Title: The emergence of DLT in entrepreneurship: opportunities and business models.

Semester: 4

Semester theme:

Entrepreneurial Master

Project period:

01 February 2018-

31 May 2018

ECTS: 30

Supervisor: Jacob Lundberg

Project group:

2 members

Andrius Baliutavicius

Cristian Alexe

Number of printed copies: 0

Total number of pages: 99

Total number of characters (including spaces):

Synopsis

The rise of ground-breaking technologies always presents the possibility of either completely disrupting or modifying existing solutions. The distributed ledger technology is presents all the qualities of such a groun-breaking technology.

This master's thesis aims at bringing a contribution to the research regarding the emergence of distributed ledger technologies (DLT) and its implications to the entrepreneurial process.

The thesis aims to provide an overview of the implications of the appearance of DLT on two key components of entrepreneurship: opportunities and business modelling.

The results of this research endeavour are used in creating a start-up proposal based on DLT.

By signing this document, each member of the group confirms participation on equal terms in the processes of writing the project. Thus, each member of the group is responsible for all the contents of the project.

TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION AND RESEARCH DESIGN

1.1 INTRODUCTION

Distributed ledger technology (DLT) is an emerging technology that has gained the attention of a wide-variety of disciplines, such finance, technology, law and entrepreneurship. DLT is best known for it's first real-world application, Bitcoin, which is based on one of the forms of DLT, namely blockchain. When it comes to innovation, DLT is seen as a technology that has the potential to be responsible for an "explosion of creative potential that catalyse exceptional levels of innovation" (Walport, 2016, p. 4).

The rise of ground-breaking technologies always presents the possibility of either completely disrupting or modifying existing solutions. Disruptive innovation theory, as explained by Christensen (2015), suggests that the emergence of new technologies presents small companies or start-ups with the opportunity to challenge the status-quo of larger businesses.

The central innovation of the technology is that it enables digital value transaction between parties unknown to each other, whilst removing the need for a third party. Its in-built properties provide provable trust, transparency and verifiability as well as increased security through the usage of cryptographical algorithms. Because of it's properties, DLT is considered a digital medium for value just as the internet is a digital medium for information.

The number of current projects and the level of financial investment show that the technology at focus and the applications built on top of it have the potential to create entrepreneurial opportunities as well as affect business modelling. An increasingly large number of applications is available now or is in the early stages of development, the clear winner here being cryptocurrencies (i.e. Bitcoin, Ether).

The authors engaged in writing the thesis as a technology review seen through the lens of venture creation by using the entrepreneurship theories accumulated throughout the whole master's degree. The motivation for this decision is detailed in the next section.

The thesis aims to provide an overview of the implications of the appearance of DLT on two key components of entrepreneurship: opportunities and business modelling. The authors aim to use these results as a guide for future endeavours related to DLT.

The secondary purpose of the thesis is to present a concept based on DLT proposed by the group. It can be considered that the results of the analytical part of the thesis are used as a technical, market and

organizational basis for the concept. The concept proposes using DLT to enable users to monetise the data generated by their mobile health and fitness apps. The authors want to pursue this project outside their academical obligations.

MOTIVATION

This thesis was written based on Arteaga and Hylland's (2014, p.11-17) statement: "Innovation is bringing discipline to chaos". It is meant to be an incursion into bringing clarity to the relation between the emergence of Distributed Ledger Technology (DLT) and entrepreneurship.

The need to bring clarity was observed by the authors during their personal experiences with projects associated with the technology. The need was furthermore reinforced by the authors' discovery that the speciality literature meant to create a bridge between processes related to entrepreneurship and DLT is either thin (like in the case of business modelling) or not centralized (in the case of opportunities). These gaps in literature are understandable because of the novelty associated with the technology and are expected to be filled by academics and professionals alike during the next decade, similar to how this happened in the case of the internet revolution. It is the authors' opinion vthat the current state of entrepreneurship in DLT is very similar to the one associated to the dot-com era – both being fuelled by the prospect of decentralisation and democratization of power.

By making a first step towards bringing discipline to the chaos currently associated with the entrepreneurial world in relation to DLT the authors also aim to pave a way for their future ventures in this field. It is their strong belief that the applications built on DLT, just as applications built on the TCP/IP protocol will become an integral part of society.

FOCUS AND RESEARCH QUESTIONS

The focus of the thesis, as specified above, is to find out the effect of the emergence of DLT has on entrepreneurial opportunities and business modelling. It is structured in the following research questions:

RQ1: Does DLT disrupt entrepreneurial opportunities?

RQ2: Does DLT enable the creation of new business models?

THESIS STRUCTURE

The first chapter aims to introduce the reader to what the group aims to achieve with this report by presenting the project purpose and goals. Further on, the first section states the research questions and the working questions associated to each of them as well as limitations and delimitations associated to the project. The second section of the 1st chapter, entitled Research design presents the principles employed in structuring the thesis as well as the research methods used, followed by reflections regarding these and the validity of data.

The second chapter provides a sum-up of the technical aspects surrounding DLT as well as the technologies build on top of it, such as cryptocurrencies, tokens, smart contracts and ICOs.

The third chapter presents an analysis of DLT from a market point of view, providing details regarding where DLT is on the adoption curve. Also, the DLT is analysed by using PESTLE, SWOT and Porter's five, all in all giving an overview of where the technology stands market-wise.

The fourth chapter describes the disruptive nature of DLT and by extension its opportunity enabling potential. A validation of the effect on opportunities is provided through the analysis of real-world applications. Its usage as a potential disruptive resource for entrepreneurial opportunities is explained.

The fifth chapter analyses the correlation between DLT and business modelling. Afterwards, a description of centralized vs decentralized business models is provided, followed by an analysis on how the business model canvas (Osterwalder, 2010) might be affected by DLT. An analysis between DLT and business model configurations, as proposed by Taran et. al. (2015) is also done. Finally, a brief description of the new business models created by DLT is shown.

The sixth chapter briefly discusses a proposal for a start-up based on DLT. The concept is based on the findings of the rest of the chapters and aims at creating a solution for monetizing data generated by mobile health and fitness applications.

LIMITATIONS

According to the limited timeframe allotted to the thesis and the research-intensive approach of the endeavour, some limitations must be specified.

This section aims to provide an insight into what these limitations are, both in from a general point of view as well as regarding specific limitations encountered because of

the theme approached.

From a general standpoint, the biggest limitation is that a thoroughly scientific technology review requires a lot of time and an in-depth level of expertise. In this case, the authors are restricted by the time-frame of the semester. When it comes to expertise, even though the authors had previous knowledge regarding most of the theories analysed in the thesis, this knowledge had been mostly exercised in a practical manner during their entrepreneurial journeys. Therefore, their expertise when it comes to creating in-depth theoretical analysis is rather limited.

On a specific level, the lack of information in literature regarding DLT and the themes analysed has also been a limitation in deciphering this subject and proposing a wider variety of results.

DELIMITATIONS

In contrast to the limitations section, which provides an overview of the external factors that hindered the authors' endeavour, the delimitations section aims to present the choices taken by the group to limit the scope of the thesis.

First of all, the authors' goal with this paper was to engage into a more academic research-based deliverable, since they believed its' outcomes would benefit them into their future endeavours. Therefore, a limited amount of attention was given to the proposal chapter.

Secondly, a delimitation was set on the search for new business models enabled by DLT, namely to only take into account new business models as proposed by speciality literature.

1.2 RESEARCH DESIGN

Methodology

The thesis was structured having in mind two theoretical models proposed in entrepreneurship literature: the entrepreneurial process model proposed by Veen et. al. (2004) and the D-I-A model proposed by Arteaga and Hylland (2014).

Reasoning

The first model used is proposed by Veen et al. (2004) and is known as the entrepreneurial process model. It is a theoretical model that provides an overview of the entrepreneurial process. This model was built by the researchers as a result of the analysis of all the entrepreneurial processes. It proposes that the common denominator of this analysis results in the process seen

in Figure 1.

This model was used because the group wanted to position the thesis firstly on the highest abstraction level for the theory of entrepreneurship. The group posits that the thesis aims to bring value to all the steps presented in the model. However, a distinction is made between the two research questions:

- The first RQ is relevant for the first phase of the model, opportunity recognition
- The second RQ is relevant for all the phases of the model, as business modelling can be used as a tool throughout all the phases

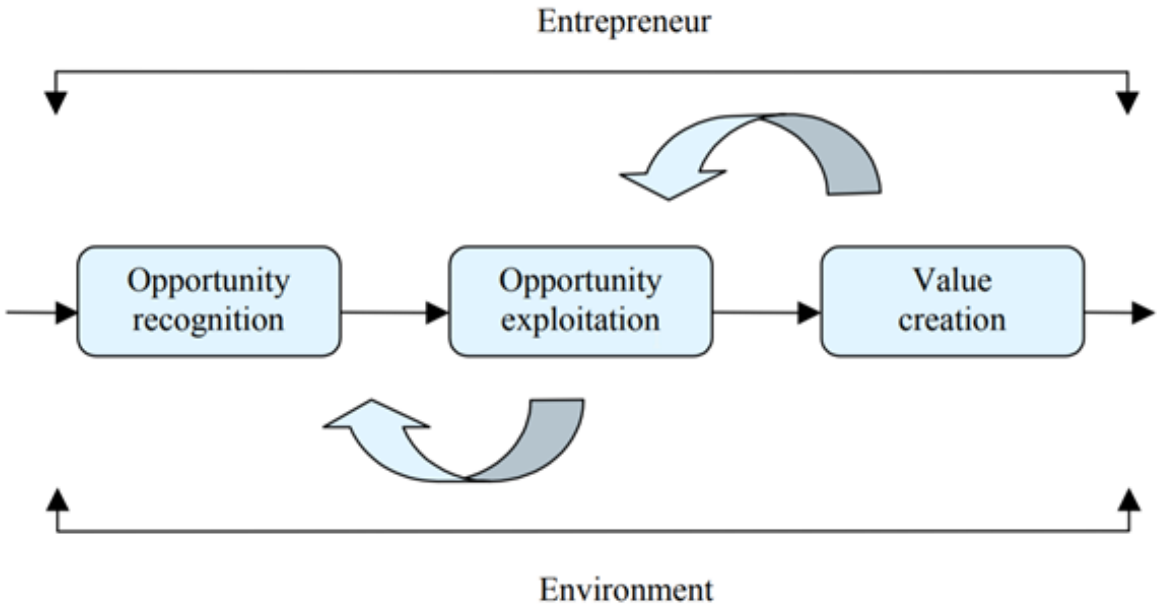


Figure 1: The Entrepreneurial Process. Adapted from "nderstanding the Entrepreneurial Process" by Veen, 2004. Retrieved May 12, 2018, from https://www.researchgate.net/publication/260064367_Van_der_Veen_and_Wakkee_Understanding_the_Entrepreneurial_Process_Understanding_the_Entrepreneurial_Processgy-and-how-online-businesses-can-use-it/

The second model was chosen because it is constructed not only as a theoretical tool, but also as a practical tool to be used by entrepreneurs, both in companies and start-ups. It's phases - Discovery, Incubation and Acceleration (Figure 2) have the same meaning as the ones presented in the purely theoretical model presented earlier. However, the authors of D-I-A complement the theory with real tools and examples of how to engage in entrepreneurship and act in each of these phases.

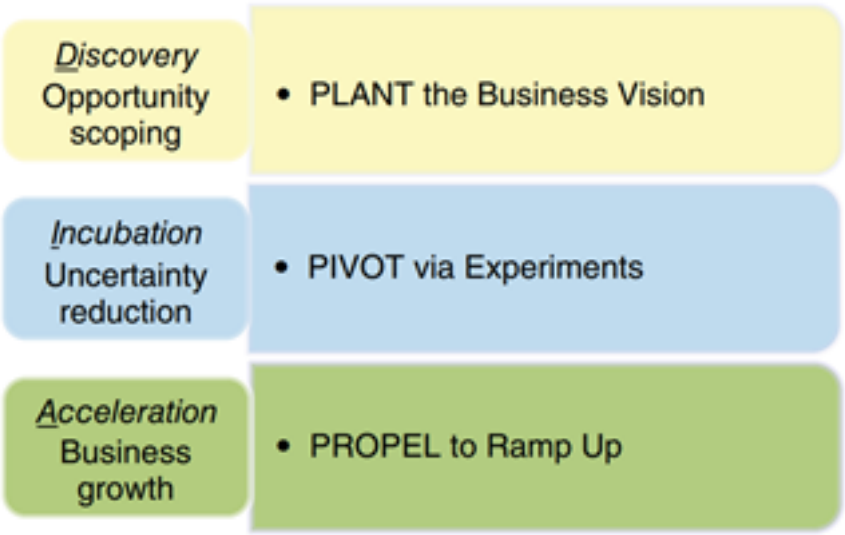


Figure 2: D-I-A building blocks. Adapted from Arteaga and Hylland (2014, p.15)

Considering that the thesis was constructed as being seen through the lens of venture creation, the group used the practical methods portrayed in D-I-A to provide the thesis results more applicability.

The D-I-A model proposes that a TMRO analysis should be used in each phase in order to mitigate uncertainties in a holistic manner. TMRO is (extract from Arteaga and Hylland, 2014, p. 26):

- Technical – understanding technology drivers, value and economic feasibility
- Market – learning about market drivers, value creation and business viability
- Resource – accessing money and project-specific people and capabilities internally and externally
- Organization – gaining and maintaining organizational legitimacy for projects aligned with business units yet on a longer time horizon, or projects where there is not a clear organizational home

The research questions provide value in mitigating uncertainties as follows:

- RQ1 is applicable for the technical and market parts, because opportunities are related to uncovering value and making use of it.
- RQ2 applies for all TMRO, because business modelling generally takes into consideration all the aspects that make up a business.

RESEARCH METHODS

Literature reviews

This investigative method was used in order to gather information and understanding on all the topics related to the subject of the thesis. The review exercise was divided

into:

A. Scientific sources: the search for trustworthy, peer-reviewed information was done by using the AAU library database. To ensure the reliability of the data, filters were to only include results from peer-reviewed articles. All the theories presented in the thesis have at least one source from a peer-reviewed article.

B. Non-scientific sources: in this case, a broader search was done by using the AAU library database as well as Google Scholar. The data acquired in this case can be considered less-valid from an academic point of view. This does not mean that the chosen sources were not reliable though, since the sources chosen are either reputable authors, government or institution-issued.

Example of AAU database search:

- "Distributed ledger technology"

- "Distributed ledger technology" + "area of research"

Online searching

This method was employed to compliment the findings of the literature reviews. It was mainly used to gather up-to-date information regarding:

A. The current market situation – mining difficulty, number of wallets

B. Companies and start-ups websites and whitepapers

C. Pictures and illustrations

D. Opinions and on-line articles regarding new business models enabled by DLT

A breakdown of all the theories and methodologies used in each chapter is presented in TABLE 1.

TABLE 1: Theory used

Chapter #	Theories used
Chapter 1	Entrepreneurial process model D-I-A model Research methods
Chapter 2	DLT definition DLT classification
Chapter 3	Diffusion model PESTLE Porter's five SWOT
Chapter 4	Disruptive innovation General purpose technologies Entrepreneurial opportunities

Empirical research

The empirical research methods were employed during the groups visit at the Global Blockchain Expo 2018 in London. The goal of this layer of research is to:

A. Observe and collect data regarding the current status of the DLT phenomenon through direct

observation

B. Conduct semi-structured interviews with a number of experts in the field

C. Conduct a face-to-face survey with people involved in the DLT field

Expert interviews

Five non-directive interviews were conducted with experts working with DLT. The initial decision was to find experts from both the start-up world as well as the corporate world, in order to present insights from both sides of entrepreneurship. All the interviews were conducted in a timeframe between 20 and 30 minutes.

The interviews were conducted in a non-directive manner because the authors wanted to ensure a free-flow of thoughts during the interviews, thus eliminating any cognitive bias enabled though questions posed by the interviewers. This technique is commonly used in design thinking, where the purpose of interviews is to step-back and provide the interviewed subjects the opportunity to deliver un-biased opinions regarding a main theme established during the beginning of the interview.

In the beginning of the interviews, the experts were asked to specify their name, company, position, background and years of experience. This step was taken to introduce them in a interview-like atmosphere, as well as to add to the validity of the fact that they can be considered experts.

Following that, they were engaged in a conversation normally following this pattern:

- story of how they got into DLT -> to check their involvement in the field and find interesting facts regarding the field;
- opinion about the field nowadays -> to gain insights into opportunities, risks and uncertainties;
- preferences regarding DLT projects -> to gain knowledge regarding what they consider as being interesting opportunities explored in the field.

The complete notes of the interviews can be seen in Appendix 1.

The information gathered from the interviews was used mainly to confirm or infirm the assumptions the authors had until the expo.

A breakdown of the interviews conducted can be seen in Table 2.

Surveys

The visit at the expo allowed the researchers to conduct a face-to-face survey with representatives of companies involved in DLT. The results of the survey were used to reinforce

Name	Company	Position at company	Background	Experience in the field
Alex Buelau	CoinSchedule, ICO and token sale portal	CEO and founder	IT	5 years
Sajjad Daya	Sparkster, venture	CEO and founder	Serial entrepreneur	6 years
Timothy Rook	IBM	Associate partner	Founded several DLT-related ventures	2 years
Manuel Montanaro	Multiversum, start-up	CEO	Founded several DLT-related ventures	6 years
Nathaniel Tsang Mang Kin	IAME, start-up	Head of compliance	Finance	1 year

Table 2: Expert interviews

the findings in the opportunities chapter. For centralized data gathered by the survey, see Appendix 2.

Table 3 explains the structure of the surveys.

Subject	Purpose
1. General information	
Background	- examine the variance in background experience
Position in the company	- evaluate the relevance of the answers
Experience with DLT	- evaluate the general experience of the people involved in DLT now - evaluate the validity of answers regarding opportunities and risks
2. About the company	
Launched or not	- evaluate the status of company
Which industry/field it belongs in	- evaluate prevalence of opportunities explored
3. Most promising opportunities	- establish hierarchy of most-promising opportunities based on a larger sample of people working in the field
4. Risk for DLT adoption	- gain insight into what the DLT world believes slows down the adoption rate of the technology

Table 3: Survey structure

CHAPTER 2. TECHNOLOGY

CHAPTER IN BRIEF

This chapter presents an overview of Distributed Ledger Technology as a basis for the rest of the thesis.

It begins by stating the historical significance of ledgers as a way to store records and the role they have in society. It then goes onto introduce the technology behind DLT, as well as its main features as defined by literature. It then present a glossary of concepts, relevant to DLT which will be reffered to throughout this thesis.

WHY LEDGERS?

Ledgers (records or databases) represent the central point of economy ever since ancient times. They are and have been historically used to record payments and contracts for the transaction of goods, property or wages. The evolution of the actual form of the ledger throughout time can be seen in Figure 3.

Figure 3:
The evolution of ledgers.

Ledgers are built generally along this metaphor: What if we could store our records in a trusted place?

Ledgers are the prime-enablers of at least four pillars that define society as we know it::

- Currency;
- Trading;
- Banking;
- Lending.

WHAT IS DLT?

DLT's are built along the metaphor: "What if everyone keeps their records in a tamper-proof repository not owned by anyone?"

Distributed ledger technology (DLT) is the underlying technology of all current applications widely referred to as "blockchain technology" in mass-media nowadays.

DLTs represent ledgers of decentralized information, shared on a peer-to-peer basis over a network. A ledger is, in its core, a database, which is shared and maintained by the machines (or nodes), who have access to it. Ledgers are not hosted on a central server, but instead are distributed and synchronized across multiple machines at the same time. Each machine holds an identical copy of the ledger. For a change to be introduced to a ledger,all machines that participate need to be in a consensus.

According to the World Bank Group (2017), every DLT-based infrastructure presents two core attributes:

1. "The ability to store, record and exchange information in digital form across different, self-interested counterparties without the need for a central record-keeper (i.e. peer-to peer) and without the need for trust among counterparties;

2. Ensures there is no 'double-spend" (i.e. the same asset or token cannot be sent to multiple parties)."

A visual representation of the main types of ledgers can be seen in Figure 4.

For the purpose of this thesis, we will consider the definition for DLT, as defined by the Government Office for Science (2016): "distributed ledgers are a type of database that is spread across multiple sites, countries or institutions, and is typically public. Records are stored one after the other in a continuous ledger, rather than sorted into blocks, but they can only be added when the participants reach a quorum" (Government Office for Science, 2016, p.17-18).

All the information on the ledger is secured and accurately stored using cryptography. The access to this information is granted through using keys (in the form of cryptographic signatures).

The information is stored along with a full history of all the transactions that have occurred, all the way back to when the said information/data piece was created.

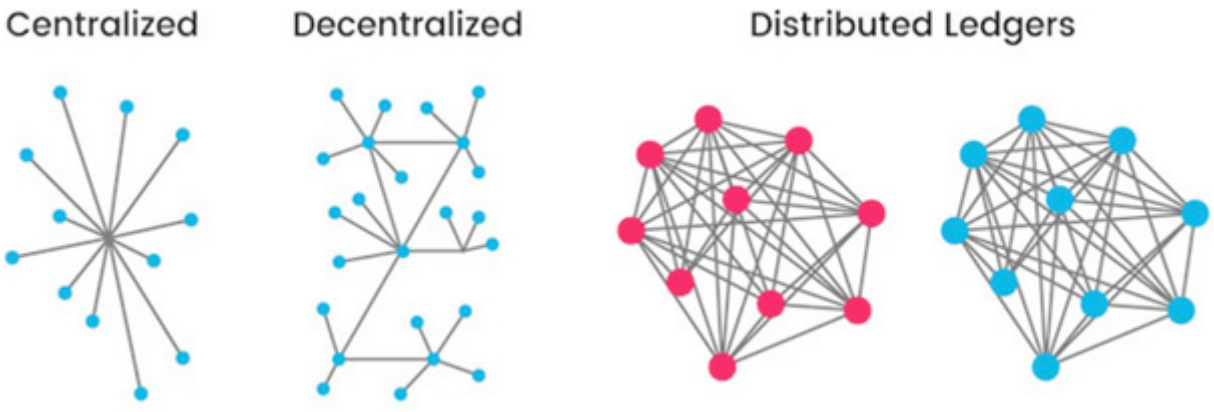


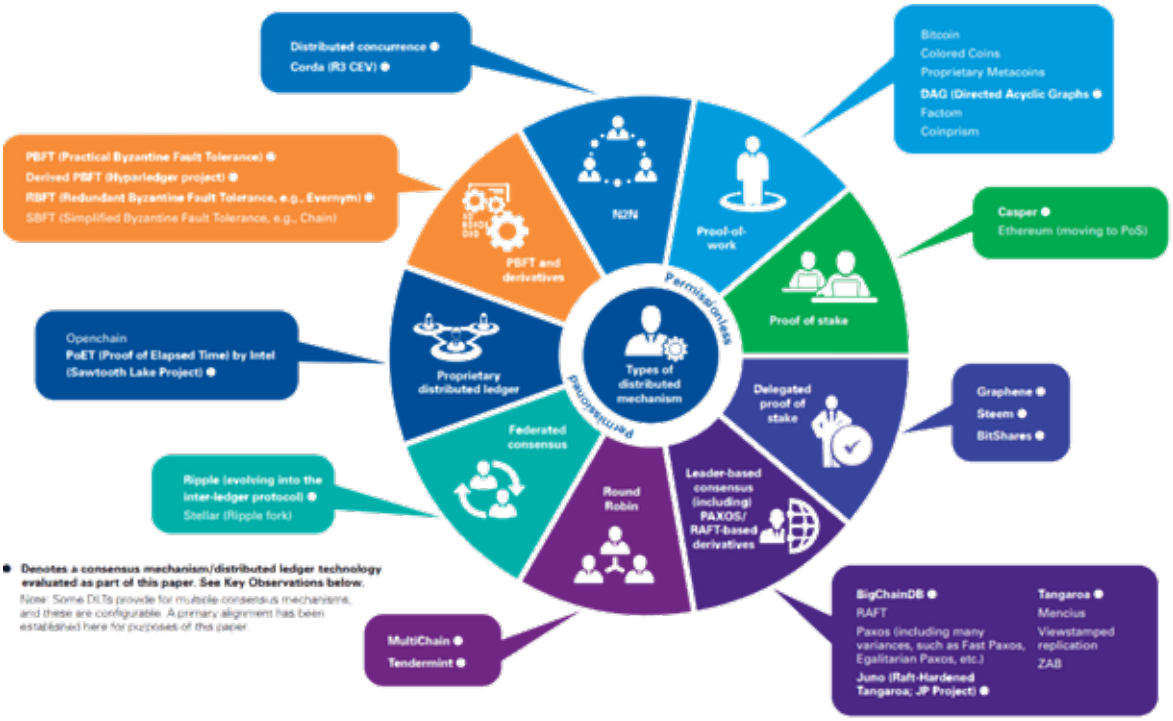
Figure 4: Types of ledgers. Adapted from "What is Block Chain Technology and How Online Businesses Can Use It - Yo!Kart Blog" by Malhotra, 2017. Retrieved May 12, 2018, from https://www.yo-kart.com/blog/what-is-block-chain-technology-and-how-online-businesses-can-use-it/

IN-BUILT DLT FEATURES

Figuring out what the main features of DLT is an on-going discussion, mainly favoured by the state in which the technology is right not. Considering that it is still a rather new technology, a lot of derivates and sub-sets of the initial version of DLT – blockchain – have appeared along the way. Nevertheless, the common truth is that DLT enables for the first time a decentralised, distributed and immutable ledger. Having taken these facts into consideration, the World Bank Group (2017) proposes that DLT has three main features - a distributed nature, a consensus mechanism and a cryptographic mechanism.

- The distributed nature of the ledger – regardless of what type of DL is under analysis, one of the central features is that control over the ledger is not centralised (instead it is shared with either all the network or a part of it, depending on the type of ledger).
- Consensus mechanism – the network participants can only reach a consensus on the validity of new data introduced in the ledger by following a consensus mechanism. The mechanism is in-built in the algorithmic design of any give type of DL. You can see in Figure 5 mechanisms explained in greater detail.
- Cryptographic mechanism – each entry on the ledger is cryp-

Figure 5: Types of distributed consensus mechanisms. Adapted from "Overview of Distributed Consensud Mechanisms" by CryptoNinjas (2018). Retrieved 1 May 2018 from https://www.cryptoninjas.net/2018/02/27/blockchain-consensus-algorithm-pow-pos-beyond/.



tographically secured both on the user-end and as far as the ledger goes and future transactions.

According to Bencic and Zarko (2018), the main features of DLT are:

- Immutability;
- Resistance to censorship;
- Decentralised maintenance;
- The elimination of the need for a centralised trusted third party.

DLT CATEGORIES

Distributed ledgers exist in a few different forms. The following section attempts to provide a concise explanation on how DLTs differ. The initial differentiation is made by looking at the mode of participation, or ownership type of DLTs. Afterwards, a quick look is given to the how DLTs differ from a more technological point of view, specifically in regard to the most common data structures types of consensus they use.

1. DLT according to ownership

A general factor that differentiates them is the type of ownership the ledgers have, basically classifying ledgers into centralized and decentralized databases. This enables the following categorisation of ledgers (Lipton, 2017):

- Traditional centralized ledger (e.g. private back account)
- Permissioned private DL (e.g. DAH - Digital Assets Holding)
- Permissioned public DL (e.g. Ripple)
- Non-permissioned public DL (e.g. Bitcoin,)
- DAH - Digital Assets Holding)
- Permissioned public DL (e.g. Ripple)
- Non-permissioned public DL (e.g. Bitcoin)

The main differences between the permissioned and non-permissioned ledgers can be seen in Figure 6.

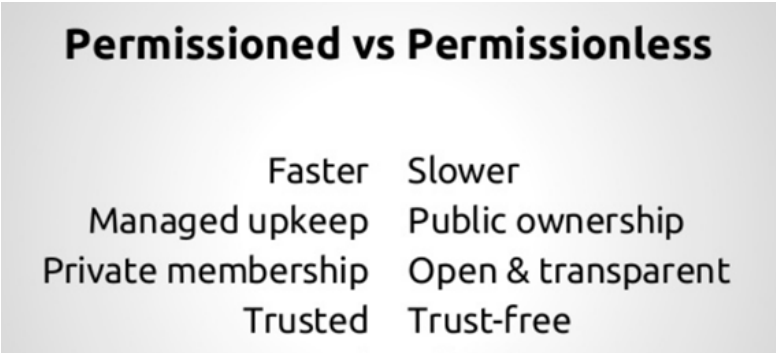


Figure 6: Differences between Permissioned and Permissionless ledgers. Adapted from "Blockchains: What and Why" by Wood (2016). Retrieved 11 May 2018 from https://www.slideshare.net/gavofyork/blockchain-what-and-why.

2. DLT according to data structures

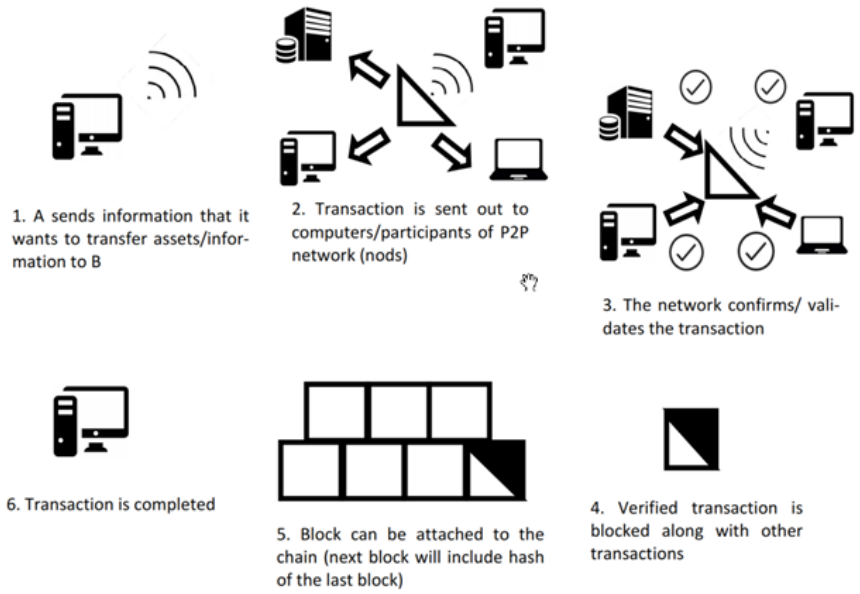
In order to furthermore explain DLT's, they can be classified according to the way data is structured in the ledgers (in layman terms):

- Blockchain– data is stored as a string, one after another, hence the resemblance to a chain, or a linear transaction log. E.g.: Bitcoin
- DAG (directed acyclic graph) – data is stored in a system resembling a blockweb rather than a blockchain. E.g. Iota – the Tangle
- Hashgraph – a DAG but using a different consensus mechanism. E.g. Swirlds

An example of how a transaction on blockchain occurs can be seen in Figure 7.

Figure 7: Simplified scheme of a blockchain transaction.

Adapted from "How Can Blockchain Technology Disrupt the Existing Business Models?" by Nowiński, W., & Kozma, M. (2017). Retrieved 1 April 2018 from http://doi.org/10.15678/EBER.2017.050309.



CRYPTOCURRENCIES

It is of importance to understand that all coins or utility tokens are labelled as cryptocurrencies since they technically represent a unit of account, store of value or medium of exchange. Most common categories of cryptocurrencies are classified into two categories.

- Altcoins

Usually referred to all other coins alternative to Bitcoin. As they are all derived from Bitcoins open source code also known as forks (Aziz, 2017). Usually all of them have their own DLT's. There are a number of Altcoins which are not forked from Bitcoin but actually have created their own DLT's and protocols, for example Ethereum.

- Tokens

Tokens can represent virtually any asset or utility which is fungible or tradable, be it a commodity or loyalty point, which is allocated on a DLT.

Platform such as Ethereum allows the creation of the tokens without establishment of a new DLT from scratch but rather using a predefined template one can issue tokens through the use of smart contracts.

SMART CONTRACT

A smart contract is term first coined by Nick Szabo (1994), stating that a decentralized ledger could be used to create a smart contract which would automatically execute when certain conditions are met. In this sense the contract terms could be converted in to a computer code

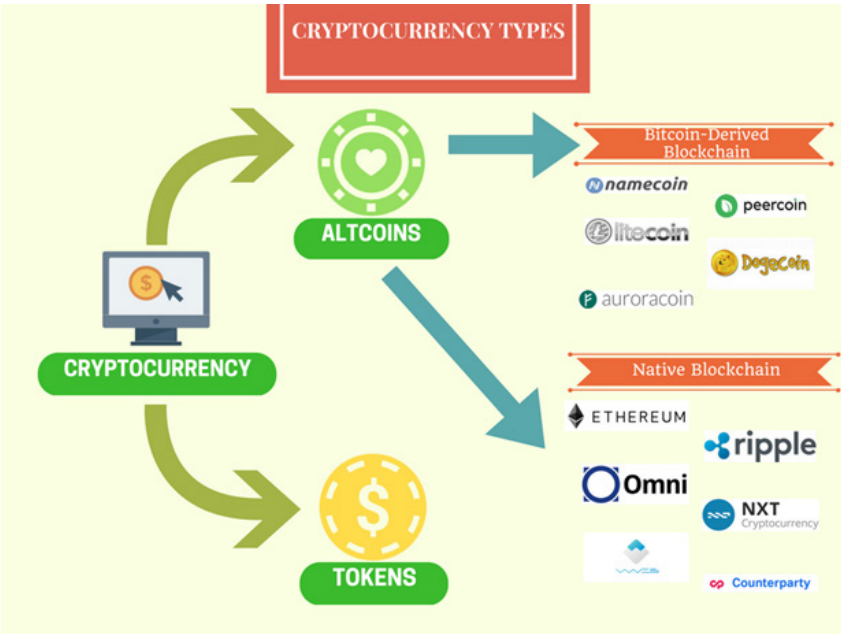
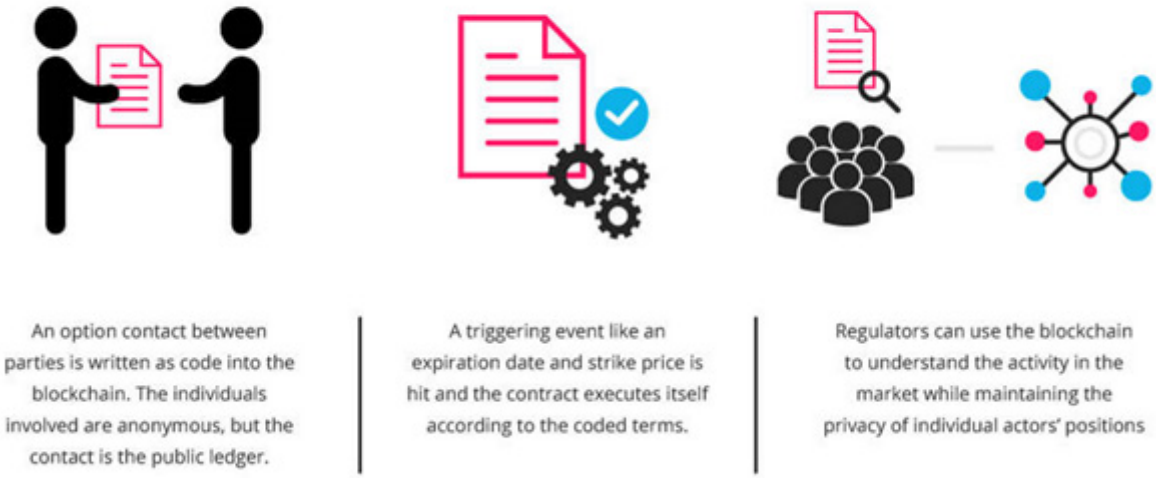


Figure 8: Types of cryptocurrencies. Adapted from "Coins, Tokens & Altcoins: What's the Difference?" by Aziz (2018). Retrieved 12 May 2018 from https://masterthecrypto.com/differences-between-cryptocurrency-coins-and-tokens/.

which would be supervised by the network of computers that are running the DLT.

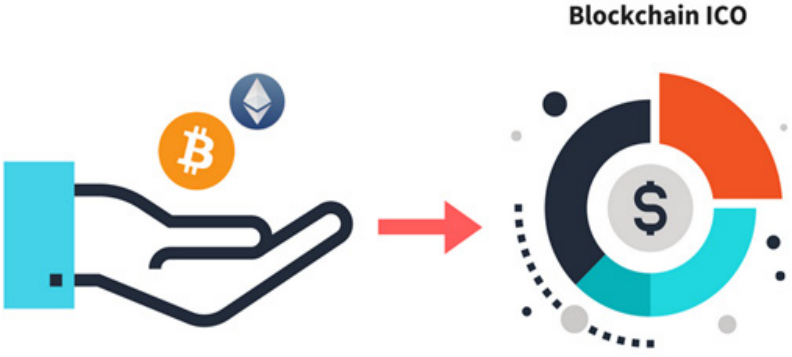
Smart Contracts can help exchange money, property, shares or basically anything which has value. Smart Contracts also define penalties for breaching the agreed rules the same way as the ordinary contracts just it will automatically enforce the obligations.

Figure 9: Smart contracts.
Adapted from "Smart Contracts: The Blockchain Technology That Will Replace Lawyers" by Blockgeeks (2016). Retrieved 3 May 2018 from https://blockgeeks.com/wp-content/uploads/2016/10/infographics-02-2.jpg



ICO

Figure 10: CO funding.
Adapted from "Initial Coin Offering – Alternative ICO Cryptocurrency Token Guide" by BitcoinExchangeGuide (2018). Retrieved 4 April 2018 from https://3mgj4y44nc15fnv8d303d8zb-wpengine.netdna-ssl.com/wp-content/uploads/2017/05/What-is-an-ICO.jpg



ICO stand for Initial Coin Offering. It is an activity performed by a start-up to offer a number of tokens in exchange for Bitcoin or Ethereum to fund the project. The same Token is used within the ecosystem the start-up creates usually based on some kind of a smart contract.

DAPPS

Johnston et al. (2016) define DApps as a new model for building successful and scalable applications on top of the DLT. They have three main criteria:

- The application must be completely open-source with its code being accessible to anyone and operate autonomously without any entity controlling the majority of its tokens, all records must be stored in a public and fully decentralized DLT.
- Application must generate tokens which are defined by preset algorithm and distribute them partially or fully at launch of the DApp. Tokens must be used within the DApps ecosystem.
- DApp should be prone to protocol improvements but only by decision of majority of its users.

Johnston et al. (2016) classifies DApps further in to three types:

- Type I Dapps which have their own DLT. Best examples of which is Bitcoin.
- Type II decentralized applications use the DLT of the Type I applications but are protocols by themselves and have tokens which are necessary for their function. Best examples would be the Master Protocol.
- Type III decentralized application use the protocol of a Type II DApp, they also have tokens, which are used within the ecosystem. Best example would cloud storage service which would release a “cloudcoin” which could be used to purchase cloud storage.

CHAPTER 3. MARKET

CHAPTER IN BRIEF

The goal of this chapter is to find DLT's position on the market as a foundation for the business proposal chapter. The purpose of this it to determine the long-term plausibility and benefit of adopting DLT-based solutions into existing business. The chapter starts off by analyzing the current location of DLT on the diffusion model by presenting relevant metrics. It then goes on to define the competitive advantage of adopting DLT. It does so by analyzing the external marketing environment (using PESTEL) and the current state of the blockchain-enabled industries (using Porter's Five Forces). By summarizing the findings with a SWOT analysis, the chapter presents an easy "go-to" list, which can be used for evaluating the potential value that adopting blockchain would bring to a business.

"The rate at which new techniques are adopted and incorporated into the productive process is, without doubt, one of the central questions of economic growth."

Nathan Rosenberg

DIFFUSION MODEL

This section will focus on models which represent the diffusion of DLT technology on consumer market. By applying several theoretical frameworks to current drivers of DLT technology to determine whether a market for business, enabled by DLT exists. Once its existance is established, further analysis will be made to determine whether it has the potential of bringing competitive advantages.

When considering what rewards innovation brings it is important to take in to account how fast is the new technology adoption takes place. According to Hall et al. (2003) "Adoption of New Technology" user decides to adopt the new technology whenever the initial costs fall. With Bitcoin as an example for well-known application of DLT, users reap its benefits by using it as a currency, hold of value or low fee cross border transfers. But at the same time, it is costly of using it as users face the possibility of exchange hacks and sharp price falls or even worse losing their private keys to their wallets which result in their Bitcoins lost forever.

Rogers (1962) is stating that diffusions of new innovations resemble the S-curve, represented by the parabolic line where the mean is representing the mean number of consumers and the "sd" is representing the standard deviation from the mean (Rogers, 2003, p. 280). As it shows very slow initial growth of the new innovation and when the market is experience saturation the

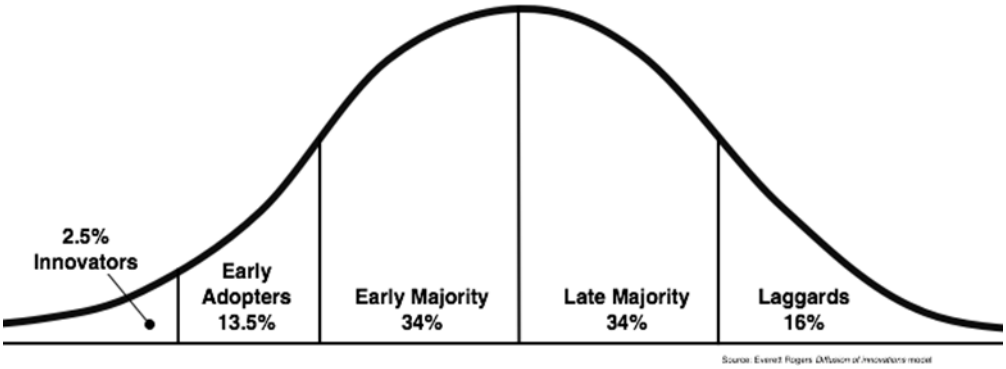


Figure 11: Diffusion of innovation model. Adapted from "Diffusion of Innovation Theory" by Rogers, 1962. Retrieved May 30, 2018, from http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/Distribution.png [Accessed 30 May 2018].

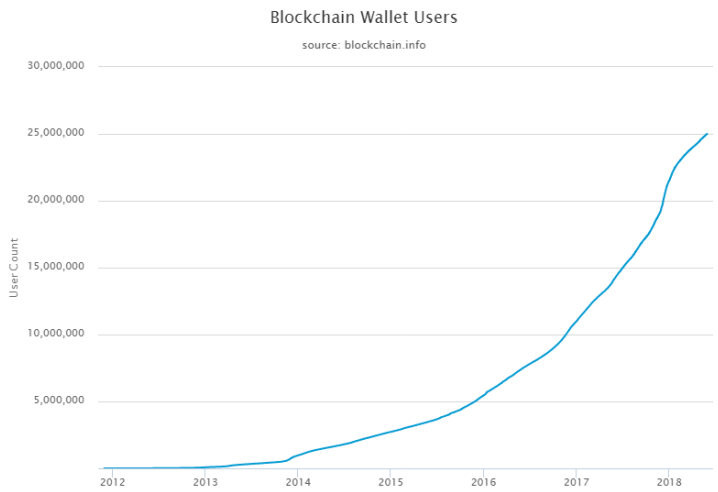


Figure 12: Bitcoin wallet users for the period 2009 – 2018. By Blockchain.info, 2018. Retrieved May 30, 2018, from https://blockchain.info/charts/my-wallet-n-users?time-span=all

growth slows. Figure 11 presents the bell curve which is derived from the S-Curve. It is divided in to 5 segments - Innovators, Early Adopters, Early Majority, Late Majority and LaggardsTo determine which segment of the bell curve DLT is currently, metrics, which can be argued to represent the popularity of DLT amongst consumers are observed. Examined are total number of wallets and overall mining difficulty over the period 2009-2018.

- Number of wallets

As Figure 12 shows, the number of wallet users has grown exponentially as Bitcoin became more and more popular. According to Hileman et al. (2017) the number of active users of bitcoin wallets in 2017 was in the range of 2.9 million and 5.8 million.

- Mining difficulty

Mining difficulty is a metric, which represents how many attempts a certain cryptographic puzzle needs so that the correct solution is found (Floyd, 2017). According to Nakamoto (2009), the purpose of slowing down mining by increasing mining difficulty is to slow down faster/more powerful machines, so that blocks are produced at a steady rate. Therefore there is a direct correlation between the amount of machines, mining Bitcoin, and the mining difficulty. By examining the metric over the last decade, we can therefore deduce how much the popularity of mining Bitcoin

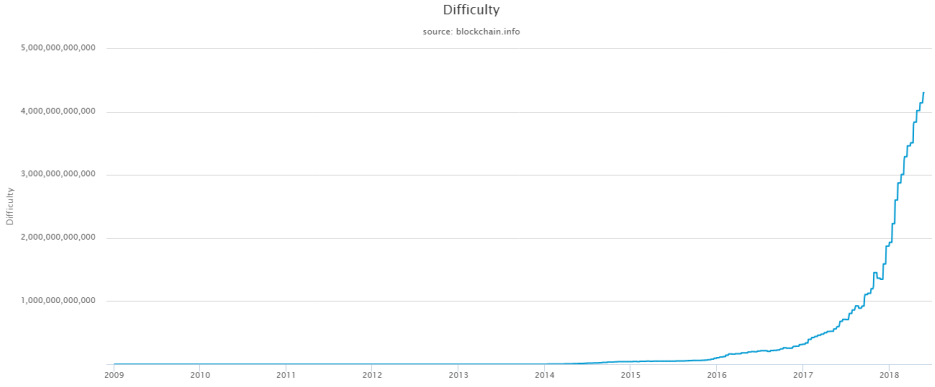


Figure 13: Bitcoin mining difficulty for the period 2009 – 2018. By Blockchain.info, 2018. Retrieved May 30, 2018, from https://blockchain.info/charts/difficulty?timespan=all

has risen, which can then be used to indicate where the technology behind it is on the Diffusion model. Figure 13 shows that there has been an exponential increase in mining difficulty in the period 2016-2018. Even though there are other factors involved (and other cryptocurrencies to attract miners away from Bitcoin), it can be concluded that thousands of new investors and miners appear every day. However, Bitcoin has still not reached a difficulty at which mining it would be unprofitable (Blockchain.info, 2018) compared to the cost of electricity, meaning that the cryptocurrency has not yet entered the Early Majority segment.

The overall conclusion from the analyzed metrics is that DLT has not yet reached the Early Majority statement. This fits with Moore's (2008) argument that with the goal to win over the majority of the consumers it is important to consider delivering the finished product which not only would have the core product but also would not lack any compelling reasons to adopt such as lack of additional hardware or not developed standards or procedures.

To understand better what the current standing of DLT with regards to its potential market application is, we need to examine the current overall macro-economic and micro-economic environment of DLT-enabled business. This will let us determine the main competitive advantage DLT-enabled businesses will be able to offer once DLT reaches the Early Majority segment.

PESTEL ANALYSIS

This section uses a PESTEL analysis in order to identify the current macro-economic factors, which influence businesses that use DLT-enabled technologies.

According to Kotler (2005) observing the macro-environment is important so that a company can adjust to it, as companies often have little influence on the way economy works. By examining the Political, Economic, Social, Technological, Environmental and Legal factors of the macro-environment, this section aims to identify the main opportunities and threats for DLT in the context of a business within the current economic climate, as well as the near-future one.

P: Political factors

The political environment looks at the political factors, which influence the adoption of DLT-enabled technologies.

DLT was first invented back in the 1990s, with its first successful application being "Bitcoin", created by Satoshi Nakamoto in 2009 (Na-

Political	· Uncertainty whether governments will oppose or support DLT adoption via regulation · Governments depend heavily on the financial sec-tor · Concerns about money-laundering and fraud
Economic	· DLT offers a cheaper, faster, more secure alter-native to existing solutions · Lack of trust in institutions · Uncertainty regarding taxation policies
Social	· People are comfortable with technology · People are comfortable with e-commerce · Negative media coverage of DLT(Bitcoin in partic-ular)
Technological	· New technology creates new business models · New technology faces “infrastructure inversion” · Companies are already adopting DLT on a larg-er scale · Governments can be big DLT adopters
Environmental	· Some DLTs require have a large footprint
Legal	· Uncertainty regarding laws · Banks will have a say in what laws are passed re-garding DLT

Table 5: PESTEL analysis summary

kamoto, 2009). Ever since, cryptocurrencies have been growing in popularity – Thake (2018) states that in 2017 the total crypto market capitalization was past $800 billion, finally reaching "the so-called 'tipping-point', the point where even your grandmother and grocer are up for a crypto-debate"(Thake, 2018).

It only makes sense that recently governments have started acting upon the use of DLT technology in the financial industries, as the discussion has really hit the public eye.

However, cryptocurrency has not been treated the same by different countries – some have entirely banned it, others are encouraging it, and some are actively postponing regulatory actions. To get a better picture of the overall political environment towards DLT, the current regulations regarding cryptocurrencies/DLT within the G8 countries is examined, as aggregated by law firm Perkins Coie (2018).

Within the EU, the European Banking Authority has warned the public about the risks associated with virtual currencies. There is concern about money laundering and terrorist financing rules via virtual currencies, which is soon to be addressed with regulation. However, virtual currencies are legal tender (and can be taxed as capital) in Germany, while still illegal in Italy and France. France has indicated that it will introduce customer identity identification rules with regards to the sale of virtual currency and is planning to launch a legal framework for authorization of ICOs. A law regarding identification has also been proposed in Italy, without any regulation being in place yet. In the UK the profits of a sale of virtual currencies is taxed under goods and services tax, with no requirements for anti-money laundering protections.

The situation is similar in Canada, where cryptocurrencies are not legal tender, and there is discussion that they become included in anti-money laundering laws.

Japan's government seems to be the furthest ahead, as it enacted a law already on April 1 2017, which authorizes the use of digital currency as a method of payment, essentially granting it the same legal status (and regulations) as any other currency. Moreover, the law requires annual audits for exchanges and training for employees.

Russia is going the opposite way, lifting previous strict regulations, which banned digital currencies, and drafting "crypto-friendly" proposals, such as tax exemptions on profits of transactions involving cryptocurrencies and a 10x increase on the limit for individual ICO investments.

The U.S government, according to Caytas (2017), has not enacted any

regulation on the federal level – instead individual states are free to regulate virtual currencies as they see fit. Caytas (2017) summarizes that "seven states have gone beyond cryptocurrencies and examined the governmental use of blockchain, either as isolated applications in specific government functions, or as integration across different government functions" (Caytas, 2017, p. 10-11), demonstrating that the government is a huge potential client for DLT.

The consensus among the G8 countries seems to be that governments are waiting to see where innovation will take DLT-enabled businesses, while doing the minimum possible to protect their citizens via regulations. In fact, the EU's official press release states that the Commission wants to "pilot projects to foster decentralized innovation ecosystems and help reshape interactions between consumers, producers, creators and among citizens, businesses and administrations to the end benefit of society" (Ansip, 2017). This seems consistent with the current situation in Russia, the USA and Japan.

This lack of regulation really allows for unstifled innovation, related to DLT. However, once regulations are put into place, they might stun/destroy the growth of DLT-enabled industries. The uncertainty of whether governments will actively support or oppose DLT-enabled businesses brings a huge amount of risk for the growth of a company in the long-term.

E: Economical factors

The economic environment largely concerns factors, which affect consumer's buying power and spending patterns – economic growth, interest rates, exchange rates, inflation, disposable income of consumers and businesses and so on (Kotler, 2005).

As stated in the political factors analysis, currently the future of DLT-enabled business is unclear, due to the lack of concise governmental regulations and taxation policies. This of course means that even though the current economic environment seems to not oppose the technology, potentially more economic measures will be put into place, as it becomes more widely adopted. A report published by IMF (2016) for example mentions as a conclusion that "more work is needed at the international level to study the evolution of VCs and their potential effects on the traditional banking and payments system, to understand the risks they pose, and to identify the most effective regulatory responses taking into account country circumstances" (IMF, 2016, p.36). The report also recommends that novel business models, based

on DLT, will need to be evaluated under a regulatory framework, which has not yet been created.

However, taxation is not the only potential actor that will affect the adoption of DLTs. In an examination of annual reports about the public trust from the last 18 years, Forbes (2018) concludes that there is an overall growing trust deficit in companies and institutions, not in small hand influenced by scandals with companies misusing and betraying their customers in the pursuit of a better bottom line. There is a global shift towards a decentralization of trust, exemplified by the growing popularity of cryptocurrencies. Forbes (2018) goes onto state that "Code and the bitcoin blockchain achieved a level of trust that millions of people, thousands of regulators and hundreds of enforcement agencies around the world struggle to maintain", pointing out how the DLT-based cryptocurrency gained popularity due to the more and more unstable economic environment. More so, the fact that DLT is by definition cheaper, faster and more secure than its traditional alternatives, gives it the upper hand with regards to a competition (World Bank Group, 2017).

S: Social factors

"Trust is a very important factor for successful online transactions" Eastlick et al. (2006).

According to Kotler (2005) social factors that should be taken into account are the ones that affect society's basic values, perceptions, preferences and behaviors. These come together to create a "feel" of the current state of mind of consumers overall, and their potential attitudes toward DLT.

As far as the adoption of DLT-based technology, it is a requirement that the customers are comfortable using it. The report published by Edelman (2018) states that the technology sector as whole is the most trusted, which can be interpreted as saying that customers perceives technology as more trust-worthy than people. Moreover, Consumers International (2018) states that "the percentage of the world's population with access to the Internet has grown from 1% in 1995, to almost 50% in 2017. People are increasingly more comfortable purchasing goods and services online as well, with a projection of 4.6 trillion US dollars in 2020 spent on e-commerce". P2P e-commerce solutions such as AirBnB and Uber are also widely adopted and praised. This trust and popularity of technology and it's pervasiveness in daily life means that consumers can readily

adopt DLT-based solutions, especially if that means a lower cost and a better value.

When it comes to the perception of DLT in the media and the public eye, it can be argued that a lot of misinformation is currently present. DLT, Bitcoin and blockchain are used interchangeably, without any real discussion of the potential opportunities that DLT-enabled business can bring.

Bitcoin is perceived as volatile and dangerous, and trading it is linked to gambling. Moreover, there is a negative stigma attached, that the main use of the technology is to anonymously purchase illegal items online (Brown, 2017). This combined with the bitcoin scams (Jha, 2015) and hacks (Mochizuki et al., 2014) builds up a mostly negative public perception of the technology, which might delay its adoption. Iansiti et al. argues that there was the initial reception for TCP/IP was similarly filled with skepticism, when compared to the at the time existing telecommunications architecture.

T: Technological factors

Kotler (2005) defines the technological factors, which influence the macro-economic environment, to be the forces, which create new technologies, creating new product and market opportunities".

Iansiti et al. (2017) compares DLT to the emergence of the Internet, and states that the emergence of DLT will potentially enable new business strategies, similar to what happened with the adoption of the Internet. It goes on to explain that once "... this basic infrastructure gained critical mass, a new generation of companies took advantage of low-cost connectivity by creating internet services that were compelling substitutes for existing businesses".

DLT is a general purpose technology so it will have ramifications on all business sectors. World Bank Group (2017) states that "DLT has a breadth of potential applications beyond cryptocurrencies in the financial sector and in a wide variety of other industries". Similar to the Internet, it will be adopted on a large scale so companies will have to adjust to it to keep their competitive edge. It can be argued that large companies are already reacting to the emergence of DLT - GoMedici (2017) states that there has been 1633 DLT patents filed in the period 2008 - 2017, by "technology companies (Coinbase, Coinplug, IBM), financial institutions (TD Bank, Bank of America, Fidelity), payment providers (Mastercard) and social media sites (Facebook) along with unusual assignees (Arkeytyp IP, Wal-Mart, AT&T)". Moreover, the report states that more patents are now filed for specific use cases and applications

as opposed to the core technology, keeping in line with the idea that new -business models are forming based on the new technology. This is supported by Brennan (2018), who state that "an estimated $2.1 billion will be spent on blockchain solutions during 2018, and by 2021 levels are expected to reach $9.2 billion".

It is important to note that due to its pervasive nature, everybody in the value chain is threatened by the adoption of DLT. World Bank Group (2017) states that "DLT is an alternative design approach that allows for a decentralized business and operational model when compared to existing, centralized design approaches that can be used for similar purposes", meaning that anything related to trust, privacy or account-holding can be altered to use DLT. However, there will be a certain amount of "infrastructure inversion" – that is, the currently existing infrastructure has been built for older technology and not DLT (Antonopoulos, 2018). If, despite that, governments do choose to adopt DLT, they can vastly reduce human error, fraud and thievery. This potential opportunity is already recognized, as some governments are spearheading DLT-enabled projects and funding research. A report issued by the UK Government's Office of Science in 2016, states that DLT "... provides the framework for government to reduce fraud, corruption, error and the cost of paper-intensive processes" (World Bank Group, 2017).

L: Legal factors

According to Kotler (2005) legal factors have to do with consumer rights and laws, which influence the macro environment. With regards to DLT, the political chapter already outlined the laws/regulations (or lack thereof) that currently reside over businesses. However, a lot of the available research on the topic of widespread adoption of DLT points to the legal implications being a big hindrance for the legal side of things.

With regards to insuring consumers and their rights, World Bank Group (2017) points out that "regulating open, permissionless distributed ledger systems is particularly complicated as no legal entity is in control of the distributed ledger". This means that it will be difficult for institutions to agree on a framework of regulations, and the most likely solution would be the adoption of private, permissioned ledgers.

As an example of how undefined the current legality of DLT is can be found in JPMorgan (2018) and their official position on the subject matter: "Rules must be developed for a P2P global payments system based on DLT. For example, what will be the recourse for money sent in error". It is evident that with regards to

the laws passed around DLT, banks, lobbyists and corporations will have a huge impact, as they form the legal, political and financial frameworks of modern economies. The situation in the near future will largely depend on the laws, passed around DLT-enabled businesses, which will depend on agreements of the already existing players in the trust-businesses. Overall, it is likely that DLTs will need to comply with the existing legal frameworks, which will mean a necessary redesign of some aspects of the technology (World Bank Group, 2017).

E: Environmental factors

Finally, environmental factors regard the natural resources / cost for the environment, as a product of DLT-enabling. In fact, over the last three decades, environmental concerns are becoming a more central focal point in the business world, as focus is shifting from non-renewable to renewable sourcing and sustainable business practices (Kotler, 2005).

World Bank Group (2017) states that permissionless blockchains that use proof-of-work protocols require vast amounts of processing power, which comes with a large electricity footprint. This is however only true about this specific type of DLT, as other examples of the technology have a consensus mechanism that does not have such a large footprint. This means that DLTs overall do not have such a large footprint, and with the advances in optimization of technology, the problem will become less and less prominent.

It can be concluded that there are a lot of uncertainties for the future of DLT-enabled business with regards to government regulations, legality, taxation policies and adoption and integration on a large scale. The consensus in the examined literature is that DLT has the potential to reshape a lot of different industries in a way, that's similar to how the Internet reshaped them. However, currently most stakeholders are letting the technology develop further before investing in a framework for its regulation. Companies are developing new use cases and applications of the technology, as there are prospects for growth in the future. However, the media portrayals of the technology spreads a lot of misinformation among consumers. Experts agree that once DLT-enabled solutions become commonplace, they will cost less, be faster and more secure than their current centralized alternatives.

From the PESTLE analysis it's evident that DLT is now on the breach of main-stream adoption, as more and more players are paying attention to the innovation, enabled by the technology.

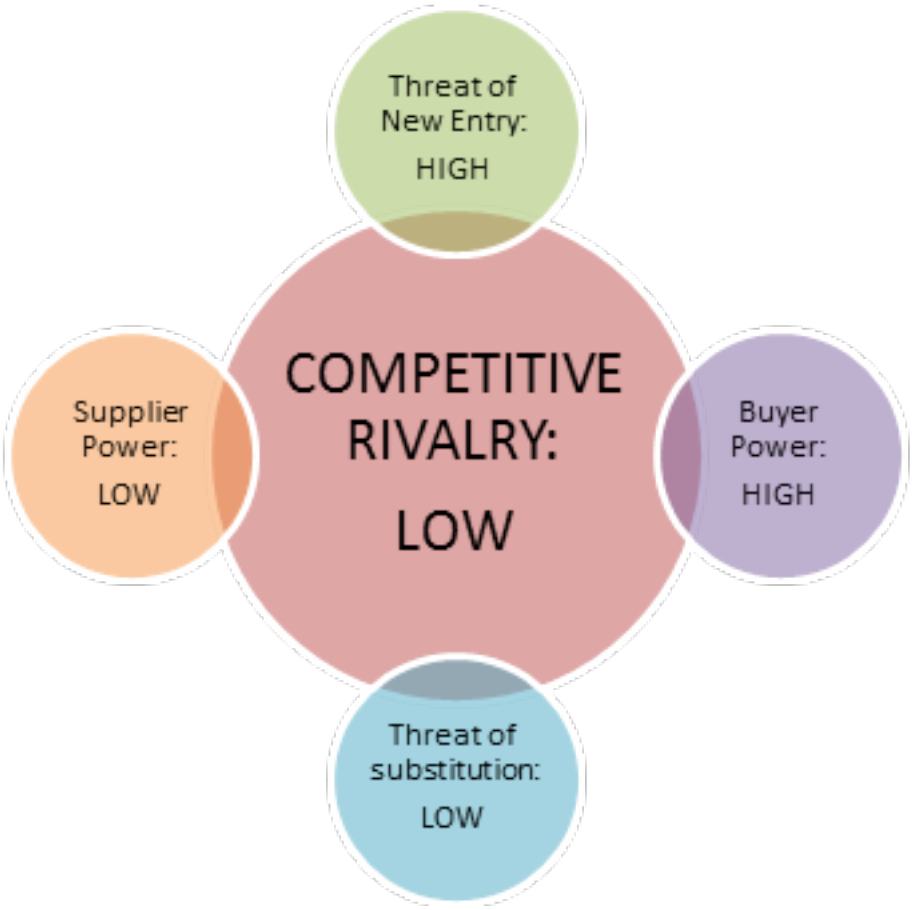


Figure 14: Porter's Five Forces

PORTER'S FIVE FORCES

Porter's Five Forces analysis is used to gain insights into the competitive rivalry, supplier and buyer positions and opportunities for the new entrants in the DLT-enabled industries. This will help fill in the overall framework, as defined in the PESTLE analysis.

NEW ENTRANTS – HIGH

The threat of new entrants is HIGH, because of the easy access to the technology. A simple example of this is the fact that in 2017 the amount of money raised via ICOs surpassed that raised by early stage venture capital for funding of internet companies (Kharpal, 2017). As the barrier to entry become larger - technology gets more complex and requires more technical know-how - the threat of new entrants will decrease.

SUPPLIERS – LOW

In the case of the DLT market, suppliers represent the people who develop the technology. Because of the decentralized nature of DLT, and the relatively low barriers to entry, their bargaining power is LOW.

COMPETITORS - LOW

The competition on the market is Low when compared to the size of analogous traditional markets. This might be due to DLT being a relatively new technology, and will increase with time.

CUSTOMERS - HIGH

With regards to DLT, a customer can be anyone using the technology through its applications. The bargaining power of the customers is high, as they can adopt another solutions. If the government is regarded as a potential customer of DLT,

SUBSTITUTE PRODUCTS - LOW

There aren't many substitute products, because the market is not saturated. That's why the threat of substitute products is LOW. Traditional, non DLT-enabled solutions are not considered substitute products, as the consensus is that DLT do the same, but cheaper and more efficiently.

It can be concluded that DLT places a lot of power in the hands of consumers, and there is a lot of space for newcomers to the DLT-enabled industries. Competition and barriers to entry are low, with a lot of potential for growth within the current climate. Taking into account this, the fact that DLT is still in the Early Adopters segment, as well as the macro-economic environment, it's not hard to draw a comparison that DLT will become for the 2020s what the Internet was for the '90s.

SWOT ANALYSIS

The SWOT analysis is used to summarize the findings from the PESTEL and Porter's Five Forces into an easy to understand list of the strength, weaknesses, opportunities and threats which surround businesses, adopting DLT. It starts off by identifying how the strengths and opportunities can be taken advantage of, and then goes onto suggest how the weaknesses and threats can be offset. Finally it summarizes the competitive advantage, which DLT brings to a business.

Figure 15: SWOT Analysis

COMPETITIVE ADVANTAGE

Overall, there is a competitive advantage for a business to embrace DLT already now, in the Early Adopters phase. On top of DLT being a cheaper, more secure alternative to current solutions, there is not a lot of competitions nor regulations, as governments are waiting to see what the technology will be able to achieve before investing in regulatory frameworks. However, it will be a painful process to retrofit DLT to fit within existing financial frameworks. This might be mitigated by DLT becoming an alternative to financial frameworks, as the people are growing more and more tired of institutions with no accountability or transparency. As stated in the diffusion model analysis, the market looks promising for DLT-enabled businesses – in the following years they would show exponential growth. Early adopters will reap the benefits as the market becomes more and more saturated and the barriers to entry raise. From a technology standpoint, DLT-solutions need to be less computationally expensive than Bitcoin, so that they make financial sense. On top of that, the people's attention should be brought to the fact that Bitcoin is just one example of a potential DLT application, to avoid the negative stigma.

CHAPTER 4. OPPORTUNITIES

CHAPTER IN BRIEF

The aim of this chapter is to assess the potential of DLT to disrupt entrepreneurial opportunity. It starts off by assessing whether DLT can be classified as a disruptive innovation technology. It then goes onto examine DLT's potential to disrupt opportunities by combining a set of literature reviews and empirical analysis.

DISRUPTIVE INNOVATION THEORY

Disruptive innovation presents a novel and different value proposition that what is currently available on the market (Christensen, 1997, p. 15). Products which are considered disruptive usually are underperforming comparing them to the established products in current markets, and are often smaller, have less features and cost much less (Christensen, 1997, p. 15). Even though these products lack the higher valued features, which majority of the mainstream users desire, these products find appeal among new customer groups who are not fully satisfied with the mainstream offerings. These disruptive products improve the existing ones in such way that the incumbents do not anticipate which results of their removal from the market, causing a disruption of the established mainstream market.

GENERAL PURPOSE TECHNOLOGY

General Purpose Technology was defined for the first time refers to a technology which is pervasive and is being adopted by majority of market segments, facilitates innovation and complimentary inventions at the same time being prone to improvements and change, become more efficient over time. GPT usually does not bring instant economic growth, but in some cases may cause a slowdown instead, as organizations and individuals might not fully understand how to exploit for their benefit. Bresnahan and Trajtenberg (1996) argue that to tell apart GPT from other technologies one should understand these three characteristics:

- Pervasiveness – Should spread to most market sectors.
- Improvement – Should improve over time and lower the costs for the users.
- Innovation – Should make it easy for new inventions and innovations to come.

To determine whether DLT can be called a GPT, it is examined with regards to each characteristic individually.

IS DLT PERVASIVE?

To determine whether DLT is a GPT, its It could be argued easily that the DLT technology can be applied to a large array of market sectors and industries, while even potentially disrupting them. This can be confirmed with the very nature of the DLT. “The blockchain allows the dis-

intermediation and decentralization of all transactions of any type between all parties on a global basis." (Swan, 2015, p. 10). Swan (2015) goes even further, stating: "Perhaps all modes of human activity could be coordinated with blockchain technology to some degree, or at a minimum reinvented with blockchain concepts." (Swan, 2015, p. 37) and presenting blockchain as the "next major disruptive technology and worldwide computing paradigm" and could have a effect on human kind similar to the Internet.

IS DLT CONSTANTLY IMPROVING?

By initial design the DLT is was meant to be continuously developed and improved. When the original whitepaper by Nakamoto (2009) was first published, the code was provided as open-source for developers build on and improve. Ever since, Bitcoin has been under constant development, following consensus of the community. This concept is referred to as the "Bitcoin Improvement Proposal"- the process of developer submitting proposals for new features to be added to the code. Till this day Bitcoin code has had many different revisions and updates which resulted in continuous new version releases. With regards to DLT, permissionless distributed ledgers have an open source nature that a large number of new applications is being built upon besides Bitcoin. It is important to mention that the permissionless DLT's are exposed to continue improvement because of its open source nature, which enables transparency and encourages involvement. For private or permissioned DLT's development will still occur, but it will be led by the organization managing it.

IS DLT ENABLING INNOVATION?

As mentioned above, that decentralization is at the core of the DLT. Which allows the DLT to disintermediate almost everything, transactions or decentralize the markets. Current examples of the application of this process are within the DLT ecosystem are Smart Contracts and DApps. The two technologies are built on top of the DLT and complement each other. These can be seen as an example of how DLT can assist the creation of a secure shared economy distributed applications.

Following the analysis of the above three characteristics, it can be concluded that DLT is a GPT. However, based on the definition, DLT is not a disruptive innovation, as decentralized applications which are built

upon the DLT are regarded as the disruptive innovation while DLT itself is only the facilitator. Next, two example of the disruptive innovation of DApps are presented.

Follow My Vote

A new platform named Follow My Vote is offering a disruptive way of voting by utilizing the transparent nature of DLT. Any country can allow their citizens to cast their votes in elections from their home. Their value proposition is to ensure that the votes of each citizen is counted and follow the process in real time. What is also fascinating they allow the voters to change their vote any time before the election ends. These two possibilities can shake up the two-party system, as people might not be keen on voting for a third-party candidate who would most likely not win. But with ability to view the voting in real time might draw a number of votes from the dominant parties with similar, views increasing the chances for the opposition to win. It also would also allow voting from any place in the world with a valid government issued ID it would also be a viable solution for elderly and disabled people who find it hard to leave their home. Finally, it is very cost-effective, and a lot of taxpayer money would be saved without the need to print voting ballots or hiring voting center personnel.

Cryder

Another good example of DLT based disruptive DApp is Cryder. Which provided a similar value proposition as Uber but keeping the network completely decentralized without the central hub. Which means that the drivers and customers are connected directly via DLT and the ecosystem is powered by the CRT utility token. For example, Uber takes around 20-30% in fees while Cryder allows the drivers to keep 100% of their earnings.

DLT AND THE INTERNET

According to Iansiti et al. (2017) DLT is the foundational technology and compares it to the distributed networking technology TCP/IP which paved the way for the development of the internet.

Introduced in 1972 TCP/IP was valued for just one use-case which was an e-mail client. Which was used among the researchers on the ARPAnet. As TCP/IP could breakdown information in to small packets and send them over the public network without any central authority.

At the very inception telecommunications companies were not convinced that this technology is suitable for robust data, messaging or voice and video connections more over that it could be secure and

scale up accordingly. But with the emergence of companies such as Sun, Netscape and Yahoo new services have been built as compelling substitutes for existing businesses. Iansiti et al. (2017) go on to state that internet connectivity brought companies which fundamentally changed the way businesses created and captured value. They draw parallels between DLT and TCP/IP stating that similar to email, DLT's most recognized current application is Bitcoin which enables bilateral financial transactions, and that the development of the DLT is open and distributed same as TCP/IP's. The Internet enabled new economic value by lowering the costs of connections dramatically, similar to how DLT will reduce the costs of transactions, which will result in radical shift of the economy, once mass adopted.

DLT AND CONSUMER ADOPTION

The model in Figure 16 shows how applications, enabled by DLT, will gain acceptance and propose a way in which broad adoption will play out. Two dimensions will affect how the business cases of the technology evolve – novelty, describing the degree of how new the application is to the world, and complexity, which describes the number and diversity of different parties which must work together to achieve value with the technology (Iansiti et al., 2017).

After establishing that DApps are in fact an example of disruptive innovation, it is important to examine DLT with regards to its ability to disrupt entrepreneurial opportunities.

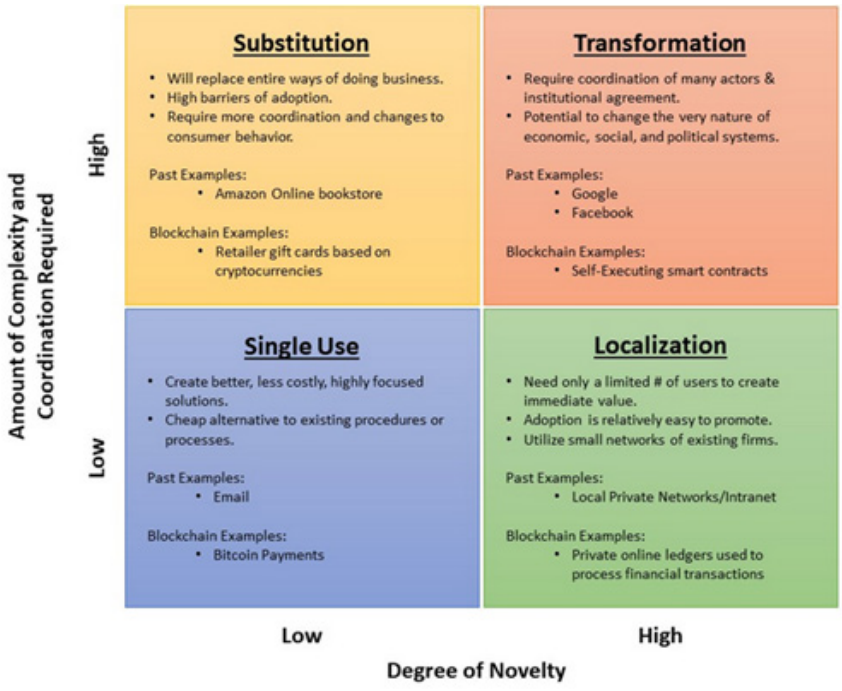


Figure 16: Customer adoption model

WHAT ARE OPPORTUNITIES?

Entrepreneurial opportunities and the process of identifying them has been assessed and reassessed by multiple researchers in the past century. As such, there are number of different ways of classifying or creating taxonomies of how, when and where entrepreneurial opportunities arise and are identified. The consensus though, is that the end result of identifying opportunities is the starting point of entrepreneurship (Shane, 2000).

A study conducted by Alvarez et al. (2007) is taken as a basis for the incursion in the opportunity identification field. In their paper, the researchers examine the vast majority of literature regarding opportunity identification and conclude that there are two schools of thought in regard to why opportunities appear in the first place:

- Endogenous opportunities (a.k.a. discovery opportunities) – here, the unusually alert entrepreneur harnesses the opportunities that arise because of the emergence of changes and/or innovations in fields such as technology, demographics or consumer preferences.
- Exogenous opportunities (a.k.a. creation opportunities) – here, the entrepreneur is considered the main driver of the appearance of opportunities as well as harnessing them

From this perspective, we can assume that the appearance of DLT enables the identification of opportunities from an endogenous point of view.

This classification is then further analysed by Audretsch and Keilbach (2011), and their conclusion is that “while the entrepreneurship literature has taken entrepreneurial opportunities to be exogenous, the literature on firm innovation and technological change has taken the creation of such innovative opportunities to be endogenous”. This paper is a clear example on why there is a lack of consensus in literature regarding the opportunity identification process.

But how is this relevant when it comes to DLT? Shane (2000) demonstrates in his extensive study regarding identifying opportunities how one new technology allows the creation of multiple entrepreneurial opportunities, either completely innovative or built on top of existing models. Therefore, if we make a parallel between his study and the emergence of DLT and its applications (as seen in the previous chapters) we can argue that this technology also creates a new “playing field” for entrepreneurs.

The goal of this section is to determine whether DLT enable disruption across all sectors. To achieve this, a two-level analysis is conducted: the existing literature on the topic is examined, validated against real-world applications of it (ventures) and then cross-referenced against the results from a survey, conducted by the participants.

OPPORTUNITIES IN LITERATURE

The first step is to create a comprehensive list of the opportunities, related to DLT, as defined by recent literature. This will form the canvas within the domain, on top of which the results of the conducted survey will be applied.

For the literature review, only reports published by reputable, regulatory international sources with a certain amount of gravitas are considered. Furthermore, the amalgam of opportunities is divided in two groups – ones related to the Finance industry, and ones that are not. This is done because about half of the aggregated DLT applications, as presented in the examined literature, fit into the Finance industry. The data is gathered from the combined findings of UK Government Office for Science (2016), World Bank Group (2017), IMF (2016) and Board of Governors of the Federal Reserve System (2016).

To further analyze whether all the sectors have real-world applications, each opportunity is matched to a corresponding venture, identified in literature and the Blockchain Expo Survey.

BLOCKCHAIN EXPO SURVEY

The purpose of the survey was to assess what people in the field consider as the most relevant opportunities, enabled by DLT. The answers were then processed and centralized, so as to fit within the framework, established above.

The survey was conducted among companies, present at the London Blockchain Expo, the leading global event for DLT based businesses. The survey asked a number of question relating to the background of the respondents, such as professional experience and position in the company participating in the expo. Furthermore, respondents were asked to give their subjective opinions on industries present the biggest opportunities for future applications and what the biggest threats the DLT industry might face are.

The survey which was carried out has certain limitations. Only a fraction of the participating companies were interviewed because of time constraints - as the number of booths was very large and the survey team had only two participants.

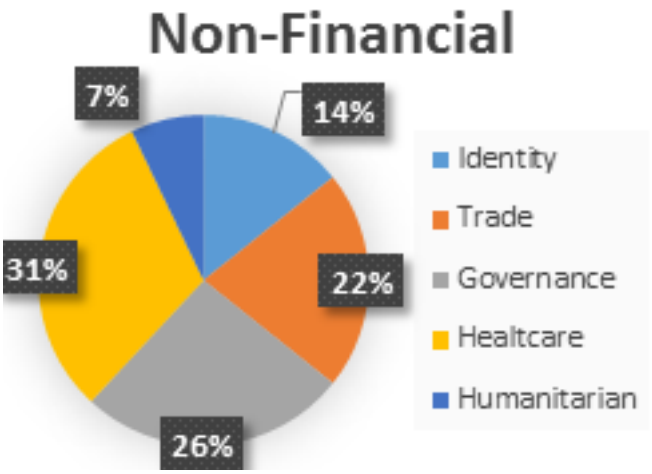


Figure 17:
Opportunities in Non-Financial industry according to surveyed results

Moreover, the respondents of the survey where mostly involved in Financial sector, dealing with promotion of new coins and various financial services. Among the other respondents, most were involved in businesses dealing with identity and security matters.

According to respondents' biggest opportunities in the future can be found in financial sector - 52% of respondents stated that they feel the biggest opportunities can be found in financial services sector with special emphasis on crowdfunding. This is more or less consistent with the proportion of opportunities discovered in the literature. However, respondents have placed the Healthcare industry, especially in mHealth sector, in 2nd place with 31% of total responses. Trade of goods is in third place with 22%. The rest of the responses have a wide variety, showing that there is a range of opportunities. To further validate the results, a cross check with real world use-cases is done.

The survey also uncovered additional DLT opportunities (which respondents were currently working with), not present in the examined literature. Those were also added to the DLT opportunity list. The final

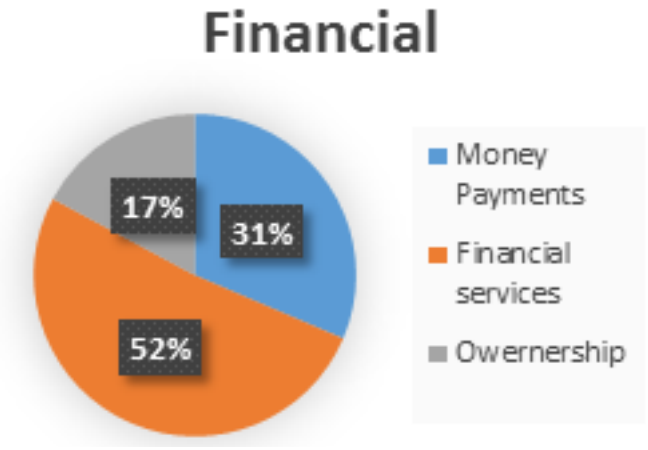


Figure 18:
Opportunities in Financial industry according to surveyed results

outcome of the analysis are Table 6 and Table 7, which encompasses all gathered information on opportunities.

From the data presented above, it can be concluded that DLT disrupts entrepreneurial opportunities, as it creates opportunities across almost sectors of the economy, therefore creating a new playing field for entrepreneurship. As a result, a hypothesis can be made that DLT widens the opportunity field for entrepreneurs. This can be divided into:

- adapt existing opportunity to the new technology to harness the advantages it brings;
- create new opportunity which were not possible before the emergence of the technology.

Table 6: Summarized list of opportunities enabled by DLT within the financial sector, including survey results. Adapted from UK Government Office for Science (2016), World Bank Group (2017), IMF (2016), Board of Governors of the Federal Reserve System (2016).

Financial sector applications		Ventures
Money and Payments	Digital currencies	Bitcoin
	Payment authorisation, clearance settlement	Aeternity
	International remittances and cross-border payments(alternative to correspondent banking)	Ripple
	Foreign exchange	Bitfinex
	Micropayments	R3 CEV
	Money transfer	R3 CEV
Financial Services and Infrastructure (beyond payments):	Capital markets: digital issuance,trading settlements of securities (in combination with smart contracts)	R3 CEV
	Track ownership of digital representation of securities	R3 CEV
	Commodities trading	R3 CEV
	Notarization services (e.g. for mortgages)	R3 CEV
	Collateral registries	Bank Hapoalim
	Movable asset registries	R3 CEV
	Syndicated loans	eCoinomic
	Crowdfunding(as initial coin offerings)	R3 CEV
	Financial inclusion	R3 CEV
	Insurance(in combination with smart contracts) for automating insurance payouts and validation of occurrence of insured event	InsureX
Collateral registries and ownership registers	Land registries, property titles & other collateral registries	Ubiquity
Internal systems of financial service providers	Replacing internal ledgers maintained by large, multinational financial service providers that record information across different departments,subsidiaries, or geographies	Xage

Other sectors		Ventures
Identity	Digital identity platforms Storing personal records: birth, marriage and death certificates	ShoCard Khanections
Trade and Commerce:	Supply chain management (management of inventory and disputes) Product provenance and authenticity(e.g.artworks, pharmaceuticals, diamonds) Trade finance	GXS BlockVerify Blockpoint.io
Agriculture	Financial services in the agricultural sector like insurance,crop finance and warehouse receipts Provenance of cash crops Safety net programs related to delivery of seeds, fertilizers and other agricultural inputs	 Provenance
Governance	E-voting systems E-Residence Government record-keeping, e.g. criminal records Reducing fraud and error in government payments Reducing tax fraud Protection of critical infrastructure against cyber attacks Asset registration Auditing VAT transactions Information sharing Monitoring the state and integrity of software for illicit changes	Follow My Vote Borderless. tech Estonia Govcoin BITNATION Rivetz Everledger Guardtime Brave PeerNova
Healthcare	Electronic medical records	GEM
Humanitarian & Aid	Tracking delivery & distribution of food, vaccinations, medications, etc. Tracking distribution and expenditure of aid money	Bitgive
Entertainment	Media / Data Security E-Sports Gaming Gambling Media	Freely DreamTeam Fathom TruePlay bitcoinist.com
Real Estate	Real Estate Management & Development	SwissRealCoin
Information Technology	Cloud Computing	Sparkster

Table 7: Summarized list of opportunities enabled by DLT within other sectors, including survey results. Adapted from UK Government Office for Science (2016), World Bank Group (2017), IMF (2016), Board of Governors of the Federal Reserve System (2016).

Through this chapter the theory of disruptive innovation and general-purpose technology has been discussed and compared to the phenomenon of the DLT with the aim to answer the research question Does blockchain disrupt entrepreneurial opportunities? We can conclude on the findings of the discussion that the DLT by itself can be regarded as general-purpose technology, similar to the Internet, which has potential to affect a large array of industries, being of open source nature is prone to constant technological upgrade, and most importantly serves as a catalyst for new innovative developments.

CHAPTER 5. BUSINESS MODEL

CHAPTER IN BRIEF

The aim of this chapter is to analyse whether the appearance of DLT and its likely propagation into mainstream will affect business modelling. In this sense, the group firstly gained knowledge by analysing literature on business models and business model innovation. In continuation, the main values of DLT are presented, to be used in conjunction with business modelling.

In this sense, the team aims to focus its initial analysis on discovering how DLT affects the business model configurations as proposed by Taran (2016) and the implications of the perceived discoveries. Building on top of that, the analysis aims at narrowing down the implications of DLT in business modelling by applying the uncovered data from business model configurations to another abstraction level of business modelling, namely the business model canvas (as proposed by Osterwalder et. al. 2010).

BUSINESS MODELS

In order to start the analysis on the business modelling side, a few terms must be first understood, namely the concepts of business model and business model innovation.

Initially, a stance on the definition of business modelling must be assumed, since this domain also has a lot of definitions associated with it. On top of that, we must reassure ourselves of the importance of business modelling in the entrepreneurial life. Consequently, we decided to work with the definition provided by Osterwalder et. al. (2005, p. 17) who defined it as: "a conceptual tool that contains a set of elements and their relationships and allows expressing business logic of a specified firm... a description of the value company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams".

Osterwalder et. al. (2015) describe in their book the BM as having four main elements: infrastructure, offered benefits, customers and lastly, financial structure.

Considering that the analysis at hand is related to DLT, a form of technological advancement, defining the relationship between business models and technological advancement is also required. Chesbrough (2007) argues that historically firms that have better business modelling strategies can overcome technological advancements, therefore having a business modelling approach in a company's innovation process is of utmost importance. According to Baden-Fuller & Haefliger (2013), business models provide the bridge between a company's performance and the appearance of new technology, where the decision to implement new technologies has factors such as openness and user engagement engrained within it.

The role of business modelling when it comes to technological advancement is also described by Gambardella & McGahan (2010), where they argue that up until recently, either opportunities or technological bottlenecks required the appearance of new technology, whereas recently the tables have turned, since now there are technological solutions that are either seeking commercial applications/ opportunities or technological problems to fix.

Wirtz et. al. (2016) outlines the purpose of business modelling as a key for companies that want to stay successful in increasingly competitive and more digitised markets, since it enables them to embark into business model innovation which in turn would give them a better opportunity at "continually adjusting to varying market conditions and to cope with a highly dynamic and competitive business environment".

The importance of business modelling is two-fold from the perspective of who gets to benefit from it. On the one hand, it can be used by entrepreneurs willing to create new ventures. Their main take from business modelling is that they have a framework for (almost) any type of venture – therefore they can f.ex. analyse the status quo of current businesses in the market they want to reach into. On the other hand, BM can be used by existing companies to assess how their business is currently running and get a quick insight into whether they must engage into business model innovation or not.

BUSINESS MODEL INNOVATION

Innovation is considered by both scientific research and management practice as being an effective way of tackling the challenges provided by a very competitive environment (Wirtz, 2016). According to Wirtz (2016), innovation has four cornerstones, namely product, service, process and lastly, business model innovation. Andreini and Betttinelli (2017) conducted a large literature review on the thematic of business model innovation and in doing so, elaborated a definition of BMI that more-or-less satisfies all the literature. They argue that BMI is "a holistic concept used to deal with issues related to the search for new business logics and new ways for a company to create and capture value for its stakeholders".

DLT AND BUSINESS MODELLING

As the previous chapters reveal, DLT has the potential to disrupt businesses, especially because of its features that enable it to disrupt commerce as we know it. DLT allows transactions to be made using "programmable" money (cryptocurrency) that is verified and validated

"There has been considerable debate about the precise nature of the relationship between technology innovation and business model innovation. […] However, fundamentally, commentators agree that technological change requires a simultaneous adjustment of the business model to be effective."

Maul et.al. (2017)

by a P2P (peer to peer) network that reaches consensus where software (i.e. smart contracts) can make such transactions without the need for 3rd party mediation (or human intervention). Everything takes place autonomously in a distributed and decentralised way, where the said transactions cannot be censored in any way (intercepted, forbidden etc) by any government or firm (i.e. financial institution). This, once again, means that the trust is embedded in the cryptocurrency (through the innate properties of DLT) and is not related to an issuing body (i.e. central bank issuing fiat money) - trust is thus a trait available to each node of the network by design.

Nowinski and Kozma (2017) argue that the majority of the literature regarding business model innovation agrees on the fact that the main drivers for BMI can be divided into internal and external drivers. In their analysis of the effect of blockchain on BM, they conclude that the technology is mainly considered as being an external driver for BMI.

According to Zamani & Giaglis (2018) the usage of DLT is beginning to change the nature of money and commerce as we know it. Historically, at the highest abstraction level the market is comprised of three basic elements: buyers, sellers and intermediaries. The properties of DLT offer the possibility of eliminating one of these elements, namely intermediaries, thus allowing a further disintermination in commerce in general, built on top of the trend established by the rise of e-commerce. This, in turn, will have an impact on BM.

The analysed DLT-related business modelling literature therefore posits that there is a consensus on the fact that DLT has, or will have an impact on BM and BMI and specifically on anything related to commerce.

"For the first time, there are the conditions for buyers and sellers to communicate directly and transact safely and securely without a third party needed to establish a secure communication between the two."

Zamani et al. (2018)

NEW BUSINESS MODELS, ENABLED BY DLT

The group researched a large number of articles available in the AAU Library database, with the purpose of finding any publications that refer to DLT and new business models. Note that by new BMs, the authors refer to BMs that are completely novel. To have the most trust-worthy results only, the search was limited to books, journals and articles. The search query was fed a combination of the terms: business model, distributed ledger technology, DLT, blockchain.

This tactic proved to be very unfruitful, because the speciality literature only provides one example of a new business model enabled by DLT. search based on googling all of the same terms as in the first round. Therefore, a clear delimitation must be set between the results, as the

IoT E-business model - proposed by Zhang and Wen (2017).

Example:

The first real-world proof of concept for this business model has been made by ElaadNL (ElaadNL, 2017) and is enabled by using a tangle-based form of DLT, IOTA. In their experiment, they created the world's first car charging station that both transfers energy and charges payment using DLT, in this case - IOTA.

In Table 9, a brief comparison is

Table 9: Comparison between IOTA and non-DLT solution

DLT-based solution stakeholders		Non-DLT based solution stakeholder	
User	Car-charging company (ElaadNL)	User	Car-charging company
No fees	No credit card infrastructure needed	Micro credit-card fees	Must pay for credit card infrastructure
Safety of data	No need to invest in data-security	Risk of charging terminal to be hacked and reveal personal info, such as credit-card details	Must pay for digital solutions to create hack-proof terminals

made between this case and a non-DLT solution. The main perks for two of the stakeholders are presented in both cases.

MAIN VALUES OF DLT

DLT has a set of intrinsic properties, as discussed in previous chapters. These properties can be derived into values that the technology has the potential to bring to BMs by design.

The World Bank Group (2017) provides an overview of the result of their analysis on the key advantages of DLT. The advantages are (adapted from World Bank Group, 2017):

A. Decentralisation and disintermination – DLT removes the need for a central authority controlling the ledger, thus enabling true P2P transfer of value. This factor can affect firms by potentially reducing costs, offering better grounds for scalability and a faster rate of going to market.

B. Transparency and easier auditability – all members of a DLT-enabled network have access to a full copy of the ledger and every change occurring on the ledger is approved via a consensus mechanism, everything happening in real time. This trait of DLT combined with the previous one can reduce fraud and further lower costs by eliminating reconciliation.

C. Automation and programmability – smart contracts are programmed pre-agreed conditions that are automatically executed as soon as the conditions are fulfilled by the parties involved. This further reduces time and money spent on different type of transactions.

D. Immutability and verifiability – DLT offers a pure and true audit trail for every transaction that ever occurred on the ledger

E. Increased speed and efficiency – by removing the third party, DLT removes the need for clearing and settling transactions, thus increasing speed and efficiency

F. Cost reductions – this is achieved through the removal of reconciliation processes, lower infrastructure costs, frictions and fraud.

G. Enhanced cybersecurity resilience – because of its distributed nature, attacks on the network are much harder to achieve, since there is no single point of attack.

DLT AND THE BUSINESS MODEL CANVAS

In order to be able to analyse the effects of DLT on business modelling, the group decided to take Osterwalders' et. al. (2010) business model

canvas (BMC) and try to decipher whether it is affected by DLT. The decision to analyse this tool from the multitude of available tools was taken mainly because it is a tool well-known to people engaged in entrepreneurship, innovation and business modelling.

Osterwalder et. al. (2010) describe BM in their book as having four main elements: infrastructure, offered benefits, customers and lastly, financial structure. These elements are then further broken down into nine BMC blocks and create a visual canvas for analysing, designing and innovating BMs. For the purpose of this analysis, the group decided to take each building block and look at them through the lens of the accumulated information so-far, focusing mainly on the main value of DLT (as discussed in the previous section), whilst also aiming to provide real-world examples for each block discussed.

1. Customer segments

DLT gives companies the opportunity to address customers that have been out of their reach historically. A good example of this is the company known as Cashaa (www.cashaa.com), that has developed a digital wallet solution that eliminates the need to create a bank account, thus being able to reach a large number of consumers that have never had a bank account.

DLT enables what can be considered an anonymous customer. The advent of DLT could impact this block heavily, because DLT doesn't require the customer to give away any of his personal information in order to participate in a transaction. If cultural factors (such as the recent media uproar regarding companies giving away people's data without their consent i.e. Facebook scandal) will also continue to add to this, the public might be swayed to adopt DLT faster.

2. Value proposition

As explained in chapter 4, DLT enlarges the field of entrepreneurial opportunities because of it's design, by enabling the creation of value where it wasn't possible before. Different value propositions arise in a multitude of sectors, centred around what DLT offers by-design. This includes propositions ranging from currencies (i.e. Ripple) all the way to government related activities such as voting.

3. Customer relationships

This building block gets mainly affected because now customers can actually get reimbursed for the data they are providing and generating, as well as for the ads they are receiving. A notable example of how this is happening in DLT is Wibson (www.wibson.org), where they offer "infrastructure and financial incentives for individuals to securely sell

private information that is validated for accuracy, all without sacrificing personal privacy".

4. Channels

DLT enables new channels for exchanging value with customers.

5. Revenue streams

DLT empowers companies as well as individuals with a number of ways of receiving money that was not possible before, whilst also reducing costs afferent to a number of transactions. Slock.it (www.slock.it) proposes a solution that enables any company or individual to "rent, sell or share anything" whilst also reducing costs on a few different levels.

6. Key activities

This section can also be affected by DLT, as can be seen with examples such as Corda (www.corda.net). In their description of Corda business processes (key activities) get heavily impacted by the implementation of DLT: "Corda removes costly friction in business transactions by enabling businesses to transact directly. Using smart contract and blockchain technology, Corda allows existing business networks to reduce transaction and record-keeping costs and to streamline business operations. Corda enables an interoperable, open network that empowers organisations to collaborate and transfer value directly with trust. Corda achieves this with complete privacy in a freely available open source software platform" (Corda.net, 2018).

7. Key resources

Considering that most organisations (big and small) work in some instances with people employed on a freelancing basis, DLT has the potential of making this relationship easier and more cost effective. A good example of this can be seen in Canya (www.canya.io).

8. Key partners

This part of the canvas has been the "bread and butter" of large companies such as IBM, with their project Hyperledger or Maersk with their project on tracking global shipment. If DLT is to be implemented in any given supply chain, a lot of optimisation on factors such as costs, and efficiency can be achieved.

9. Cost structure

The fact that companies and individuals are able, by using DLT, to dispose of any third-party intermediaries has a large impact on cost structure and the way this building block will be considered in the future. An example of this is UjoMusic (www.ujomusic.com), where customers can directly buy music from the artists. Artists in turn benefit from the fact that the process is a

lot easier than other ways of selling their music or making sure that their royalty rights are respected.

The analysis on the building blocks of BMC reveals that DLT can influence each block and this is reinforced by the examples of how different companies using DLT currently aim to do this.

DLT AND BUSINESS MODEL CANVAS

Business model configurations (or archetypes) are of importance for any entrepreneurial endeavour mainly because, as Taran et. al. (2016) argue, they provide a "framework to map out potential innovation routes" from a business modelling point of view. In their paper, the importance and value of business model innovation is iterated and analysed through the perspective of creating a list of business model configurations or patterns. These can be used by entrepreneurs and managers alike to "envisage radical, disruptive and new-to-the world business model configuration ideas or apply existing configurations from other industrial settings in what may be deemed new-to-the-industry innovation" (Taran et. al., 2016).

The importance of archetypes or ideal-types, from a historical perspective, seems to be well-rooted into the psyche of societies all around the world, as Jung (1927, p. 342), argues that "all the most powerful ideas in history go back to archetypes. This is particularly true of religious ideas, but the central concepts of science, philosophy, and ethics are no exception to this rule". Hence, having access to a toolset such as the one proposed by Taran et.al. (2016) could be of great value for anyone involved in entrepreneurship and business innovation.

According to Fielt (2013), BM process configurations are ideal-type examples that describe and distinguish the "behaviour" of companies operating in the real world, thus providing managers, practitioners and academics with formulas that have already been tried and tested in practice. We can then assume that the main value of this list of configurations is that entrepreneurs can easily have access to a thoroughly tried-and-tested set of ways to innovate.

The most useful or redeeming quality of this list is the identification of the core operating business process-

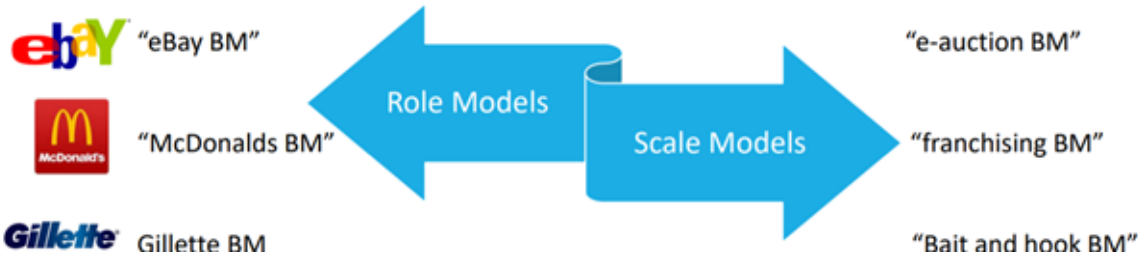


Figure 19: Examples of Role Models and Scale Models

es features behind the ideal-types described. These are often used in conjunction with the names of specific real-life companies, which are supposed to frame particular strong points and specific features. The classical "role-model" examples such as the "Gillette BM"; "McDonalds BM" or the "eBay BM" are well known in the entrepreneurial world. Taran et.al. (2016) reveals that previous literature as well as their own analysis tries to deliver both "role-models" as well as "scale-models" (see Figure 19) derived from the real world. Taking this into account, our analysis also focuses on delivering examples of existing DLT companies for each of the cases established earlier in order to make it easier for future readers to associate the given configuration with a real-life model.

Taran et.al. (2016) describe in their analytical effort that they had to construct a classification framework scheme in order to be able to produce the list of configurations. Following this logic, their analysis concludes that the best way to organise this list is to form a group of five key value drivers that should apply to any BM. These five key value drivers are interpreted in the same paper by creating a correlation to the building blocks proposed by Osterwalder et. al. (2010), which can be seen in Table 10.

Table 10: Correlation between BM configuration and BMC blocks

Key value drivers (Taran et. al., 2016)	BMC blocks (Osterwalder et. al., 2010)
Value proposition	Value proposition
Value segment	Customer segments and Customer relationships
Value configuration	Key activities, Key resources, Channels and Cost structure
Value network	Key partners
Value capture	Revenue stream

DLT AND BUSINESS MODEL CONFIGURATIONS

Starting from the premise that DLT will have an effect on BM (as per previously explained), as well as on the results of the analysis on BMC and DLT, the next step is to look at how DLT impacts BM configurations. To do that, the values these inbuild properties can influence Taran et. al.'s (2016) proposal for business model configurations. The appearance of DLT into mainstream then allows us to analyse where this technology and its applications might fit into this list of configurations. Our main goals with this research exercise is to find and specify, to the best of our knowledge, which configurations:

- apply when using DLT.
- are enriched, modified or disrupted by using DLT – this is deducted from examples of real-world applications.

The first step of the analysis is to determine whether DLT is applicable for a particular business model configuration. Put otherwise, whether the adoption of DLT makes sense, to the best knowledge of the authors, for a certain BM configuration.

After narrowing down the configurations, for which DLT is applicable, the second step is to examine which of the technology values, as presented earlier in this chapter, could applies for that specific case.

Next, based on the outcome of the second column, the BM configurations are finally in the "Potential influence level" column as High, Medium or Low, with regards to the number of value factors, that DLT could bring to a specific BM configuration. This is done so that an overall determination can be made regarding the benefit of applying DLT to said BM configuration.

In the final column, real-world examples of companies that currently use DLT and fit into the same BM configurations are presented. By extension, the authors propose that the (versions of) configurations these companies use are either: (a.) improved or modified, (b.)application specific, or (c.) completely disruptive because of the values of DLT. The group did not engage into classifying the said companies and their respective BM configuration proposal into the three categories enumerated, but it is rather only trying to clarify what the variables are.

Even though the analysis aims to make a preliminary list of the most probable BM configuration that will be affected by DLT, a very import-

ant specification must be made: all these BM configurations get affected by the implementation of DLT on a large scale and cross-sectors, because this will more-than likely bring it improvements to aspects such as cost. The only difference that will matter in this respect is the rapidity to which companies will employ the usage of DLT in their value chain.

The complete table containing the configurations can be seen in Table 8.

Number	Configuration name and real-world example	DLT applicability	DLT values that could apply							Potential influence level	DLT equivalent example
			A	B	C	D	E	F	G		
VP1	Brokerage (Orbitz Worldwide, Century21 Real estate)	Yes	X	X	X	X				Medium	CEX.io
VP2	Collaboration platforms (Podio)	Yes	X	X	X	X	X	X	X	High	IBM Hyperledger
VP3	Cool brands (Nike)	No									
VP4	Crowd sourcing (Wikipedia, Youtube)	Yes	X							Low	Flixxo
VP5	Experience destination (Nike Town, LEGOLAND, Barns and Noble)	No									
VP6	Fast follower (MCI Wolrd-Com with AT&T)	No									
VP7	Full service provider (Alberta Health Services, Geek Squad)	No									
VP8	Incomparable products/ services (Genzyme, Polaroid in the 60s)	No									
VP9	Infomediary (Edmund)	Yes	X	X		X	X	X		High	Blockchain.info; datum
VP10	Mass-customized commodity (Dell)	No									
VP11	No frills (Ryanair)	Yes			X		X	X		Medium	
VP12	Peer to peer (Airbnb, Zopa)	Yes	X		X		X			Medium	Powerledger, BEE Token
VP13	Price-reduction bundling (Fast food value meals)	No									
VP14	Quality selling (Lego, Saks Fifth Avenue	No									

VP15	Selling product performance (Rolls Royce engines, Zipcar)	Yes	X				X			Low	NiceHash
VP16	User design (lulu.com, LegoFactory)	Yes	X		X				X	Medium	Sparkster
VP17	Trusted advisor (McKinsey, Merrill Lynch)	Yes		X		X			X	Medium	CoinSchedule
VP18	Trusted operation (Rolls Royce, State Street)	Yes		X		X			X	Medium	
VP19	Trusted product/service leadership (Teradyne)	Yes		X		X			X	Medium	
VP20	Value added reseller (Toys R Us, Berkshire Computer)	No									
VP21	Value bundling (Omnicom, ModusLink Global Solutions)	No									
VP22	Value chain coordinator (Celarix, PrintConnect.com)	Yes		X		X		X	X	Medium	IBM Hyperledger
VP23	Value chain service provider (Paypal, UPS)	Yes		X		X		X	X	Medium	IOTA
VS1	Breakthrough markets (AIG Insurance)	Yes	X	X	X	X	X	X	X	High	Cashaa
VS2	Customer focused (Zara)	Yes	X	X			X	X	X	High	Cashaa
VS3	Free for advertising (Facebook, Google)	Yes	X					X	X	Medium	steemit
VS4	Multi-sided platforms (Nintendo, Google)	Yes			X		X	X	X	Medium	IBM Hyperledger
VS5	Robin Hood (TOM's Shoes, Warby Parker)	No									
VS6	Round up buyers (Costco)	No									
VS7	Target the poor (Grameen Bank, Walmart)	Yes						X		Low	
VS8	Ultimate luxury (Lamborghini, Jumeirah Group)	No									
VCo1	Branded reliable comodity (Goodyear, Heinz tomato sauce)	No									
VCo2	Channel maximization (CocaCola, Nestlé)	No									
VCo3	Core focused (Mobile Telco, Private banking)	Yes			X		X	X		Medium	
VCo4	Disintermination (Dell)	Yes	X		X		X	X		Medium	NANO
VCo5	E-mall/mall (eBay, Walmart)	Yes	X	X	X	X		X	X	High	OpenBazaar
VCo6	E-procurement/procurement (Public invitation to tender)	Yes		X	X	X			X	Medium	GEP
VCo7	E-shop/shop (ASOS)	No									

VCo8	External sales force (Mary Kay, Vorwerk)	No									
VCo9	Integrator (Zara, Ford)	Yes							Low		
VCo10	Reverse innovation (Nokia, Renault)	No									
VCo11	Self-service (Ikea, McDonald's)	No									
VCo12	Trade show (Alibaba, Exhibition fair)	No									
VCo13	Trash to cash (H&M)	No									
VCo14	White label (Foxconn)	No									
VN1	Adaptive (Apple Iphone)	Yes		X			X	X	X	Medium	IOTA
VN2	Affinity club (MBNA affinity cards, Payback)	No									
VN3	Barter (Magnolia hotels, Pay with a Tweet)	Yes	X	X		X			X	Medium	Tradestuff
VN4	Content creator (Bloomberg LP)	Yes	X	X		X			X	Medium	Primas
VN5	Crowd funding (Pebble Technology)	Yes		X	X		X			Medium	Indiegogo
VN6	De facto standard (SHARP flatpanels)	Yes			X	X	X	X	X	High	IOTA
VN7	Franchising (McDonald's, Starbucks)	No									
VN8	Inside-out (GlaxoSmith-Kline)	No									
VN9	Integrated (Proctor & Gamble)	No									
VN10	Outside-in (Proctor & Gamble)	No									
VCa1	Bait and hook (Gilette, HP Inkjet)	No									
VCa2	Cell phone (Sprint, Mobile Telco)	No									
VCa3	Comission (Vitual Mall)	No									
VCa4	E-auction/auction (eBay)	Yes	X	X	X	X			X	High	OpenBazaar
VCa5	Fractionalization (time-sharing condos, NetJets)	No									
VCa6	Freemium (Skype)	Yes		X					X	Low	IBM Blockchain
VCa7	Freemium upside-down (Insurance companies)	Yes	X	X	X	X			X	High	InsureX
VCa8	Instant gratification (Capital One)	Yes		X		X		X	X	Medium	ETHLend
VCa9	Leasing (Xerox)	Yes			X			X		Low	IBM Hyperledger
VCa10	Pay-as-you-go (PG&E)	Yes	X		X					Low	ElaadNL
VCa11	Pay what you want (NoiseTrade, Humble Bundle)	No									

VCa12	Reverse auction (Elance.com)	Yes	X	X	X	X		X	High		
VCa13	Reverse bait and hook (Amazon Kindle)	No									
VCa14	Subscription club (Costco, Netflix)	Yes			X		X	X	Medium		Artis
VCa15	The long tail (LEGO, iTunes)	No									
VCa16	Upfront payment (Amazon.com)	No									

Table 8: Evaluation of business model configurations with regards to DLT

The results of the analysis reveal that:

- There are 36 BM configurations that DLT could be applied to.
- Out of the these configurations, the potential influence of the DLT values is (Figure 18):
    a. Low in 7 cases;
    b. Medium in 20 cases;
    c. High in 9 cases.
- Out of the total configurations analysed, 29 of them already present a real-world solution with the help of DLT.

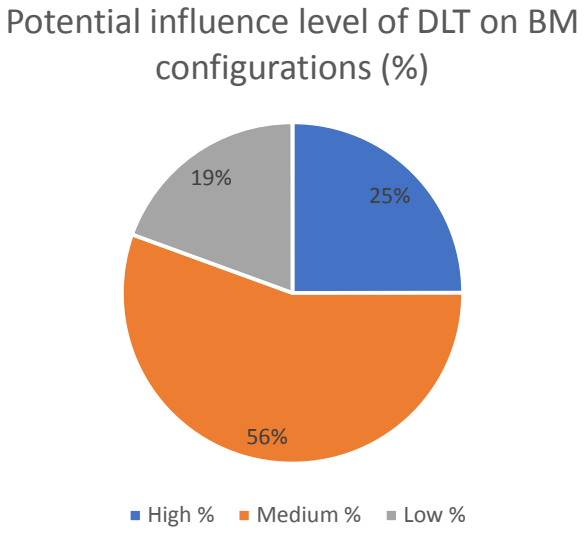


Figure 18: Potential influence level of DLT on BM configurations

CENTRALISED VS DECENTRALISED BUSINESS MODELS

The removal of third parties can be seen as a form of decentralisation of business models. This move towards decentralisation, as brought by DLT, implies a number of differences between companies that will pursue the use of DLT instead of remaining with the status quo. The decentralisation of the business model enables more up-sides for users but creates a few dilemmas for companies. We identified three major factors that can be greatly impacted by using DLT and thus enable a decentralised version of a said business model: namely decision making, revenue model and data storage.

Decision making is impacted mainly because most of the companies nowadays rely on the decision making of leadership, whereas in a decentralised model decisions could be achieved through consensus of a majority. As an example, we can look at how Google manages the issuance of new apps in it's Appstore. Google has a governance system put in place (approved by key people in the company) that reviews and accepts or refuses the addition of apps in their application store. We can consider this effort to be centralised. On the other hand, in a decentralised system, the users of said system could decide whether they want an app included or not in the ecosystem, regardless of the leadership of Google.

When it comes to revenue models, differences between centralised and decentralised models also appears. On the one-hand, centralised business models work solely for the purpose of gaining revenue for a said company, even if it occurs through micro-transactions, whereas decentralisation could bring a part of this revenue back to the content creators. To keep the same centralized example as in the previous paragraph, we can look at how Google processes and keeps a part of every payment made for any product sold on it's platforms (such as books, apps etc), with a ratio of 70-30. A decentralized version of this model basically frees up the content creator from the burden of giving away such a large portion of his revenue (30% in Googles case). An example of this sort of platform is Blockstack (blockstack.org), where the ratio perceived is much smaller, closer to 99-1 or less.

Data storage and its transaction is another factor identified as a key element that enables some of the most prominent centralised business models. Facebook is the prime example, where their whole business is centred around collecting and using/trading data about its us-

ers. This data can be anything from age to hobbies and other information which is monetised by selling it to i.e. advertising companies that can create targeted ads to specific groups of users. DLT enables the possibility for users to protect their data and choose whether to monetise it by themselves instead of freely giving it up. An example of how this could happen in the social media sector is Steemit (steemit.com), where they would gain revenue by enabling micro-transactions – users pay each other by creating content, number of views, likes etc. and the platform retains a micro-fee for each of these actions.

CHAPTER 6. CONCLUSION

CHAPTER IN BRIEF

This chapter contains the outcome and conclusion of the project. It discussess the findings of the thesis and presents an overall conclusion as to the topics discussed - Distributed Ledger Technology.

OUTCOME

The combined analysis of chapters 2 to 5 aims to answer the research questions that formulated at the start of this thesis. The analysis on these questions was arranged on a multi-level tier, following the TMRO structure proposed in the 1st chapter.

RQ1: Does DLT disrupt entrepreneurial opportunities?

The first result of the analysis is created by unifying and analysing multiple reputable sources with empirical studies, in the end proposing a complete table of what the potential of opportunities are at the time of this thesis, to the best of the knowledge of the authors.

These potential opportunities are then screened against current applications of DLT gathered from multiple reputable sources as well as empirical studies to show the current status of how these opportunities are being harnessed.

The third result of the analysis is a description of the incidence of the usage of the opportunities.

Considering the cross-market, cross-sector incidence of opportunities enabled by DLT, it can be concluded that DLT does indeed disrupt the field of entrepreneurial opportunities, thus opening a new playing field for entrepreneurs worldwide.

RQ2: Does DLT enable the creation of new business models?

The outcomes of the analysis on this aspect of DLT are also structured on multiple levels.

Initially, the fact that DLT has an effect on business modelling and business model innovation is demonstrated through analysing multiple scientific sources. A single completely new business model as found in speciality literature is described right after.

Secondly, the authors' interpretation on the impact of DLT on Osterwalders' (2010) BMC is presented by making a parallel between the building blocks of the model and current DLT applications that impact each of the blocks.

Then, a proposal on how DLT affects business model configurations as proposed by Taran et.al. (2016) is made. This results in a total of 36 potential applications configurations that could be affected by DLT. For a part of these configurations real-world DLT applications have been identified, which means that these are currently the configurations most-prone for business model innovation.

The final section of the chapter provides a brief comparison between centralized and decentralized business models, enabled by DLT.

The end-result of the analysis is that DLT does have an effect on business models, either by improving existing ones or by enabling completely new ones.

CONCLUSION

Distributed ledger technology presents itself as general purpose technology, presenting a high level of pervasiveness and a high-adoption rate of the majority of market segments. The thesis shows how the technology, with its in-built properties and the applications built on top of it disrupts entrepreneurial opportunities and enables new business model creation.

Proposal

CHAPTER IN BRIEF

This chapter contains an initiall version of the venture proposition, based on the findings in the main body of the thesis. It aims to take advantage of the disruptive potential that the application of Distributed Ledger Technology has. To do that it discusses the results obtained through the thesis. It will be structured as follows. First the introduction into the mHealth application usage and according to the challenges the industry currently is facing, a proposal of the DLT based smart contract will be made.

THE CONCEPT – FRAMEWORK

The project proposal will be based on the findings of the thesis as well as it will use mode of Discovery – Incubation – Acceleration which was introduced in the book Pivot – How Top Entrepreneurs Adapt and Change Course to Find Ultimate Success (Arteaga & Hyland, 2014). The theory behind the model helps the entrepreneurs to go through different stages of new business creation and deal with high level of uncertainty in innovation. The main focus of the proposal will deal with Discovery phase as well as assumed actions which can be taken during the Incubation and Acceleration phases. Discovery phase will deal with ideation behind the idea and how it translates in to opportunity which will later be experimented with in the Incubation phase. While focuses on the business becoming a full-fledged market player.

OPPORTUNITY ASSESMENT

Innovation in healthcare and wellness through the use of IT technology has a wide range of opportunities with improvement potential in reducing the costs, efficiency and quality of the services. In the last decade with the emergence of Google Play and Apple App an enormous number of different eHealth related applications became available for the mass population. Currently more that 50% of all users are tracking data with mHealth related mobile or wearable applications. According to the research by Statista.com (2017), In 2017 health and wellness related app download number was around at 3.7 billion. This number is projected to grow and according to American Marketing Association market will grow to 206 Billion Dollars by 2020. With Mobile Health segment at 41% of all value.

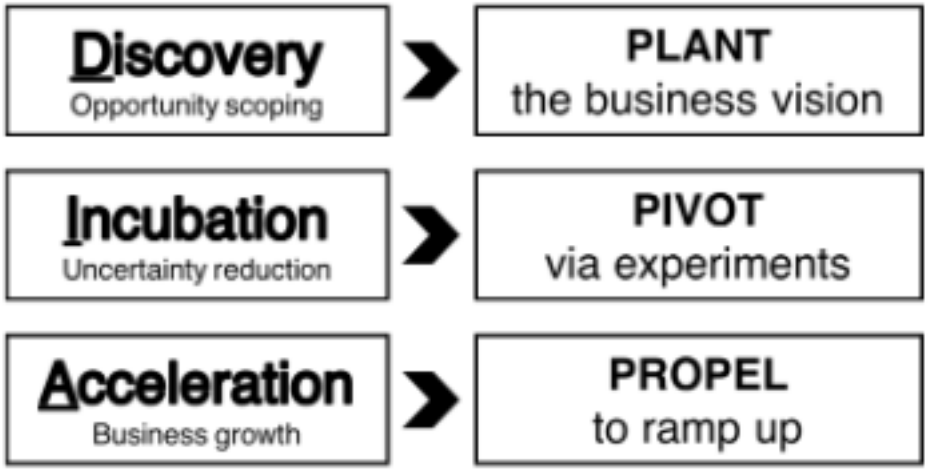


Figure 20: DIA model. Adapted from Arteaga & Hyland, (2014)

According to the research carried out by Huffaker et al., (2015) who have investigated the adoption of Health-related apps. They managed to categorize the most popular application which help individuals with change or health related behaviors such as motivation and self-awareness (see Table 11).

They state that users find using the applications motivating because of they provide possibility of tracking the progress and create a checklist with set goal. Furthermore, they emphasize that reward features inside the applications are highly appreciated by the user and makes the entire process of using such applications fun and motivation is much more sustainable.

As we can see from the table Fitness is the leader with 44% of all applications which aims at the users who want to engage in activities related to weight loss and exercise.

During this process the user gathers a big amount of data, but currently there is no solution how he could monetize it and sell it to other industry players who find this data valuable. DLT can empower the user and disrupt the eHealth industry by tokenizing all user-generated data. DLT based smart contracts can enable users to be in control of who can view and access their data which is generated through a large variety of different of ways such as medical records from clinics to wellness applications which are installed on smartphones and wearables.

According to the survey which was carried out at the London Blockchain Expo the health sector can be considered to have the most poten-

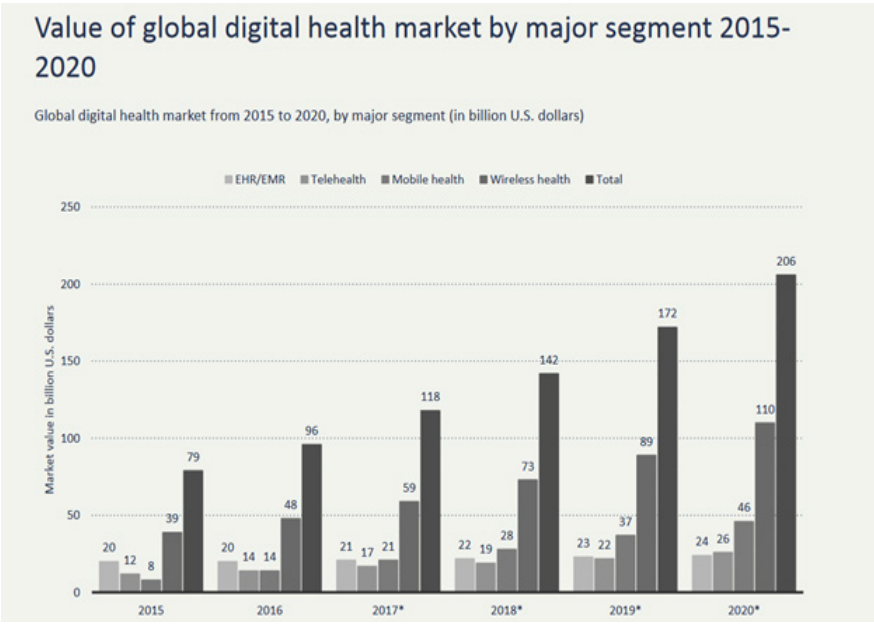


Figure 21: Overview of global digital health market. By Statista.com, (2017)

Category	Description	Example Apps	%
Physical Activity			44
Training	Workout guides, information, videos, coaching	Fitness Buddy, Daily Leg Workout, Cardio Trainer	22
Logging	Recording workout routines or routes	Map My Walk, Endomondo, Runtastic	13
Logging: Pedometer	Apps that use phone sensors (GPS, accelerometer) for step-counting. (Separate from apps that are a companion for a pedometer device, which are Wearable-Apps)	Noom Walk Pedometer, Walkroid	4
Logging: Heart rate	Apps that use phone sensors (built-in camera) to calculate heart rate. (Separate from apps that are a companion for a heart rate device, which are Wearable-Apps)	Instant Heart Rate, Cardiograph	2
Wearable-App	App by wearable manufacturer (e.g., FitBit, JawboneUP, Polar Monitor) made for use with that device	Fitbit Mobile, UP It Pro, Polar Bear	3
Medical			23
General	Symptom checkers and any app designed for patients, related to specific medical condition(s), or offered by a healthcare provider	iTriage Health, WebMD	7
Women's Health	Menstrual cycle, pregnancy	My Days, I'm Expecting	16
Healthy Behavior and Well-Being			17
Lifestyle Coach	Apps with functionality encompassing multiple aspects of health behavior management (e.g, tracking food plus planning workouts plus emotional encouragement, etc)	Map My Fitness, Workout Trainer	1
Weight Loss Companion	Health behavior management explicitly aimed at supporting weight loss goals	My Fitness Pal, Spark Coach, Noom Weight Loss Coach	14
Psychological Support	Mood trackers, personality tests, horoscopes	Know Yourself	2
Food			10
Logging	Calorie counters, food tracking	Calorie Count, Weight Watchers, Points Calculator	7
Recipes	Recipe catalogs, forums for sharing recipes	Favorite Recipes	2
Water	Hydration logging, reminders to drink water	Water Your Body	1
Sleep			6
Sensing & Logging	Sleep monitoring, recording, and assessment	Sleep Bot, ShutEye	1
Relaxation & Sounds	Ambient noise, white noise, and melodies to aid sleep or relaxation	Music Therapy, Sound Sleep	5

Table 11: Rate of adoption of health related apps. Adapted from " Mobile Health Apps: Adoption,Adherence, and Abandonment 2015" by Huffaker et al., (2015)

tial for new DLT based opportunities.

SURVEY RESULTS BY INDUSTRY

Respondents claimed that DLT could be in use creating interoperability between different medical institutions. An example was given that sharing clinical records between continents would become a possibility. Furthermore, health insurance was identified as the sector prone for new disruptive applications. Lastly user-generated data was the most emphasized topic.

PRODUCT AND SERVICE PROPOSAL - PERFORMA

Pain

mHealth market is booming with billions of apps in downloads every year. With majority of applications specified for particular functions which return very specific user information for providers of such application without understanding the full scope. Furthermore, while the user uses the applications and gathers his data he has no motivation to share and direct this data to service providers and most what will be done in this case that the user might share his achievements on social media, unless a reward mechanism will be created.

Cure Business Idea

Performa is a proposal which would create an environment where users could control and tokenize their generated data and exchange it with the Fitness and eHealth industry players for Performa utility tokens. All industry players who range from personal trainers, gyms sportswear producers to health insurers and of course the users himself would interact in the Performa Store where the tokens could be exchange for goods and services and in result everyone would be rewarded equally.

The App

Performa an application which would serve as a wallet where users would receive rewards for his shared data. He would be able to create a user profile and connect it to any mhealth application which he uses daily. The data gathered will be accessible via a permission which would be stored on the DLT. Do have better understanding of the reward mechanism it can be divided in to two scenarios.

- Goal Checklist – user would be rewarded for achieving a predefined goal which could be making 10’000 steps a day for a week or following a healthy died, and after submitting all data to the Performa profile.
- Competition – attending an event organized by one of the Performa partners such as special marathon or sports competition.

Tokens which would serve as a value transmitter in the ecosystem would be used by the users to buy a large variety of goods and services. Such as training sessions with fitness coaches or any other sports trainer for that matter. While the more partners join the Performa environ-

ment the specter of goods would increase and expand to lifestyle products such as sporting clothes, healthy foods and supplements or gym memberships. All these tokens would come to the users through data submission reward mechanism.

While wellness coaches' gyms or wellness product producers would be able to attach reward programs to their goods or services. Which would allow them to organize events and special tasks and motivate regular healthy style seeking Performa users to engage and supply their mHealth data.

To grasp better understand of the various aspects of the Performa business model proposal it was decided to use the Business Model Canvas at the same time to use the findings form the previous chapter of the decentralized business modeling.

BUSINESS MODEL

Partnerships/Stakeholders:

As mentioned before in the decentralized business model the first block of Stakeholders might be better named as Key Partners. As everyone in the Performa ecosystem who holds the tokens can be named as a stakeholder.

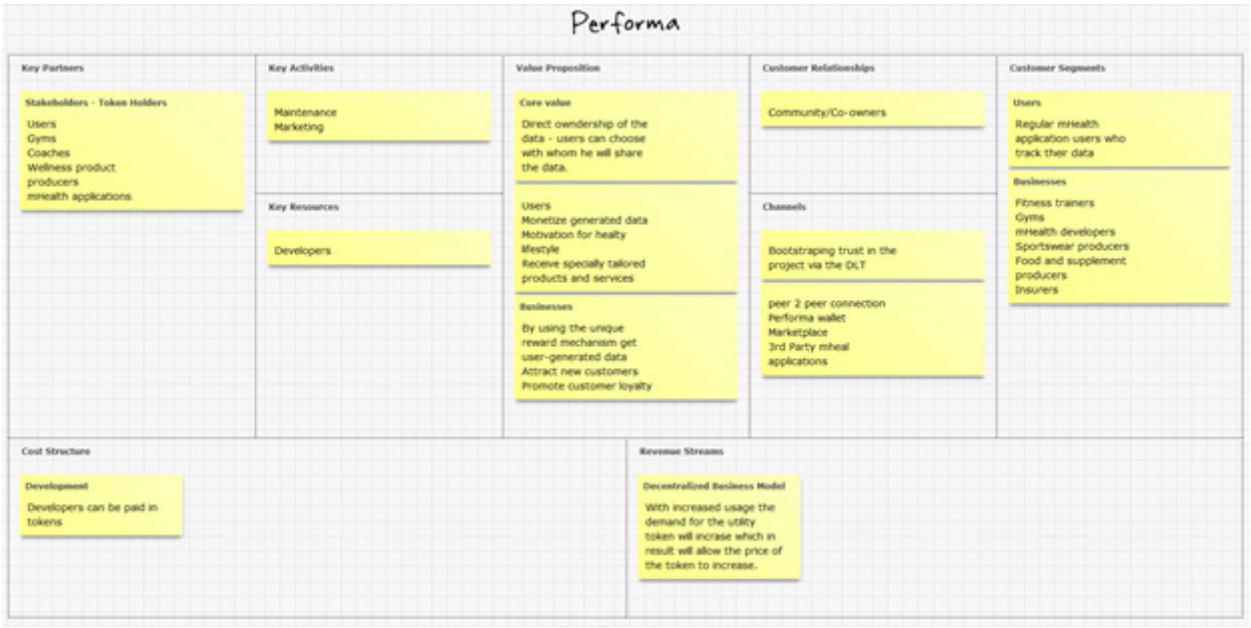
Key activities

The actions Performa must complete to in order to fulfill its Value Proposition is to reach out to the Customer Segments and maintaining the Performa application.

Initially key activities could be identified as Performa marketing and contacting Customer Segments. More customer segment actors join the ecosystem and become key

Figure 22:

Performa: Business Model Canvas



partners the bigger it grows. Furthermore, development of the application and maintenance is necessary activity sustain value drivers.

Use of the VPC it was decided that positioning the user in the center of the mHealth market and allowing him to monetize his gathered data will be the core of the value proposition. On the other hand, as mentioned above Performa is aims to connect user generated data with the rest of the mHealth industry such as coaches, gyms, wellness product producers and it is important to address all parties involved and the VPC will include jobs, pains and gains for each one of them to understand how Performa intends to create value.

Customer relationships

The merge between Key Partners and Customer Relationship blocks can be visible as all customers become co-owners as they hold the Performa utility token.

Customer segments

Customer segments are the same as the Key Partners.

Revenue

As the Performa utility token will play the key role in the ecosystem. The Performa utility token will be available for trading and will attract investors and new stakeholders. Once the community grows bigger Performa utility token will get higher in price which allows to sell the tokens for FIAT currency.

Cost Structure

The main expenses will be maintaining the developer team behind the protocol. Same tokens can be used as wage. The success of the protocol will determine the value of the token which will motivate the developer team.

Channels

From technological perspective Performa will bootstrap via the network trust via DLT and allow the users to communicate between in P2P manner. The entry point in to the environment will be the Performa wallet while data – generation will take place using the 3rd party mHealth applications.

Performa Stakeholder communication will take hold via number of Health blogs, websites and social media.

Stakeholder	Value	Details
Ordinary user	Monetize gathered data, find personalized health services, struggle to keep motivation.	Extra motivation while monetizing generated data and receiving specially tailored wellness services based on submitted data.
Personal Coaches	Attracting new clients, tracking their progress.	Using the reward mechanism would be easy to promote yourself with unique value proposition and attract new customers as well as track their progress.
Gyms	Attracting new clients to gym, market new services.	The unique token reward mechanism would allow to promote customer loyalty and increase gym visits.
Sportswear and wellness product producers	Market products to specific segments	The unique reward mechanism would allow interaction with the customers and receive their gathered data from various mHealth platforms.
mHealth apps	Promotion encourage customer engagement	Reach wider user base by promoting the unique reward mechanism for the users.

Table 11: Stakeholder analysis

Refferences

Arteaga, R. and Hyland, J. (2014). Pivot. Hoboken: Wiley.

Ansip (2017). Answer to a written question - Distributed ledger technology - E-009012/2016. [online] Europarl.europa.eu. Available at: http://www.europarl.europa.eu/sides/getAllAnswers.do?reference=E-2016-009012&language=EN [Accessed 30 May 2018].

Antonopoulos, A. (2018). Infrastructure Inversion. [video] Available at: Kharpal, A. (2017). Initial coin offerings have raised $1.2 billion this year and now surpass early stage VC funding. [online] CNBC. Available at: https://www.cnbc.com/2017/08/09/initial-coin-offerings-surpass-early-stage-venture-capital-funding.html [Accessed 30 May 2018]. [Accessed 30 May 2018].

Ama.org. (2018). [online] Available at: https://www.ama.org/publications/enewsletters/marketing-news-weekly/documents/ama_dom_digitalhealth_052017.pdf [Accessed 25 May. 2018].

Aziz (2017). Guide to Forks: Everything You Need to Know About Forks, Hard Fork and Soft Fork - Master The Crypto. [online] Master The Crypto. Available at: https://masterthecrypto.com/guide-to-forks-hard-fork-soft-fork/ [Accessed 18 May 2018].

Aziz (2018). Cryptocurrency types. [image] Available at: https://masterthecrypto.com/differences-between-cryptocurrency-coins-and-tokens/ [Accessed 12 May 2018].

Baden-Fuller, C. and Haefliger, S. (2013). Business Models and Technological Innovation. Long Range Planning, 46(6), pp.419-426.

Bencic, F. and Zarko, I. (2018). Distributed Ledger Technology: Blockchain Compared to Directed Acyclic Graph. [ebook] Zagreb: University of Zagreb, p.1. Available at: https://arxiv.org/abs/1804.10013 [Accessed 1 May 2018].

BitcoinExchangeGuide (2018). What is an ICO. [image] Available at: https://3mgj4y44nc15fnv8d303d8zb-wpengine.netdna-ssl.com/wp-content/uploads/2017/05/What-is-an-ICO.jpg [Accessed 4 Apr. 2018].

Blockgeeks (2016). Smart Contract Infographic. [image] Available at: https://blockgeeks.com/wp-content/uploads/2016/10/infographics-02-2.jpg [Accessed 3 May 2018].

Blockchain.info. (2018). Difficulty. [online] Available at: https://blockchain.info/charts/difficulty?timespan=all [Accessed 30 May 2018].

Blockchain.info. (2018). Blockchain Wallet Users. [online] Available at: https://blockchain.info/charts/my-wallet-n-users?timespan=all [Accessed 30 May

2018].

Blockstack.org. (2018). Blockstack. [online] Available at: https://blockstack.org/ [Accessed 25 May. 2018].

Steemit.com. (2018). [online] Available at: https://steemit.com/ [Accessed 25 May. 2018].

Brennan, D. (2018). Finance experts warn that Bitcoin could be hampering the future of blockchain. [online] Gowling WLG. Available at: https://gowlingwlg.com/de/news/firm-news/2018/bitcoin-could-be-hampering-future-of-blockchain [Accessed 30 May 2018].

Brown, M. (2018). Bitcoin's Present (and Future) Role in the American Economy - LendEDU. [online] LendEDU. Available at: https://lendedu.com/blog/bitcoins-role-in-the-american-economy/ [Accessed 30 May 2018].

Caytas, J. (2017). Blockchain in the U.S. Regulatory Setting: Evidentiary Use in Vermont, Delaware, and Elsewhere. [online] The Columbia Science and Technology Law Review. Available at: http://stlr.org/2017/05/30/blockchain-in-the-u-s-regulatory-setting-evidentiary-use-in-vermont-delaware-and-elsewhere/ [Accessed 30 May 2018].

Consumers International (2018). World Consumer Rights Day 2018 Briefing: e-commerce backgrounder. [online] Consumers International, p.1. Available at: https://www.consumersinternational.org/media/154916/e-commerce-overview-report.pdf [Accessed 30 May 2018].

CryptoNinjas (2018). Overview of Distributed Consensus Mechanisms. [image] Available at: https://www.cryptoninjas.net/2018/02/27/blockchain-consensus-algorithm-pow-pos-beyond/ [Accessed 1 May 2018].

Daspit, J. (2017). D. Andreini and C. Bettinelli: Business model innovation: from systematic literature review to future research directions. Journal of Management & Governance, 21(3), pp.785-792.

Disparte, D. (2018). [online] Forbes.com. Available at: https://www.forbes.com/sites/dantedisparte/2018/04/26/why-blockchain-why-now/#6694ff364f42 [Accessed 30 May 2018].

Edelman (2018). 2018 Executive Summary. Trust Barometer. [online] Edelman. Available at: http://cms.edelman.com/sites/default/files/2018-02/2018_Edelman_TrustBarometer_Executive_Summary_Jan.pd [Accessed 30 May 2018].

Floyd, D. (2018). Difficulty (Cryptocurrencies). [online] Investopedia. Available

at: https://www.investopedia.com/terms/d/difficulty-cryptocurrencies.asp [Accessed 30 May 2018].

Gambardella, A. and McGahan, A. (2010). Business-Model Innovation: General Purpose Technologies and their Implications for Industry Structure. Long Range Planning, 43(2-3), pp.262-271.

GoMedici (2017). Blockchain & Cryptocurrency Patent Overview (Sept 2017). [online] GoMedici. Available at: https://memberships.gomedici.com/research-categories/blockchain-cryptocurrency-patent-overview-sept-2017 [Accessed 30 May 2018].

Government Office for Science (2016). Distributed Ledger Technology: beyond block chain. [online] London: Government Office for Science. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf [Accessed 1 Apr. 2018].

Gaurav, K. (2018). Cashaa is the future of banking. Soon to be in 200 countries - find CAS on the best cryptocurrency exchanges online today!. [online] Cashaa.com. Available at: http://cashaa.com/ [Accessed 25 May. 2018].

Hall, B. and Khan, B. (2003). Adoption of New Technology. [ebook] Cambridge: Academic Press. Available at: http://www.nber.org/papers/w9730 [Accessed 30 May 2018].

He, D., Habermeier, K. and Leckow, R. (2016). Virtual Currencies and Beyond: Initial Considerations. [ebook] IMF. Available at: https://www.imf.org/external/pubs/ft/sdn/2016/sdn1603.pdf [Accessed 30 May 2018].

Hileman, G. and Rauchs, M. (2017). Global cryptocurrency benchmarking study. [online] Cambridge: University of Cambridge. Available at: https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2017-04-20-global-cryptocurrency-benchmarking-study.pdf [Accessed 30 May 2018].

Iansiti, M. and Lakhani, K. (2017). The Truth About Blockchain. [online] Harvard Business Review. Available at: https://hbr.org/2017/01/the-truth-about-blockchain [Accessed 12 May 2018].

IMF (2016). Virtual Currencies and Beyond: Initial Considerations. [online] IMF. Available at: https://www.imf.org/external/pubs/ft/sdn/2016/sdn1603.pdf [Accessed 30 May 2018].

Jha, M. (2015). 5 Bitcoin Scandals You Need To Know. [online] Cryptocity. Available at: https://cryptocity.wordpress.com/2015/05/23/5-bitcoin-scandals-

you-need-to-know/ [Accessed 30 May 2018].

Jpmorgan.com. (2018). Distributed ledger technology | J.P. Morgan | J.P. Morgan. [online] Available at: https://www.jpmorgan.com/global/distributed-ledger-technology [Accessed 30 May 2018].

Kharpal, A. (2017). Initial coin offerings have raised $1.2 billion this year and now surpass early stage VC funding. [online] CNBC. Available at: https://www.cnbc.com/2017/08/09/initial-coin-offerings-surpass-early-stage-venture-capital-funding.html [Accessed 30 May 2018].

Kotler, P. (2013). Principles of marketing. Harlow: Pearson.

Lipton, A. (2017). Blockchains and Distributed Ledgers in Retrospective and Perspective. [ebook] Cambridge: MIT Connection Science and Engineering. Available at: https://arxiv.org/pdf/1703.01505.pdf [Accessed 1 May 2018].

Malhotra, K. (2017). What is Block Chain Technology and How Online Businesses Can Use It - Yo!Kart Blog. [online] Yo!Kart Blog. Available at: https://www.yo-kart.com/blog/what-is-block-chain-technology-and-how-online-businesses-can-use-it/ [Accessed 12 May 2018].

Maull, R., Godsiff, P., Mulligan, C., Brown, A. and Kewell, B. (2017). Distributed ledger technology: Applications and implications. Strategic Change, 26(5), pp.481-489.

Mochizuki, T. and Warnock, E. (2014). Mt. Gox Shows Bitcoin's Growing Pains. [online] WSJ. Available at: https://www.wsj.com/articles/bitcoin-platform-mt-gox-apologizes-for-delayed-response-1392636011 [Accessed 30 May 2018].

Moore, G. (2008). Crossing the chasm. New York, NY: Collins Business Essentials.

Nakamoto, S. (2009). Bitcoin: A Peer-to-Peer Electronic Cash System. 1st ed. [ebook] bitcoin.org. Available at: https://bitcoin.org/bitcoin.pdf [Accessed 30 May 2018].

Nowiński, W., & Kozma, M. (2017). How Can Blockchain Technology Disrupt the Existing Business Models? [ebook] Entrepreneurial Business and Economics Review, 5(3), 173-188. Available at http://doi.org/10.15678/EBER.2017.050309 [Accessed 1 Apr. 2018].

Osterwalder, A., Pigneur, Y. and Clark, T. (2010). Business model generation. [Amsterdam]: Alexander Osterwalder & Yves Pigneur.

Perkins Coie. (2018). Digital Currencies: International Actions and Regulations | Perkins Coie. [online] Available at: https://www.perkinscoie.com/en/news-insights/digital-currencies-international-actions-and-regulations.html [Accessed 30 May 2018].

Rogers, E. (1962). Diffusion of Innovation Theory. [image] Available at: http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/Distribution.png [Accessed 30 May 2018].

Szabo, N. (1994). Smart Contracts. [online] Fon.hum.uva.nl. Available at: http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart.contracts.html [Accessed 12 May 2018].

Stanford.edu. (2018). [online] Available at: http://stanford.edu/~emurnane/files/UbiComp15_Mobile.pdf [Accessed 25 May. 2018].

Support.google.com. (2018). Transaction fees - Play Console Help. [online] Available at: https://support.google.com/googleplay/android-developer/answer/112622?hl=en [Accessed 25 may 2018].

Taran, Y., Nielsen, C., Montemari, M., Thomsen, P. and Paolone, F. (2016). Business model configurations: a five-V framework to map out potential innovation routes. European Journal of Innovation Management, 19(4), pp.492-527.

Thake, M. (2018). Who invented Bitcoin? – nakamo.to – Medium. [online] Medium. Available at: https://medium.com/nakamo-to/who-invented-bitcoin-2f4ba574f3f7 [Accessed 30 May 2018].

Wirtz et. al. (2016). [online] Journals.aau.dk. Available at: https://journals.aau.dk/index.php/JOBM/article/download/1621/1303 [Accessed 25 May. 2018].

Wood, G. (2016). Blockchains: What and Why. [image] Available at: https://www.slideshare.net/gavofyork/blockchain-what-and-why [Accessed 11 May 2018].

World Bank Group (2017). Distributed Ledger Technology (DLT) and Blockchain. Washington, DC: International Bank for Reconstruction and Development / the World Bank. Available at: http://documents.worldbank.org/curated/en/177911513714062215/pdf/122140-WP-PUBLIC-Distributed-Ledger-Technology-and-Blockchain-Fintech-Notes.pdf [Accessed 12 April 2018].

Zamani, E. and Giaglis, G. (2018). With a little help from the miners: distributed ledger technology and market disintermediation. Industrial Management & Data Systems, 118(3), pp.637-652.

ment & Data Systems, 118(3), pp.637-652.

Appendix

Appendix 1. Interview notes

Expert interview 01 notes

Name: Alex Buelau

Company: CoinSchedule, CEO and co-founder

Background: IT background, very passionate about technology

Mining since 2013, as a hobby

Mastercoin ICO, LabCoin, others called IPOs

Dealing with transactions Since the ledger was hard written down basically

Coinschedule founded around 2016, between ETH ico and coins

Apr 2017 things exploded because of ETH, turning point for the industry in his pov

Advantages are that you can always invest 24/7 around the world, open f reveryone, super liquid because you can buy sell at all times

For companies, getting money from anywhere, no barriers or very low barriers for starting an ICO

Problems today: the barrier became quite high now because of the huge number of ico, therefore they need to invest a lot in marketing

400 ICOs last month, only 15 pushed through a month after

It's becoming too expensive to launch an ICO

There is no cap, which makes it very volatile

Too many scams so far, hence coinschedule became for pay instead of free, so they removed all the spam by making and adding a fee. Scammers still appeared because scammers still payed they fee, hence they started making diff levels of payment and added KYC to further diminish this.

A to E trustworthy to less worthy – how they qualify the ICOs

Another trend is with private placements with investments for US, especially because of regulations in the US and the SCC

Still early stage, there are multiple ways to get back to the main values of DLT

Regulators waiting for the industry to self-regulate before they come out with a verdict

No success fees

See platinum projects on coinschedule

Opportunities on trend:

Power generation through tokens WePower

PrimalBase, each token represents a working desk

Verification of info on the value chain thru blockchain is really on trend, example with rolex watch being original

Selling of patents is also on trend, creating a global patent system

Healthcare within BC, like with medical records from one country to another

150 submissions every week, he claims that at least 1 per week is super maazing

Expert interview 02 notes

Name: Sajjad Daya

Company: CEO Sparkster

Background: Serial entrepreneur, built 1st business when 19, internet was relatively new at that point, early 2000s

Over 1 mil rev 1st year, created same business in another country and got it to 10 mil

Discovered virtual currency in 2012, saw the opp in BC and IoT

Platform is a result of solving IOT, how to make IoT accessible

Enterprise software is architecturally incompatible with today's technology – main problem

Their business aims to solve that, by building a coding platform that can be adapted to all the new solutions

Helping comp build and use the tech of the future

2 yrs ago started researching BC and seeing how it works, how it's build etc

Background in mathematics, hence it was easy to go in the space and learn about the tech and build software on top of it

Platform to take the software you have into it and run in it a decentralised network

Amazon – pay for sserver, building, cisco switches, ups backup, cooling etc

Sparkster, take software components and run them on mobile phone

Use the tech if it provides substantial cost reduction or solves any major issues

Focused on bringing about mainstream blockchain adoption

EX: creating power with solar panel – can't sell it easily to your peers, calling power company, get contracts etc ------ adding blockchain solves this problem, because you can keep track and trust how much energy is being transacted, immutable data source

The appearance of P2P business models becomes a reality, look at the internet and traffic for downloads p2p

Look at Filecoin – IPFS tech, referencing Napster

Enables entrepreneurship through p2p business models

Platform is free for individuals, not for big companies, they have to pay licence and transcation fees

Global impact is ensured

The 1% of the market grants them 20 bil in 10 yrs.

Business model canvases are a no-go

Expert interview 03 notes

Name: Timothy Rook - Tmothy.rook@ibm.com

Company: IBM, position - IBM associate partner

Position:

Background:

Founding member of YesBlockchain, always believed in BC

50-60 enterprises so far within IBM using BC

His sector is construction engineering

Everything there from value chain to contracting and everything else, can be improved via blockchain

Improved business, reducing cost, making things accountable

The revolutionary stuff is not here yet but it's coming over

Not familiar with business model canvas

Claims that they are at the beginning of internet with e-mails

Open ledger makes them not care about tps, it's friction free

Energy trading for domestic is already here, good time for consumers

2yrs experience

No shortage of new people here

Claims that most of the people think blockchain is bitcoin

Hyperledger is business oriented and is making good progress, because of privacy, data security, confidentiality – they are solving this

Closed blockchain, dealing with mainly huge corporations, like banks and whatnot

Spent a lot of time researching the applicability of blockchain

Regulators slow down the process in some countries, but they are getting thru with vehicles and humans accountability

Expert interview 04 notes

Name: Maneul Montanaro

Company: Multiversum crypto system LLC, CEO

Background: IT

info@hooni.io

manuel@hooni.io

Has 3 other start-ups within BC

6 yrs ago got into BC, before the empty blocks crash

Studied crypto, philosophy and IT

Interested in the security systems provided by BC

Throught of real use cases for BC, understood the potential of distribution provided by BC, the freedom offered to everyone involved in it

He got interested after vitaliks' articles and whitepaper etc

Gathered a group of people interested in this sector and started investing in ETH

The posiblities for start-ups to capitalise and go worldwide is the biggest opportunity, because of RC20 mainly

In Italy it's very controversial

His belief is that BC allows real freedom compared to normal ways of getting money or anything

The company wants to enable and facilitate the perks of BC to the world

The next level in his opinion is to make the certification of the data or life (cars, belongings etc), not transactions

There are no BC that make this certification until now

So enabling a way to find a single transaction in the BC without downloading the whole BC

They also want to reduce the energy impact of PoW by doing this

Security transactions with very low impact by using proof of integrity, PoI

Their project is still in concept

Their main goal is not to make money so there is no strategy for that

The core is that there are a lot thing to build and that they have a lot of work to do

Claiming that the most important value is working with other and not for others, the distribution of work is imperious for them

Spent more than 15k to be at the expo, which is not that great for a start-up like theirs

Expert interview 05 notes

Name: Nathaniel Tsang Mang Kin – Co-founder

Company: IAME

Background:

Aware of bitcoin since its inception – bought in 2016, but without looking into applications.

Claims he really got invested when ETH came into play, mainly because of the smart contracting capability.

Was working into Mauritian finance (offshore).

The Other co-founder is a full stack dev.

Started working on the project mid 2017.

Realised that decentralised applications are very important, hence created IAME in mid 2017.

Used BC to do mass-identification, main value driver

They built prototypes, MVPs (on website) – got some angel investors on-board with MVPS.

Focused on tech before going into business modelling, didn't care how to monetize initially

Validation through gamification to log-in and feel like they are part of the economy

Check out the app

Working on Ethereum, claiming that the tech is not really on the level necessary for them to run smoothly, mainly because of traffic congestions and other problems with storing

Mainly EHT because of the fact that it's super widely known

Choosing a blockchain was a lengthy process

The reach of ETH is best right now, according to him

Hack worthless – main value – they remove the security risk for hacking because they are formed in pieces, basically solving a security issue they other way around. None-invasive, secure

Confident that next 2 years wil bring usage to 5-7 percent of all population

Looking at the problem through regulations eyes, blockchain reg-tech

Claiming that regulators are really unaware of the tech and how it works, this makes everything harder and scarier. They are afraid of putting out the wrong regulations

Their concept is based on the fact that crypto transactions will have to be regulated at some point in time, and that is mainly identification

Merchants, micro-transactions

Looking at the business model related to enterprise, especially companies managing client accounts with blockchain

Small team, everything is done inside – 11 people, 9 out of them are tech

Claiming that it will grow outside the US or China,

Grey (UAE), white(RO, DK etc), black jurisdiction (south Korea) – finance wise

Every ban has happened for BC and has been overcome – thus a cultural revolution.

Distributed Aid system in Africa, for giving people vaccines instead of money – 1 token for 1 vaccine ex

Removing wastage along the value chain, esp because of removing theft and money laundering.

Appendix 1. Survey results

Survey ID	Booth Number	Gender	Background	Position	Management	Experience [years]	Company Name	Startup	Startup Phase	Business Industry
1	73	M	Software development	Contributor	N	6	decred	Y	Launched	Digital Currency
2	73	F	Public management	Contributor	N	2	decred	Y	Launched	Digital Currency
3	165a	M	Sales	Event manager	Y	1.5	eCoinomic	Y	Launched	Lending / Finance
4	165a	M	Banking	CEO	Y	2.5	eCoinomic	Y	Launched	Lending / Finance
5	163	M	Communication	Marketing manager	Y	1	SwissRealCoin	Y	Prelaunch	Real Estate
6	66a	F	Mba	Co-founder	Y	4	Arianne	Y	Launched	Anti-counterfitting
7	66b	M	Science	Community manager	Y	4	LGO Markets	Y	Launched	Exchange
8	270	M	Marketing	Marketing director	Y	1	BlockMkt	Y	Launched	
9	265	M	Accounting	Chairman	Y	0.5	AbacusFinancialServices	N		Wealth Management
10	263	M	Management	COO	Y	2	GlobaCAA	Y	Prelaunch	Securities
11	262	M	Finance	Director	Y	1	BuggyraRacing	N		Racing
12	261	M	Digital marketing	Head of marketing	Y	0.7	Celsius	Y	Launched	Digital Currency
13	267	M	Finance	Blockchain advisor	N	5	Rivetz	Y	Launched	Cyber Security
14	259	M	Mechanical engineering	Operation manager	Y	0.5	GXS	Y	Launched	Supply Chain
15	317	M	Media	CEO	Y	0.5	Freely	Y	Launched	Media / Data Security
16	225	M	Quality Assurance	Blockchain solution architect	Y	6	SettleMint	Y	Launched	Digital Currency
17	103	M	Law	CEO	Y	7	CoinGovernanceSystem	Y	Prelaunch	Digital Currency
18	227	M	Digital marketing	CMO	Y	0.6	nTitle	Y	Prototyping	Licensing
19	174	M	Politics	Head of International Comm.	Y	1	SBC Platform	N		Business Services
20	165b	M	Sales	Head of Institutional Partnership	Y	2	University of Nikosia	N		Science
21	135	M	Marketing	Marketing director	Y	1	DreamTeam	Y	Launched	E-Sports
22	121	F	IT	COO	Y	1	Fathom	Y	Prelaunch	Gaming
23	122	M	Marketing	Consultant	N	0.5	TruePlay	Y	Launched	Gambling
24	122	M	Entertainment	CEO	Y	2	TruePlay	Y	Launched	Gambling
25	113	F	Finance	Affiliate manager	Y	2	A2Bit	Y	Prelaunch	Digital Currency
26	111	M	Asian studies	Marketing executive	Y	0.1	MyCreditChain	Y	ICO	Digital Currency
27	111	M	Finance	CEO	Y	3	MyCreditChain	Y	ICO	Digital Currency
28	112	M	Marketing	Head of marketing	Y	0.2	BlueWhale	Y	ICO	Freelancing
29	117	M	Mathematics	CEO	Y	2	Sparkster	Y	Launched	Cloud Computing
30	92	M	Media	CEO	Y	5	bitcoinist.com	N	Launched	Media
31	91	M	Systems engineering	Project Manager	Y	2	Chimera	N	Launched	Gaming
32	46	M	Marketing	Marketing manager	Y	0.3	Xain	Y	Industry	Mobility
33	57	M	Student	Personal Assistant	N	2	DeStream	Y	Prelaunch	Gaming
34	57	M	Business	Product Manager	Y	2	DeStream	Y	Prelaunch	Gaming
35	50	M	IT	CEO	Y	6	Multiversum	Y	Prelaunch	Digital Currency
36	108	F	Science	Product development	N	1	BGX	Y	Inception	Digital Currency
37	33	M	Digital marketing	Marketing manager	Y	4	Varanida	Y	Launched	Marketing
38	33	M	Business development	CEO	Y	6	Varanida	Y	Launched	Marketing
39	105	M	Mathematics	Co-founder	Y	3	Iame	Y	Build upface	Identification
40	52	M	Marketing	Marketing manager	Y	1.5	Gibraltar Stock Exchange	N		Digital Currency

RISK	RISK	
18	Regulations	5
8	Government	5
3	Banks	4
16	No risk	4
15	Negative public opinion	4
23	Usability/UX	3
11	Legislation	3
20	Security	3
10	Lack of knowledge	3
14	Money Laundering	2
13	Missinformation	2
12	Market fluctuations	2
7	Fraud	2
4	Centralized power	2
2	Bad business proposal	2
1	Applience	1
9	Lack of implementation	1
6	Cost	1
5	Complexity	1
17	Quantum computing	1
19	Scalability	1
21	Self responsibility	1
22	Transactions/second rate	1
0	Anonimity	1

	Opportunity	Responses
0	Healthcare	9
1	Banking	6
2	Finance	5
3	Logistics	5
4	Payments	5
5	Security	4
6	Global Currency	4
7	Insurane	4
8	Crowdfunding	4
9	Supply chain	4
10	Gaming	3
11	Voting	3
12	Digital Rights	3
13	Legal	2
14	NGO	2
15	Ownership	2
16	Marketing	2
17	Gambling	2
18	Microfinance	2
19	Equity	2
20	Privacy	2
21	Parking	1
22	Payment systems	1
23	Transport	1
24	Trust-related	1
25	Mobility	1
26	Private markets	1
27	Attendance	1
28	Licensing	1
29	Land registering	1
30	Hardware	1
31	Governance	1
32	Fraud prevention	1
33	Entertainment	1
34	E-commerce	1
35	Digital Currency	1
36	Decentralized markets	1
37	Data storage	1
38	Counterfiting	1
39	Cloud Computing	1
40	City Infrastructure	1
41	p2p Lending	1