and Eamon's is the lock you know the campiness lockets.

Yeah yeah. The current developing lock. With distillation of block Chain technology includes. So how how how do you know anything about this lock.

Is that the company did provide a low credit banks which you made?

K: Yes, I think so. The East German company. Because. Lockheed. Densher concept to that concept today gets. That sort of digitally Luks your bike and you can knock your back. Is that what you mean. Yes, I heard the name of the company that's lockets and it's a shame. Yeah. Yeah I think that gets to Scholte chip kind of from identity type of thing Kishan to identify devices an entity on the block. Is this being this rendering all that love. I think so. Yeah okay. Then you should everybody should be registered on the block chain or the budget can exchange anything. Yeah yeah. Sure, there are piece to peer perspective probably is maybe you must pay for it. The fundamental perspective. Yes. Okay.

J: What kind of applications that you know are being developed with blockchain?

K: Business. That's. This integration between sprog change technology and the thing that we regularly use these days. Besides bitcoin though now you say any education that's in the net and people are developing to integrate these two as the expense.

J: Because like I know there's some developments on block chain technology on insurance for example or some banking system. They also are using you. So, do you know anything else that they also adopt brought change to.

K: Yes, yes there's there's a lot of initiative Shatz Aloma says that's why I was asking in which area are you looking for examples and if you can't you're looking for chuckles in the insurance industry or anyone else to be in the entertainment workshop or do anything really.

K: Because it's global. Yeah your cation in India UK companies called every letter and they registered diamonds on the blood bank. To make it traceable whether diamonds ish artists try to avoid that you buy diamonds. That's one application of this letter is technology and the other aspect is that if someone claims a diamond to be stolen the insurance company can then they ever let Churchland have inside index registration or at least if they claim are issued the legitimate owner of diamonds. Okay cool. Yeah the application okay. So, step the two year should go its quite established company already.

Okay so basically they just picked the advantage of records everything is automatically records in the system. So, everything is traceable and they highlight this feature. Because.

Well it's not Ulstermen Labor Day they register a lot of its attributes our criteria about a diamond the block chain so it's really recognizable as that diamonds. Okay.

J: Cool. But like because. I know it's. Because I read it from the internet they say Denethor is one of the most leading country and has a lot of people who are interested and dedicated to and. To to block.

K: Well that's what I read too. And yeah there are lots of initiatives in the Netherlands indeed. I don't know how that is in other countries. I do know that there are a lot of initiatives for example also in Germany and in Switzerland because I participated by in the global I could tell that the largest global consumers of organized by the United Nations. It was based both because it was the site track of that climate took on and was the only person from the could tell. Oh, OK. But in general, there is a lot of initiative Shindand. Yes.

K: OK. Birds. Thrillist like this. Quite some integrating developments going on. And like you mentioned the or the like avocations birds tubeless block. And B nodes and investment still hesitating. What is the obstacles Pasupathi? Either technical aspect or the societal expense. Is blocking the way.

K: I think one of the biggest problems just that the legislation is not up to par with research to new technologies.

K: Not only blocked Chandler for almost every new technology that makes people agitating of course because if it's not an option then lets you have an initiative that called the landlords the landlord an initiative in the real estate sector they register rental houses on the block chain and you could buy a share in that transit house and you get so you get revenue as a percentage of that rich part you in that sense. And the central authorities share a little bit in doubt whether they are like giving out to issuing shares or it's a company that is selling houses. It's the company that is renting houses show to central Surtees don't know how to treat this new kind of business concept. Ok. Yeah that stands in the way of course. OK. So, this supports all the mention from government use the weak.

K: Yet the legislation is difficult and. Yeah yeah I think that's one of the most important things. And of course, it's quite small group. It's still sequential growth because it's integral in a lot of people are talking about look change. But if you see several people that understand low change and are capable of developing system that version is still unlimited okay. And, I think one of the problem is the speed of accuracy.

K: And of the transaction of course because now they by the EUs centralized system. So, we trust i n g we trust Rouba. Or so on and so on. But. Heck everything is peer to peer. Somehow it's a really Hafer the lights on the quality of the people and ease is although the code is the law and the code is the fix. But somehow I think people use the CAN BREAK THE THE THE THE THE. The law of the system. And do you think that would be a problem. Yeah.

K: Well that bring to back that today on the legislation. Why do we trust them? You know don't break a bank is not necessarily a party that gives you a lot of revenue. Today it's almost zero. You almost must pay for the money that you protect your savings you. And still we trust the bank. Why is that. Because there are whole governments around it. There's governance built around the concept of that and that whole governance issue now. Missing in the Glub changes.

J: OK. And so, I wonder if the notes. A little bit more specific about how confident things about these technologies. And the legal aspects of legislation do. Give me a sample a sample one or two. Of how they think Kofinas for some of them and I'm not the only Irish. Disclaimer.

K: But I did talk about too many teach and some governmental departments and I know there's a lot there's a huge interest in launching that do see the benefits of efficiency. National day readers looking to apply look at technology to gain more. Efficiency in their purchases to reduce debt. Yeah they're the airbrushing into purchasing. So, that's for one shows there is interest watch in terms of legislation. Until today more Hsin debt existing laws and regulations are applied to new technologies. And on Placek and

that's new regulations have been developed for new technologies. And I think it should be better if we are to challenge new legislation new technologies for example there's one example that I know of that says the European Commission that. I don't know your clients and anti anti money laundering legislation. And. Apparently, it is that they said okay all the scripture Perenchio should also Oshiomhole on their anti money laundering legislation but that's a whole other chapter that whole anti money laundering concept is built around the centralised bank system. I think it's difficult to apply that same legislation to that distributed system like block chain with 8000 Noach worldwide. I say it's almost impossible Yeah. Yeah and there's another. Problem

J: I can't hear you're saying that how do you feel like the block chain technology is going to change the whole economy. Because basically everything is centralized. And now. With this technology. Given. Everything is going to be you know like it's is going to affect a lot of people's.

K: Benefits or our profits of a lot of big co-operate. And so, that's going to be a huge problem of how those bank things of these technology. And. But in some way, they also stop you know using it or start to understand how it works. What is the correlation between these companies? And if blocking technology is going to be a big huge impact for them.

K: There's two things to peer to peer possibilities. New business models will. Arise. It's not new business models at least. And she gains in existing business models because of peer to peer model takes out demand in the middle. No. Demand in the middle of English gets her sample or Naciri or someone who is buying printing and buying and selling parturition chitchatted change the. Current role because they will lose. Despite selling to each other. Yeah you're considering you to preach knowledge that leads to shift responsibility. Show us it's on the rules now. Yes. Because if that search falls through a pay directly to you then venture should try another role in the economic system because they still get to pay their bills and they will just disappear so that they will be looking for other and like the other party parties to date and so they their turn to look for other roles to try to match starting. OK. I see.

[00:20:07] Okay then I think I'm good with knowing more about a block chain. So, then I'm going to move on to my actual topic. The connection with the bike sharing scheme.

J: Share and do you know anything about sharing economy. I'm sure you do. But how how how. How do you see the future?

K: I still need a bit down. Yeah sure get your full concept. But for example, what does shave Relix far into the future. Nobody will own a car anymore. Yeah. Well it's your car. Yeah for sure. The point Stotish. I don't know. I don't know if we will end up with nobody. I don't think it will be. I can see that it will be just black and white dentists nobody will own any more. Anything that's happened to black and white.

J: Okay. Because since now I wonder. Like basically my intention of having these papers is to cause the vice sharings see some now like the old face like they live in France or some big company like O4 and Moabite in China. It's going popular and a lot people are using it. But per the nature or nature of economics those are not very common at all. So.

J: I want to find out and this is off the record is not related to rupturing but it's just this personal question. For example, if you have a bike and you must lock the lock we've dropped into a block vent so we can wait it out. Your bike. You'll be inches of green dance like resemble some people they have them. There are more than one or two bikes and they're normal. Most of the youth are new with maybe. And now we can contribute these bikes to the society and you can charge. Boy would that be. Also a.

K: Pension Application of using Propp trying to think there's a difference between a car. Yeah of course much more expensive. Yes. Yeah some time and data about your car's shift people are share because you're sitting in it you put your you know your your phone charger in it's your sunglasses your little personal things you're almost a moving house today. Yeah yeah I think it's it's like getting into your house to anybody if you're not there.

K: Yeah that's how the. Because of a and b b right. But not like it but the House is going to be more complicated but bike is easy right.

K: That's what I'm saying. I agree with you and I would do that to her current at the time. Thank you. Your question about a sharing economy. I think it's different for the.

J: What kind of role that blockchain is going to be relating to some of the exit back. Like how relating to the currency about. Something else like you find them you find the most interesting part of launching.

K: I think we could look Chen lands an interested Schorsch million with the concept and trust it. Sure. Yes. Yeah I think the fact that this is a technology that allows you to utilize trust me should tell you. And then how is going to be like because. Of for example for my contract.

K: Is one of the features. And that's going to be it's going to be like some people to write the code. And then would that be a third party of like for example for the bike sharing schemes like you'll have to bike and I want to buy. And then we must go to the. To the code that you.

K: If you would try them you would see the cash preset culture for a lot of things. There are slight constraints that you can just get from the Internet's open source ship. In that sense the most DIMAR Pumpkin Patch outpolls stolidity any Garion because the market couldn't turn out your programs and stash a lot of available. I don't think it should third party. Nobody wants to call it. Who. Now have you all been working on that race on the blog. This is like you don't have to answer it personally thank you. Now.

K: Since three or three years ago I started to read about Bluck change by doing some study. He was frequently speaker and Schonely decided to focus my management's work only on innovation and not change and not working. Well first I do I do inspiration's session chair I support companies to explain to them what this block chain ever could have made to your business. And we built a culture church. So, in summary what I do know that today for Dutch expert Greenback's and shash I'm working with some other in international. Yeah it's still kind of full on group that is working on an energy and another thing.

K: Yeah it's always good to get something for a new generation. Ok so Lots of fast. Yeah I hope this helps.

J: OK no problem. Thank you so much. Have a good day for you? Thank you so much. Yeah but. By.

Interview with Bike sharing expert

(I) Informed Consent Form

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Appendix 6.4 – Informed Consent Form

Informed Consent Form

1) Project Title
2) Project Description (1 paragraph)

If you agree to take part in this study please read the following statement and sign this form.

I am 16 years of age or older.

I can confirm that I have read and understood the description and aims of this research. The researcher has answered all the questions that I had to my satisfaction.

I agree to the audio recording of my interview with the researcher.

I understand that the researcher offers me the following guarantees:

All information will be treated in the strictest confidence. My name will not be used in the study unless I give permission for it.

Recordings will be accessible only by the researcher. Unless otherwise agreed, anonymity will be ensured at all times. Pseudonyms will be used in the transcriptions.

I can ask for the recording to be stopped at any time and anything to be deleted from it.

I consent to take part in the research on the basis of the guarantees outlined above.

Signed: _____ Date: 20 DEC 2017

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Interviewee name: Ronald Haverman

Relation: The interviewee was the founder of OV-fiets and is currently the manager of Mobile International branch in the Netherlands. As a specialist of bike sharing scheme, he has dedicated himself to be more professional with the Internet of Things and contribute to the sharing economy.

Age: 46

[J: Zhao]

[H: Mr. Ronald Haverman]



J: Thank you sir. Thank you so much for coming. I am just going to start a short introduction of the topic of my research. Basically my research is about what impacts that blockchain have on bike sharing schemes. So basically I just have to analyse what is the current bike sharing systems, OV fiets, mobike, ofo and velib, as examples to represent the industry. And also the reason why I choose mobike because they have launched just not while ago. So it is actually a good example to look at as well. So I just gonna analyse what blockchain have what is the reason how it could change things. so i need to look at which parts can be improved. You've really got it by sharing with great reporting but also in you get bored. Well yeah but we will talk about it.

J: So could you introduce yourself a bit and how you relate to the field of the topic?

H: So I am the founder ov-fiets which was one of the first sharing system to the world back to the where fuel before the barriers and everything laid aside. It is a quite simple system. It's used in old fashion and old technology or but it's very simple and very popular a lot of people use it. Of course it's centralizing its own about it railway. Now this would do a good job but at the moment the other possibility is that this was a smart Lawks. There is also the decentralized definition about so good for now. Yeah and really one of the experts in the Netherlands knows more about this thing. Although I'm happy with the system I invented that I think it is appropriate to review room for improvement now. So that's why I keep being innovative.

H: I'd rather do 150 railway station, so I was the chair of the organization for a long time. When we established this stuff 150 railway stations to livery almost all the series in the Netherlands then handed over to the Dutch railway. So this brings a lot of expertise about the old fashion bike sharing by sharing the bike sharing with us normal to do. All these developments with smart locks. Now I want to use the different thing and of course with blockchain. Because. I wasn't hiding any connections.

J: The first question I asked is not relevant to what I will finally find out, which is when people speak of bike sharing. The concept of bike sharing that people argue bike sharing is not part of the sharing economy is just a bunch of company that finds a way to manufacture bikes cheaply. so to rent out the bike. I'm sure there's no wrong or Right Answer. But what do you think of it?

H: It is the definition of about sharing economy and a lot about sharing was private bikes. For me, it's very important that. People can get a bike always and everywhere.

H: But the thing is a lot of people in the Netherlands do have their bike and they use their bikes a lot but they always use it from your home where you can grab your bag and you can go somewhere you can go back. So let's do this there's maybe 10m and and for all the other places you visit and you do not have your bike with you. It is a huge opportunity to have a bike available for all those hotspots. So that's

why I want to have bikes available always and everywhere. For me it's a lot more important if this asset is private own and public own. But it is a service-based economy. Providing products to services. For OV first, it fills in a large part of the gap that when people don't have their own bikes with them. We did a good job with to reach the goal always available everywhere. We have to do more.

J: what is the general reaction how Dutch customers to the newly launched Mobike in Rotterdam.

H: Maybe it is early to have the conclusion. We got a lot of positive reaction. For example, The weather does influence a lot due to the fact the flexibility of Mobike is better than OV Fiets.

H: for example, it starts raining in the afternoon you have to bike back and people like the flexibility of my bike as well. Very much because of Mobike is flexible you can just see if you go back or use the meter. So the lack of flexibility but at so early stage.

H: We started off with 150. We increased slowly. We have a different approach, but at first we are not just dumping the bikes we want to do it in nice a proper way, and we do nothing good relations to government, and we don't want to have heaps of unused bikes. So that's why we increase slowly, and we try to get the customer out of all the bikes and when it is sprung and that will open up more bikes. So. We will slowly than of course when people start riding in spring.

J: What is the most relevant factor that most influence how Dutch users choose their bikes? I think is a combination of price and flexibility.

H: I think the price is important. But on costs 3.85 a day. That would be a roof for all new comers.

H: But let's see if for example a mobile of course 50 cents at the moment. If you need more work twice, you go to your distillations you go back. To sets up the euro and. Log. Out. Of. Nowhere it didn't do very you know I think Prize board and you know how low it is more important if I were you I would tell you. And then it comes to the biggest advantage, flexibility which you could grab a bike and leave it as you wish.

H: Also we target and advertise mobike is stylish, young people, as it is one of the core values for Mobike.

H: A month or so away. I think there is very fast that it is on the market for one last year. This market is still a very. Big. Innovation. And of course, this is a big step in now. There will be smaller steps it will be improve the pay, but the concept is quite good the lock is good. The basic concept is that they choose smart lock work with your phone. Also need to adjust to the local, such as the size of the bike due to the size of the people here.

J: Regarding project management for the technical matter, which part can be used to reduce the cost so people pay less?

H: we need to look at the bike, the bike distribution, maintenance of bike. We have to keep the bike nice and tidy in the street. So our central idea is the customer to do that and the attitude and tentatively user to work together to do so so the cost for the company won't be so high. Such as a point system in a credit system to do so that would help.

J: one of the essential ideas I place in my thesis is the idea of ofo. that is ofo for all, all for ofo. Basically, it means that you could contribute your bikes to the platform you would have free access to the ofo bike. Ah yes, that's the biggest difference between them. Coz of initiated themselves As a connect not a manufacturer. However, it was a successful value but it turned to another direction as Mobike does after.

H: I know the story but I never seen a private bike, it is always yellow. and p2p model is so difficult when it comes to logistic of the system, the maintenance, the rent out fee, the contract with the owners

of the private bikes, it needs to be careful with it

H: you can image but the model in between for those small company who have a few bikes so they can give it away for open standards to integrate small-scale bike company 20 or 50 bikes. Connecting the resources. then it can work reasonably

H: Ah. So they team will Focus on those more properly. So they can act like. Small can't. Buy. Guns and put no factor in. Those. Those five. Years ago. So there we will also. By. The way the mobile does. They just. Have to. On factory. Thought. Yeah.

H: Yeah yeah. So the last two years I was involved to create this open standard with a Dutch government, and that's the system when you are a member of one of those bike sharing companies you still can use all those bikes. You're you can access about of your system doesn't exist because it's quite complicate to establish But it a strong way for the government to make bike sharing bigger. You can be the member of the organization than on your own you can use different bikes. But it is not there yet but the government is pushing.

J: Let's move on to the blockchain. Based on research I have done, it is quite obvious that blockage can benefits business, such as increase Efficiency, connect Peer to Peer. like increase the speed, lower the cost, better personal information protection. so regardless as a business man, despite your behavior to a centralized world users, blockchain promotes decentralized way, as it will overwhelm the whole world . what do you think of the concept?

H: I have to say that private bike is certainly not mobike's interest. but it is interesting to have a decentralized world in which more demographic and more democratic. Blockchian is bit more further away since Mobike is still looking at now and current situation. That create not a one winner takes it all but several companies working together and so it can be a very good solution.

J: The law, the legal perspective, it is very difficult to integrate blockchain already to the current business world.

H: That's why it needs these companies to do bike sharing now then later on we can work on how it can actually help with anything. On. One kind of other. Part. Of the system. If I. Ask you. To. Say you. Want to use blogs like. That. Were passed by the.

H: Because there is no big centralized to administer Holston can be decentralized so small companies get to go structure and do their business. And again we still be hug advantage for big companies but so that's okay but there's also options for small local so the it gives more fair big field for big and small companies working together.

H: So know that it's good to have small local players in this environment because often people like local company. So that can be a good structure which is just local company. Still we can have the advantages of the big corporate. i think it can make it easier to work together gather for big and small companies because they go to whole thing. There's no need for a lot of legal structure. They could just do this.

J: The entry barriers is quite easy but problem is that the company is way too big to compete with. so the blockchain could be a strategy to win over the market share.

H: However, it is also good for big companies. maybe it eliminate a win take all. so it gives a more open environment, space for others to join the industry, so it helps everything in the field. Well. So again it can be a structure there are lots of winners.

J: Since blockchainn is a novel Innovation. So it really does require those companies to be open for innovation. how do you see the current corporate culture in this bike sharing industry, the innovative atmosphere.

H: i think is huge. the innovation is going good. it is possible to use blockchian. we use smart lock, a better system. Well if it is useful. It's not. a old fashion industry so this industry is able to make all those smart law is very effective. So if you do business opportunities there.

H: for general, yes but for general it is not.

H: So that's not barrier. Of course, if you do something on the block chain it is complicated then you have to do it in a way that you. don't have to bother the consumer with this. for most of the consumer, it is way too complicated. you can use it as a layer such as good nice app or Web application on top of it. You can do it in a way you don't bother the consumers with this very complicated application and that might be affected especially nowadays. It may be in a few years' people will understand this concept then you can try to get the use involved.
