Universiteit Leiden

MSc. ICT in Business

Business Models with Blockchain: ‘Exploring the Business Models of the Applications of Blockchain Technology in Start-up Enterprises**’**

Name: Suraj Bhattarai
Student-no: S1721089

Date: 30/08/2017

1st supervisor: Dr. Hans Le. Fever
2nd supervisor: Tino de Rijk

MASTER'S THESIS

Leiden Institute of Advanced Computer Science (LIACS)
Leiden University
Niels Bohrweg 1
2333 CA Leiden
The Netherlands

Contents

Acknowledgment

Firstly I would like to thank my supervisor Dr. Hans Le. Fever. I would also like to thank Mr. Harry Fulgencio for guiding me throughout the research process. I want to thank the experts who offered to validate my research work and therefore giving it more credibility.

Finally I would like to thank my family and friends who have always been very encouraging and have motivated me throughout this work. You all know who you are and your contributions have been invaluable.

Thank you all.

Author

Suraj Bhattarai

Abstract

Blockchain technology initially came about with the digital currency Bitcoin as the underlying technology supporting the transaction of the Bitcoins. Blockchain Technology is a digital ledger where transactions of digital assets such as crypto-currency are recorded in a chronological order and distributed across a network. This makes the recording transparent, traceable, immutable and autonomous. These characteristics of the blockchain created possibilities for new (disrupting) applications in various industries and therefore has given rise to a huge hype. Major financial institutes, technology firms and other non-financial companies have dived into the research and development of blockchain applications for adopting it in their business and are making a significant amount of investments. Similarly a lot of start-ups have emerged in the past 4-5 years who have their business model around the blockchain technology and are focused on providing blockchain based services.

This research focuses on the business models of start-ups using the blockchain technology in order to understand the potential of this new technology by investigating what new service offerings they bring about with the help of the technology and what business aspects they need to consider to make their business function. The research ultimately identifies and explores only the prominent financial applications of the blockchain for their business model owing to the lack of well-defined business models of the other under-developed blockchain applications.

The research tries to explore the business of the blockchain start-ups from a holistic perspective by using Osterwalder and Pigneur's business model concept. In order to do this the research carries out two systematic literature reviews and an analysis of news publications from the research tool Factiva. From this, two artefacts were designed. First a set of business models of prominent applications of blockchain technology and secondly, an eco-system model of blockchain services. These two models were validated by two experts working in the field of blockchain technology. The research also highlights some limitations and scope for future research.

List of Figures

List of Tables

1.0 Introduction

1.1 Thesis Summary

This research is an exploratory research on the impact that a digital technology namely blockchain technology can have on the development of new business models. The research focuses on start-up companies that have ventured into applications empowered by the blockchain technology. The research refers to the business model and its nine components as defined by Osterwalder and Pigneur, and investigates the impact of the technology with respect to these components (Osterwalder & Pigneur, 2010).

First the study carried out two systematic literature reviews referred to as SLR 01 and SLR 02 in this paper. SLR 01 reviewed the literature on blockchain technology that discusses different applications and business models of blockchain technology. The result of this SLR was used to come up with a categorisation of the various prominent blockchain applications and the start-up companies exploiting the technology. SLR 02 reviewed the literature that discusses the impact of another digital technology namely cloud computing with respect to the nine components of the business model. The results from SLR 02 were used as a conceptual background to base the investigation of the business models of the various blockchain applications found in SLR 01. Finally, the business models for each of these applications were annotated with data from news publications on start-ups and their corresponding blockchain applications published in the research tool, Factiva.

The results led to a set of holistic, nine component business model or service archetypes derived from prominent blockchain start-ups. Additionally, an envisioned eco-system model of blockchain applications is proposed. The business models allow start-up companies to understand business models and their characteristics that are in existence and to position themselves appropriately. SLR02 led to the eco-system model for blockchain start-ups, which enables them to understand the role each application plays so they can align themselves according to the application they serve. The final results (the BM service archetypes and the ecosystem model) were validated with the help of interviews of two select professionals working in the scope of the research topic. The results were revised and finalized accordingly.

1.2 Thesis Motive

The advent of current digital technology means that business enterprises have new opportunities at the same time as new challenges forcing them to be able to adapt to the changes brought about. In recent years, firms have taken up initiatives to identify latest digital trends and have started to investigate opportunities for making use of these trends in order to improve and gain business advantage (Matt, Hess, & Benlian, 2015). While companies may have extensive investments and processes for exploring new ideas and technologies, they often have little if any ability to innovate the business models through which these inputs will pass (Chesbrough, 2010).

The adoption of new technology involves the transformation of key business operations which often leads to changes in the products, services as well as the entire business model of the company (Matt et al., 2015). However the same idea or technology taken to market through two different business models will yield two different economic outcomes therefore, it makes good business sense for companies to understand the possibilities offered by the technology and therefore re-structure and innovate their business models accordingly (Chesbrough, 2010).

Changes in the business model leads to new business offerings therefore it's important to understand the impact of digital technology on business models (Amit & Zott, 2009). However new technology brings about uncertainties in this regard as often the possibilities of new technology are identified gradually as it gets adapted and reaches a certain maturity level (Teece, 2010). This understanding becomes even more crucial for start-up companies who lack a proper guideline for them to follow in their venture into block-chain technology.

Blockchain technology, being a new digital technology that promises to be extensively used in future business operations and processes, it's very important to understand the new business models it has generated and the characteristics of these models. The success of a technology is often determined by the value it brings to an enterprise and profit-oriented enterprises are particularly keen about creating value for their customers. An enterprise would be wary of trying a new technology with business models that have not been experimented with before and therefore prove to be too risky. Therefore it's important for enterprises to know what kind of opportunities the blockchain technology presents and what are the different business

aspects that need to be considered while adopting it in order to leverage from the possibilities offered by the technology. This can be done by looking into the business model empowered by blockchain technology from a holistic perspective as that would explain and give an understanding of the impact of adopting the technology on the various elements of a business such as the value offering, revenue streams, customer segments and partners among others that are detrimental for any successful business model.

Therefore, this research explores the various business models of start-up companies and their characteristics from a holistic perspective by investigating them with respect to the nine components of their business model. This research will help in understanding the impact of the blockchain technology in generating new business models and their characteristics. The findings from the research can help future-start-ups venturing into blockchain applications to refer and understand the different business aspects to consider in order to develop their business. It will also provide a reference point for future research on the topic of generation of business models exploiting blockchain technology.

2.0 Background Literature

2.1 Business Model

The concept of Business Model has gained considerable interest in the past decade as new business models help enterprises gain competitive advantage and build stronger customer relationships (Lindgardt, Reeves, Stalk, & Deimler, 2009). The definition of business model varies in different academic literature and according to Schallmo and Brecht they have found 52 definitions of it with several focuses (Schallmo & Brecht, 2010). Based on these definitions they define business model as a description of how an organization combines a set of elements to create value to customers and partners while the value maintains relationships to customers, supports differentiation from competitors and is created with products and services (Schallmo & Brecht, 2010).

2.1.1 Business Model Design

In literature the various elements of a business model have been discussed and defined. Two of the most prominent and widely adapted ones have been from the research work of Zott and Amit, and Osterwalder and Pigneur. Zott and Amit define three elements of a business model namely, content, structure and governance. The content element relates to the selection of the actual business activities to be carried out by the firm while the structure defines how these activities are linked to each other and their importance to the firm, and finally the governance relates to who performs these activities (Amit & Zott, 2009).

As mentioned in the thesis motive, the research considers the impact on the business model from a holistic perspective. Osterwalder and Pigneur's business model design offers a well-structured as well as a comprehensive design by dividing the business model into nine key components. This model has been used extensively in research as well as by business firms to develop their own business models. Therefore this research will refer to the business model design of Osterwalder and Pigneur in order to form a systematic and well-defined base for investigation (Osterwalder & Pigneur, 2010).

Osterwalder and Pigneur define nine elements of the business model namely, customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships and cost structure (Osterwalder & Pigneur, 2010)

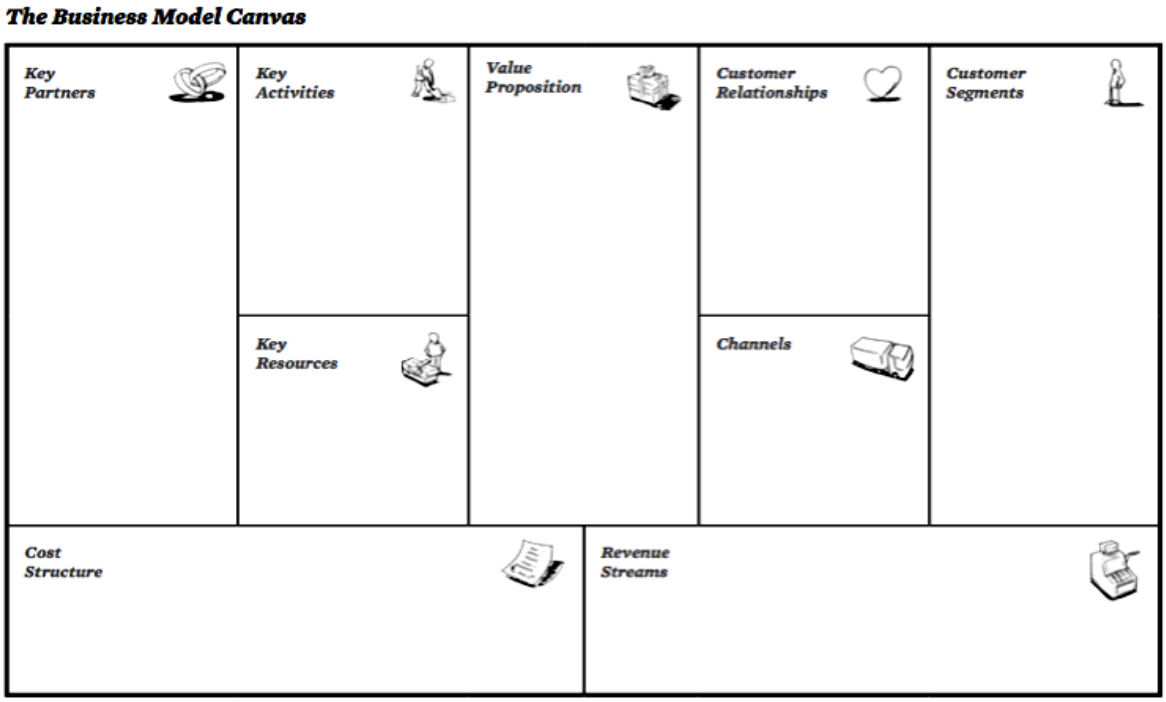

Figure 1.0: The Business Model Canvas (Osterwalder & Pigneur, 2010)

The customer segments defines the different types and categories of customers an enterprise aims to serve while the value proposition relates to the products and services that it provides and creates value to a segment of customers (Osterwalder & Pigneur, 2010). The channels describes how a company communicates with and reaches its customer segments to deliver their value proposition while the customer relationships describe the types of relationships a company establishes and maintains with different segment of customers (Osterwalder & Pigneur, 2010). The revenue streams relates to how it will generate cash and monetize its product offerings while the key resources describes the most important assets needed to make the business model function (Osterwalder & Pigneur, 2010) . The key activities relate to the most important activities to be undertaken to make the business model work while the key partnerships describes the network of suppliers and partners that make a business model work (Osterwalder & Pigneur, 2010). Finally the cost structure relates to the expenses incurred to operate a business model (Osterwalder & Pigneur, 2010).

2.1.2 Business Model Generation

The generation of new Business Models has gained considerable interest in the past decade as new business models help enterprises gain competitive advantage and build stronger customer relationships (Lindgardt et al., 2009). The issue of understanding the importance of

the business model for enterprises to constantly reinvent and stay relevant in the business environment they operate in has been addressed in past research. Teece addresses this as he explores the connection of business model with business strategy and innovation management where he comes up with an understanding that all business explicitly or implicitly employ a business model (Teece, 2010). Further he mentions that a business model should be customer oriented, unique and hard to imitate and he concludes that technological achievements have commonly failed commercially because little attention had been given to designing a business model to take them to market properly and that it can and should be remedied (Teece, 2010). According to Lindgardt et al., the innovation of a business model can provide companies to overcome of intense competition under which products and processes are easily imitated, competitor's strategies have converged and sustained advantage is elusive (Lindgardt et al., 2009). Teece mentions that a firm's capacity to capture value will be compromised if it won't have the capacity to create new business models (Teece, 2010).

This inability of enterprises to innovate and come up with a sustainable business model according to developments in technology has been addressed in other research. Amit and Zott address this issue as they try to investigate the impact on business model for value creation while trying to develop a conceptual framework for the process (Amit & Zott, 2009). Similarly Geisen et al. addresses this issue while coming up with a three step pathway for implementing change in the business model (Giesen, Berman, Bell, & Blitz, 2007). Amit and Zott come up with a conceptual primer on how to innovate a business model. They define the what, how and who of business model innovation. The 'what', entails to the consideration of activities to be performed, while the 'how', entails to the structure of the activity and the action plan to be carried out and finally the 'who', refers to the governance of the activity (Amit & Zott, 2009). Giesen et al. come up with three approaches towards innovation of the business model, namely the innovation of the industry model, the revenue model and the enterprise model (Giesen et al., 2007). The industry model innovation relates to innovation of the industry value chain while the revenue model innovation relates to the innovation of the revenue streams by changing or re-configuring the business offerings and finally the enterprise model innovation relates to the innovation of the overall structure of the enterprise (Giesen et al., 2007).

Another aspect that has been addressed in past literature is the organizations dilemma as when to go for new business models and the barriers it could face. Chesbrough addresses this as he tries to investigate the opportunities and barriers of generating new business models where he concludes that the barriers are real while the innovation itself is more about trial and error and not really about having a superior foresight and at times adapting to the new business model after its adoption (Chesbrough, 2010). He adds that organization processes must also change together and internal leadership is crucial for managing the change and making the innovation work (Chesbrough, 2010).

2.2 BM's with Digital Technology (DT)

Several publications describe digital technology to be the main accelerator for generating new business models and current digital trends have been topics of major investigation in the field of digital technology powered business transformation. Three current digital technology trends that have been extensively discussed and investigated for or their potential to disrupt business models across organizations and industries that they represent are big data (analytics), social media and cloud computing.

2.2.1 BM's with Big Data

Schroeder and Halsall in their research address the challenges and opportunities of business model innovation powered by big data. The paper finds data quality and data security as primary concerns while it explores the opportunities by analysing the different business models that have emerged due to the technology as well as the challenges that come with it (Schroeder & Halsall, 2016). They come up with three different types of data driven business models, namely 'data users' that use analytics to make business decisions, 'data suppliers' that supply the data for analytics and 'data facilitators' that provide support services such as the infrastructure and consultancy (Schroeder & Halsall, 2016).

Brownlow et al. in their research address the lack of a framework for a data driven business model innovation for established organizations and business start-ups by analysing different randomly chosen established organizations and start-ups and their efforts towards data driven business model innovation (Brownlow, Zaki, & Neely, 2015). The study comes up with a blueprint containing six questions for organizations to answer for helping them in their own data driven business model innovation journey. These questions cover aspects of identifying

how big data would be used and what the value propositions would be as well as what actual data would be required and ways to process and deploy it (Brownlow et al., 2015). Further it covers aspects of identifying ways of generating revenues and the barriers that can be perceived while implementing big data (Brownlow et al., 2015).

2.2.2 BM's with Social Media

Ketonen-Oksi et al. have tried to look into the existing research on social media and its impact of value creation on current and future business models through the analysis of a number of literature on related topic (Ketonen-Oksi, Jussila, & Kärkkäinen, 2016). The study concludes that commonly used research models and frameworks are incomplete and that there is a need to reframe them by adding more descriptive elements to broaden their scope of analysis in order to better understand all of the various social media implications to the collaborative value networks of a business model (Ketonen-Oksi et al., 2016).

The lack of understanding in the social media use for value creation among buyers and sellers has been addressed in past research. Agnihotri et al. have tried and addressed the uncertainty faced by salespeople in finding a fit between the social media tools they use and their sales strategy by investigating existing literature on relationship marketing, task–technology fit theory, and sales service behaviour (Agnihotri, Kothandaraman, Kashyap, & Singh, 2012) . They come up with a theoretical framework describing how social media tools can help salespeople perform service behaviours leading to value creation (Agnihotri et al., 2012) . The framework distinguishes value creation into sales person perceived and customer perceived and describes a fit between service and social media to 'push' information for salesperson according to their perceived value and to 'pull' customers towards salesperson generated content according to their perceived value (Agnihotri et al., 2012).

Pihl and Sandström try and address the lack of knowledge about how bloggers in the social media landscape make money and what value do they create by analysing information on commercially successful bloggers in the fashion industry (Pihl & Sandström, 2013). The study finds the relevance of the fashion bloggers and mentions that fashion blogs have become a new marketing channel for fashion firms and, by reducing transaction costs, they create value for both consumers and fashion firms alike (Pihl & Sandström, 2013). It mainly describes the customer relationship achieved by the bloggers as the main value creation with products and

advertisements featured in their blogs alongside their recommendation and reviews to be a good source for the fashion industry to boost sales and customer loyalty (Pihl & Sandström, 2013).

2.2.3 BM's with Cloud Computing

Sultan and van de Bunt-Kokhuis address the issue of whether cloud computing can be considered a disruptive technology that gives rise to new business model by investigating on existing theory on disruptive innovation and relating it to the potentials of cloud computing (Sultan & van de Bunt-Kokhuis, 2012). The study comes up with the finding that cloud computing and its potential implication to the business models cannot be dismissed as a hype and therefore it is potentially a very disruptive technology (Sultan & van de Bunt-Kokhuis, 2012).

DaSilva et al. address the lack of understanding of the importance of developing viable business models in order to benefit from the potentials offered by cloud computing by investigating and analysing how three major companies that have emerged through cloud computing namely Amazon.com, Salesforce.com and Siebel have responded to the disruptive power of the technology (DaSilva, Trkman, Desouza, Lindic, & Lindič, 2013). They conclude that a new business model should be experimented with to leverage from the potentials of a disruptive technology and many times just optimising business processes or making incremental changes to existing business models is not enough and potential disruptions in the market should be taken seriously (DaSilva et al., 2013).

2.2.4 BM's with DT: Summary of Findings and Limitations

It's seen from sections 2.2.1, 2.2.2 and 2.2.3 that there have been investigations carried out on the impact of digital technology in creating new business models, but for each of the digital technologies in question there remains a lack of understanding about opportunities arise for generating new business models. Schroeder and Halsall have addressed this in their research business models for big data (section 2.2.1) by showing the different types of business models that have come up for this technology, while DaSilva et al. address in their research on business models for cloud computing (section 2.2.3), the need to understand the opportunities and experiment with new business models for leveraging the implementation of the technology (DaSilva et al., 2013; Schroeder & Halsall, 2016). Another aspect that has

been focused on and discussed in previous research is the lack of understanding in the value created as well as the potential revenue sources generated by the implementation of these technologies. Agnihotri et al., Ketonen-Oksi et al., and, Pihl and Sandstorm address this issue in their respective research work on business models for social media (section 2.2.2) (Agnihotri et al., 2012; Ketonen-Oksi et al., 2016; Pihl & Sandström, 2013). The first research comes up with an actual frame work while the second one suggests the need for a proper framework and finally the third one mentions the different value propositions created and revenue streams generated (Agnihotri et al., 2012; Ketonen-Oksi et al., 2016; Pihl & Sandström, 2013).

Some of the other aspects that have been looked into are the lack of a proper framework for enterprises to follow in order to manage the impact of a certain digital technology on their business model and also the lack of understanding whether a certain technology is disruptive to the business model of an enterprise or not. The concern of a lack of framework is addressed by Brownlow et al. in their research on the impact of big data (section 2.2.1) on business model by coming up with a blue print for enterprises to follow (Brownlow et al., 2015). The issue of the lack of understanding whether the technology is disruptive or not is addressed by Sultan and Bunt-Kokhuis in their research on the impact of cloud computing (section 2.2.3) on the business model by coming up with evidence that it is a disruptive technology (Sultan & van de Bunt-Kokhuis, 2012).

These studies show that miscellaneous aspects of the impact on the business model from these different digital technologies have been investigated but there has been limited focus on investigating the impact from a holistic, more in depth perspective. The various components of a business model as described by Osterwalder and Pigneur are interconnected (Osterwalder & Pigneur, 2010). Therefore it is important to understand this interrelationship and how the adoption of a new technology impacts each of the components separately and as a whole in order to understand the overall impact of the technology on the business model. Another limitation of previous research is in its general approach in terms of existing enterprises and start-ups. The impact of a new digital technology on enterprises which are either start-ups or established will be different as these two types will vary with regard to their digital maturity level and organizational scope and capacity. These limitations of

previous research form the motive for this research and therefore have been further mentioned in the research gap section later (section 2.4).

However, these studies show the business potential of these various digital technologies. A new digital technology that has come out is blockchain technology. Blockchain technology is known to be a disruptive technology and therefore it becomes an interesting and relevant field to investigate on in terms of its impact on the business models of enterprises. There has been none or very limited research done in this regard.

2.3 Blockchain Technology

Blockchain technology is one of the latest digital technology that has been steadily growing in its implementation by established business enterprises and start-ups alike. This can be attributed to the fact that it is expected to enhance security, anonymity and data integrity without any third party interference. Therefore blockchain technology creates interesting areas for research in itself and its impact on its corresponding implementation (Crosby, Nachiappan, Verma, & Kalyanaraman, 2015). The technology is a new revolution that is perceived to bring about major disruptive changes in business transactions in the world. Blockchain technology is an open ledger of different business transactions that has ever occurred which is recorded in a chronological order (Swan, 2015). Yli-Huumo et al. describe blockchain as the ‘decentralized managing technique of Bitcoin, designed for issuing and transferring money for the users of the Bitcoin currency’ by maintaining a public ledger of all Bitcoin transactions independent of a third party organization (Yli-Huumo, Ko, Choi, Park, & Smolander, 2016). Figure 2.0 explains how a blockchain works.

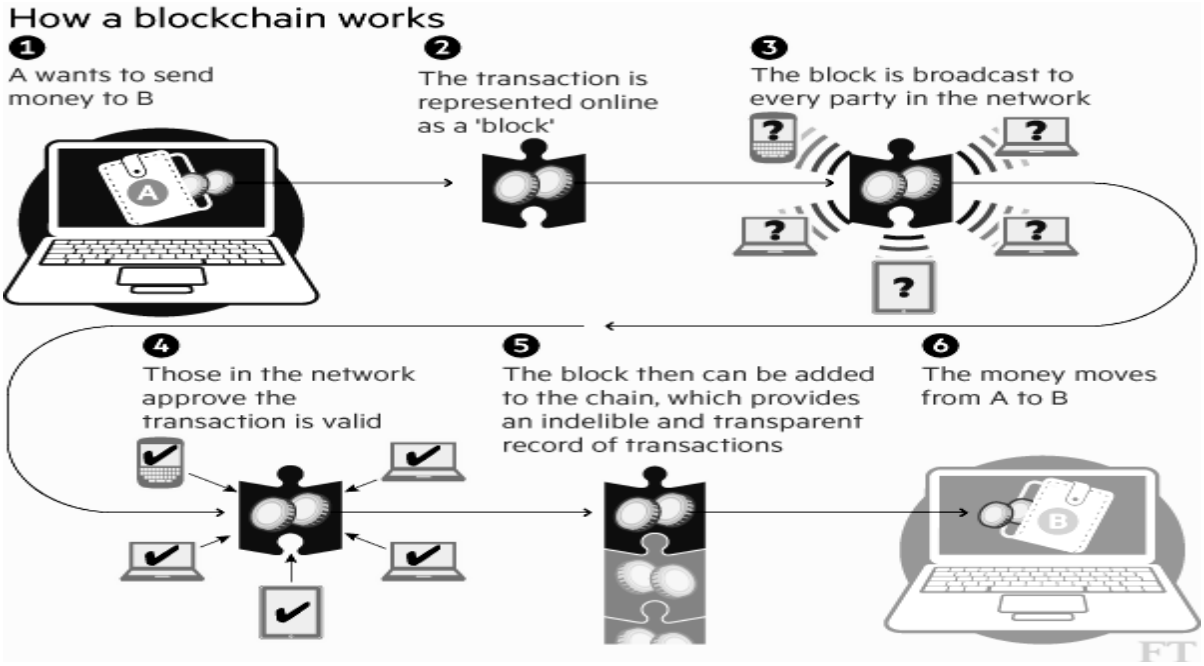

Figure 2.0: How Blockchain Works[1]

The advantages of blockchain technology has been mentioned in different literature mainly pointing towards, faster, reliable, immutable and transparent transactions with the elimination of any third-party involvement (Crosby et al., 2015; Yli-Huumo et al., 2016). The technology is believed to not just influence business processes but also empower growth of other new and advanced technologies and accelerate their adoption in our day-to-day lives (Pilkington, 2016a).

2.3.1 Bitcoin

The Blockchain Technology started with the advent of an alternative crypto-currency called bitcoin. Bitcoin is a crypto-currency used for an online payment system that uses encrypted techniques to generate units of currency and verify the transfer of funds while operating independent of a central bank (Swan, 2015). Crypto-currency also known as virtual currency are decentralised peer-to-peer payment systems that are digital representations of value and can be transferred, stored and traded electronically (Lee, Long, McRae, Steiner, & Handler, 2015). Although there are other crypto-currencies around, bitcoin is the most prominent one.

Blockchain technology is the underlying technology that chronicles all bitcoin transactions (Hurlburt, 2016). The blockchain links are established by a decentralised process called as

[1] http://www.ft.com/intl/cms/s/2/eb1f8256-7b4b-11e5-a1fe-567b37f80b64.html#axzz3qe4rV5dH

mining, where competing miners use sophisticated computers to verify the transactions before adding them to the blockchain (Eyal & Sirer, 2014). Today this underlying technology is finding its own range of applications that is not limited to just Bitcoin or even finance (Crosby et al., 2015).

2.3.2 Application of Blockchain: Beyond Bitcoin

Today the concept of blockchain technology is finding a range of applications and has moved beyond the concept of bitcoins. Tech giants, like Microsoft, IBM and Amazon, as well as major Wall Street banks, including JPMorgan Chase and Citigroup, are investing in blockchain technology while Infosys, TCS, HCL, and Accenture are working on blockchain-based products for banks as well (Breitman Kathleen, 2017). In literature, implementation of the blockchain technology has been broadly categorised into financial and non-financial areas with a majority of the study finding its major use and impact in the financial sector (Crosby et al., 2015; Swan, 2015). Lewis states that financial institutions and banks do not see blockchain technology as a threat to their traditional business models and in fact the world's biggest banks are looking for opportunities in this area by doing research on innovative blockchain applications (Crosby et al., 2015). Swan categorises these applications of blockchain technology into three broad categories, namely Blockchain 1.0, Blockchain 2.0 and Blockchain 3.0 (Swan, 2015). Blockchain 1.0 refers to the use of crypto-currency and its transfer while Blockchain 2.0 refers to extensive economic and financial transactions (Swan, 2015). Finally Blockchain 3.0 refers to 'non-financial applications', i.e. applications in non-business oriented area such as health, science, literacy, culture, and art (Swan, 2015).

In the financial domain blockchain finds its major use in the area of crypto-currency where bitcoin has been the main application which is followed by Ether, a currency used by smart contract platform Ethereum (Breitman Kathleen, 2017). Similarly, past literature mentions many other emerging platforms that use the technology for crypto-currency transaction. The other major financial use of blockchain that has been discussed in literature comes in the form of smart contracts. Crosby et al. describe smart contracts as computer programs that can automatically execute the terms of a contract where, when the terms of the contract between participating entities are met, payments can be made automatically between them (Crosby et al., 2015). Swan mention three distinct characteristics of smart contracts namely, autonomy, self-sufficient and decentralised (Swan, 2015). Autonomy refers to smart contracts being

independent of a person initiating the contract, while self-sufficient refers to its ability to be able to gather the required resources by itself and finally decentralised refers to smart contracts being distributed among networked nodes and not residing in a central sever (Swan, 2015). Smart contracts also give rise to another related application of blockchain namely, smart property. Crosby et al. mention it as an application of blockchain related to the control of ownership of a physical or non-physical property or asset such as car, house or company shares via the technology using smart contracts. Swan explains the key concept of the application as controlling ownership and access to an asset by having it registered as a digital asset on the blockchain by having access to a private key that proves the ownership (Swan, 2015). He further describes smart property to be an application that would give rise to centralized trust-less asset management systems as well as cryptographically activated assets and that it would have implications for the entire field of property law (Swan, 2015). Another application of block-chain being discussed is in the field of Crowd-funding where blockchain removes the need of an intermediary third-party. Swan mentions that this enables start-ups to raise funds by creating their own digital currencies and selling “cryptographic shares” to their investors and early backers (Swan, 2015).

In the non-financial domain there has been a wide range of applications that has been discussed in literature. Proof of existence of an entity is one major application. Crosby et al. mention that proof of existence of all legal records, legal documents, health records, and loyalty payments in the music industry, notary, private securities and marriage licenses can be envisioned to be put inside the blockchain (Crosby et al., 2015). Swan explains that this can be achieved through hashing and timestamping, where hashing provides a unique identifier to the document and timestamping provides the time it was authored (Swan, 2015). He further mention that proof of existence demonstrates document ownership and the time it was authored without revealing the information it contains (Swan, 2015). Another application is in using it to improve the performance of another digital technology, namely big data and internet of things. Swan explains that ‘blockchain technology could be joined with big data, layered onto the reactive-to-predictive transformation that is slowly under way in big-data science to allow the automated operation of large areas of tasks through smart contracts and economics’ (Swan, 2015). While Crosby et al. state that the blockchain technology facilitates the implementation of decentralized IoT platforms such as secured and trusted data exchange

as well as record keeping where the blockchain serves as the general ledger, keeping a trusted record of all the messages exchanged between smart devices in a decentralized IoT topology (Crosby et al., 2015). Another application is in the decentralised storage of electronic data. Crosby et al. mention that block-chain based storage allows users to transfer and share data without relying on any third party cloud storage applications thus allowing them to share unused internet bandwidth and spare disk space in their personal computing devices to others in return for bitcoin based micropayments. Another application of blockchain is in the implementation of the NameCoin. Crosby et al. explain that NameCoin is an 'alternative blockchain technology that is used to implement decentralized version of Domain Name Server (DNS) that is resilient to censorship'. Swan further mentions the advantage of it, by stating that it makes it possible for anyone to be able to register their DNS and thus freely publish their content without being supressed. Finally one of the application of blockchain that has been discussed in literature is in providing digital identity. Swan explains that using blockchain individual's identity to a website can be verified thus speeding access to all aspects of websites, simultaneously improving user experience, anonymity, and security.

Many other applications are being continuously developed as more and more research are carried out and more investments are being made in the area of blockchain. Blockchain enables efficient organization and effective collaboration between people and machines and therefore it can lead towards a very fast, reliable, transparent and secure interaction and dealings among people and organizations at large (Swan, 2015). However blockchain comes with its own challenges and risks that needs to be understood as organizations globally get more and more involved with this disruptive and revolutionising digital technology.

2.3.3 Limitation and Risk of Adoption

Several publications discuss the limitations of blockchain technology. One of the major risk of the technology is seen in fraudulent activities such as industry thefts and fraud. Crosby et al. express the concern on the misuse of the technology for fraudulent activities like money trafficking while Swan expresses the need for the blockchain industry models to solidify and mature such that there are better safeguards that would help the industry to be stable (Crosby et al., 2015; Swan, 2015). Another drawback is regarding technical limitations. Swan mentions limitations in scaling, throughput, latency, size and bandwidth, and security while Crosby et al. share concerns in scaling and also mention the difficulty in bootstrapping for migrating into

the new technology (Crosby et al., 2015; Swan, 2015). Another concern is on government regulations. Crosby et al. and Swan share this as they express that the future of blockchain depends on what regulations the government comes with and that it could slow down the adoption by introducing new laws to monitor and regulate the industry for compliance (Crosby et al., 2015; Swan, 2015).

Finally one major concern that Swan expresses in his research is on having a viable business model for blockchain technology adoption (Swan, 2015). He mentions that at first it may seem that traditional business models would be no longer applicable as blockchain technology tries and removes intermediaries thus disrupting their business but still there are worthwhile revenue-generating products and services to provide in the new blockchain economy (Swan, 2015). The objective of this research is to try and explore these opportunities that blockchain provides by understanding the potential of the technology and understanding its capabilities in generating new business models.

2.4 BMs with Blockchain Technology: Research Gap

Swan states that 'the economic, political, humanitarian, and legal system benefits of Bitcoin and blockchain technology start to make it clear that this is potentially an extremely disruptive technology that could have the capacity for reconfiguring all aspects of society and its operations' reference (Swan, 2015). Therefore it can be understood that blockchain technology can be disruptive to current business operations, processes, services and the business model as a whole. Swan further adds that there is a limitation on the understanding of coming up with viable business models in the blockchain economy (Swan, 2015). Although current research on blockchain technology covers aspects of the possible disruption that blockchain technology can have in the financial and non-financial sectors, they do not particularly focus on how it can come up with viable business models. This study tries to address that gap by exploring the potential disruption that the implementation of blockchain technology can have in coming up with new business models.

As discussed earlier in the previous section about the limitations of previous research work on BM with DT (section 3.2.4), there has been limited focus on the holistic aspect of the impact on BM with regard to the different components of a business model as defined by Osterwalder and Pigneur (Osterwalder & Pigneur, 2010). Zott et al. highlight this limitation of past research

in their own research work on the recent developments and future research prospects of the business model (Zott, Amit, & Massa, 2011). They come up with the finding that past literature has been developed mainly in silos and while also concluding that business models emphasize a system-level, holistic perspective to explaining how firms do business (Zott et al., 2011). Therefore there is a scope and need in addressing the business model from a holistic perspective. Further there has been no or limited focus on addressing the impact of digital technology in the business model with respect to either a start-up or an established enterprise.

Taking these limitations of previous research into consideration, this research tries to investigate the influence of blockchain technology on the business model of start-up enterprises by observing its impact across the nine different components of the business model of these enterprises.

3.0 Methodology

3.1 Research Question

This research tries to investigate and explore the business models empowered by blockchain technology. It focuses on observing the impact on and throughout the nine components of the business model. With this focus the following research question is developed.

To what extent can the digital technology, namely blockchain technology impact the development of new business models?

In order to answer this question precisely, two sub questions are developed further.

1. What new business models have been developed since the emergence of the blockchain technology?
2. What are the characteristics of the business models empowered by the blockchain technology with respect to the nine components of the business model?

3.2 Research Design

In order to answer the research questions this research carried out a systematic literature review followed by a use case analysis (Fletcher et al., 1997). The research has been designed into four steps with reference to Hevner et al. paper on design science in information systems research (Hevner, March, Park, & Ram, 2004) . Two artefacts are developed as an output from the design science method.

3.2.1 Step 1: Data Preparation

Two systematic literature review's (SLR) were conducted. SLR 01 reviewed the literature on blockchain technology that discussed its impact on the business model. SLR 02 reviewed the literature on business model that discussed the impact of another digital technology namely cloud computing on the business model. SLR 01 was conducted with a peer student researching for the master's thesis, also in the field of blockchain technology.

3.2.2 Step 2: Conceptualization

The findings of SLR 01 and SLR 02 were conceptualised. SLR 01 presented the business applications of the blockchain technology and the corresponding start-ups involved while SLR 02 presented the business models of another digital technology namely cloud computing with respect to the nine components of the business model defined by Osterwalder and Pigneur

(Osterwalder & Pigneur, 2010). The findings from SLR 02 were used as a background for investigating and presenting the business models of the blockchain business applications found in SLR 01. This was done by investigating the news publications of start-ups and their corresponding business applications. This findings were presented as business models of the blockchain technology with respect to Osterwalder and Pigneur's business model framework. Additionally an envisioned eco-system model of the blockchain applications was developed.

3.2.3 Step 3: Validation

In order to validate the two models developed, a number of professionals working in the field of blockchain development and related services were interviewed. Their answers were used to validate these models.

3.2.4 Step 4: Finalization

The models were revised according to the findings of the interview and it was finally finalized and explained.

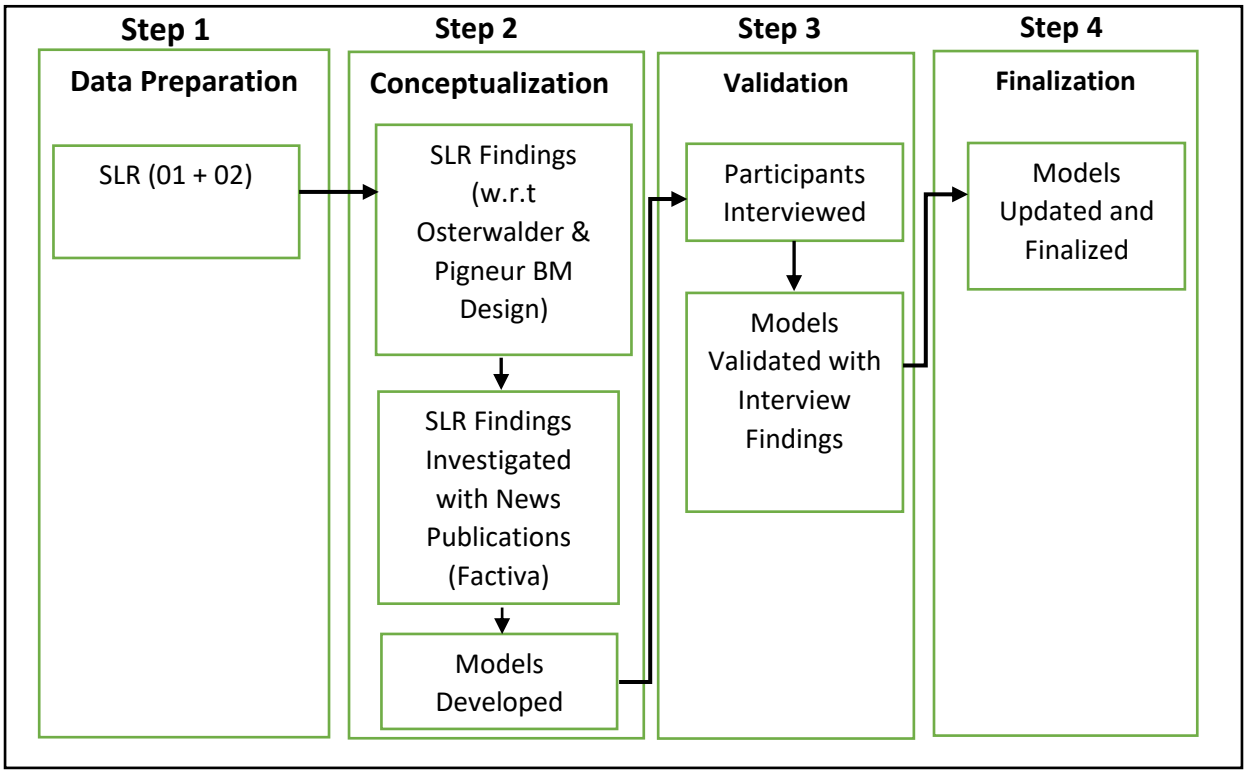

Fig 3.0 Research Design (Hevner et al., 2004)

3.3 Systematic literature Review (SLR)

3.3.1 Overview & Objective

In order to answer the research questions this research applies a systematic literature review approach. Systematic literature review can been defined as a 'means of identifying, evaluating and interpreting all available research relevant to a particular research question, or topic area, or phenomenon of interest (Kitchenham, 2006). An SLR is carried out for different reasons such as, finding gap in past research, to summarise existing evidence, and to provide a framework/background for future research or activities in the certain area.

As mentioned earlier two systematic SLR's, SLR 01 and SLR 02 have been conducted in this research. The objective of SLR 01 was to explore and understand the different business applications and their corresponding start-ups venturing in these applications. The objective of SLR 02 was to base the investigation of the business models of blockchain with respect to Osterwalder and Pigneur's business model design by reviewing literature investigating the business models of cloud computing with respect to the same business model design. The digital technology namely, Cloud Computing was chosen as it is a more matured technology and displays similar characteristics in terms of business application of the technology.

Although most research starts with a literature review, carrying out a systematic literature review is more significant as it follows a systematic approach, such as a predefined search strategy, where a significant amount of paper from a good depository of databases are accessed and selection is made following a well-defined criteria (Kitchenham, 2006). There are several advantages of carrying out a systematic literature review. An effective review creates a firm foundation for advancing knowledge while facilitating theory development and closing areas where a substantial amount of research exists, and uncovering areas where research is needed (Webster & Watson, 2002).

3.3.2 Approach

Figure 4.0 shows the approach that was undertaken for both the SLR's.

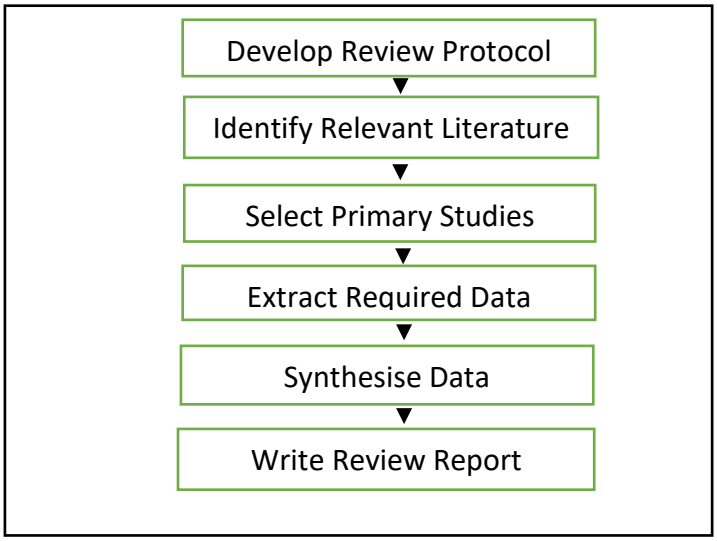

Figure 4.0: SLR Process (Brereton, Kitchenham, Budgen, Turner, & Khalil, 2007)

As shown in the figure 4.0, first a review protocol was developed with reference to Kitchenham's paper on guidelines for performing a systematic literature review in software engineering (Kitchenham, 2006). A review protocol specifies the method and process to be undertaken for a particular SLR and is necessary in order to follow a systematic approach and also reduce the possibility of researcher bias (Kitchenham, 2006) This review protocol comprises of the background literature review, research questions and finally includes all the overall process to be carried out for both the systematic literature reviews as seen earlier in figure 3.0.

The next step was to identify relevant literature from several scholarly databases in order to make the search comprehensive and authentic. The aim of an SLR is to find as many relevant research without any biases so that it can provide a comprehensive set of papers to choose the primary studies from (Kitchenham, 2006). This process included creating a search strategy where a number of scholarly databases where chosen from and key words were identified in order to make the search. The journals for the SLR was chosen from the journal databases, Web of Science, NCBI, Academic Search Premier, Social Science Research Network eLibrary, Informaworld, Taylor & Francis, IEEE, Springerlink, ProQuest Business Collection, ACM Digital Library and Sciencedirect. The search operation was carried out on these databases and the listed papers were included if they were relevant by going through their title and abstract.

The next step was to select the primary studies according to certain filtering criteria. Selecting primary studies includes developing selection criteria which should be piloted to ensure they can be reliably interpreted and they classify the results correctly (Kitchenham, 2006). Therefore a filtering criteria was developed and followed in order to include the most relevant papers that would be able to provide the necessary data for coming up with an effective and valid result.

The next step was to extract the required data from the selected primary studies. The objective of this step is to come up with proper and accurate way to record the information researchers obtain from primary studies (Kitchenham, 2006). Data was extracted in order to record the necessary information from the primary papers.

The next step was to synthesise the data. Data synthesis involves collating and summarising the results from the included primary studies (Kitchenham, 2006). The data was synthesised by summarising and categorising the required information from the papers with respect to the research objective and research question.

The final step was to write the review report. This is the final phase which involves writing up the results of the review. The entire process and corresponding results were documented and finally written down in this paper.

The citation tool used in order to save relevant literature from the databases was the citation manager, Mendeley. Mendeley[2] is a reference manager and an academic social network that is used for managing and sharing research work. It comes with the facility of sorting research papers into different folders and it provides the utility of searching through the title and abstract of the articles as well as opening articles in its own interface. It also provides a duplicate finder option. It manages citations and other meta-data of articles so it is a handy tool for referencing. Therefore due to these attributes of Mendeley, it has been used exclusively for managing the research papers in the process of the SLR.

3.3.3 SLR 01: Identifying Relevant Literature (Search Strategy)

This systematic literature review was carried out on the area of blockchain technology with business model. The main search strategy for identifying relevant literature was to focus on

[2] https://www.mendeley.com/

searching for literature on blockchain technology and related disciplines. Blockchain technology has also been described in the category of private ledger and distributed ledger. Therefore the search strategy was to identify literature focusing on blockchain, private ledger and distributed ledger. In order to make the search comprehensive 11 popular databases comprising of scholarly articles and peer reviewed publications were chosen as mentioned under SLR approach in section 3.3.1.

Three search keywords were used separately in each databases namely, 'blockchain', 'public ledger' and 'distributed ledger. The search function provided by each database was used to carry out the search. The search result details from each database is shown in the table 1.0.

Database	No of articles	Keyword: 'Blockchain'	Keyword: 'Distributed ledger'	Keyword: 'Public Ledger'	Included	Excluded	Included Duplicates	Total	Date searched
Academic Search Premier	174	13 out of 30	1 out of 5	4 out of 139	18	156	2	16	25th April
ACM Digital Library	82	53 out of 58	12 out of 18	4 out of 6	57	13	12	45	1st of May
IEEE Computer Society Digital Library	124	42 out of 89	9 out of 10	19 out of 25	70	54	19	51	25th of April
Informaworld - Taylor & Francis : Social Sciences & Humanities, Science & Technology collections	84	3 out of 48	2 out of 18	2 out of 18	7	77	4	3	2nd of May
NCBI	36	3 out of 48	2 out of 18	2 out of 18	7	29	4	3	2nd of May
ProQuest: Business Collection	91	64 out of 82	6 out of 6	3 out of 3	73	18	1	72	1st of May
Sciencedirect	86	28 out of 67	6 out of 9	6 out of 10	40	46	7	33	1st of May
Social Science Research Network	273	84 out of 181	13 out of 36	38 out of 56	135	138	44	91	2nd of May
Springerlink	342	18 out of 214	7 out of 69	10 out of 59	35	307	3	32	25th of April
Scopus	281	213 out of 238	12 out of 13	18 out of 30	227	54	4	223	20th of March
Web of Science	121	11 out of 40	3 out of 44	2 out of 37	16	105	2	14	25th of April
Total	**1694**				**685**	**997**	**102**	**583**	

Table 1.0: SLR 01 - Relevant Data Collection

As shown in Table 1.0 the search results generated a total of 1694 papers out of which 685 were included as they were related to blockchain technology and these papers were downloaded and saved inside Mendeley. The selection was done by looking into the title and abstract of the papers. Finally 102 duplicates were found throughout the different databases using Mendeley's duplicate finder option and therefore the SLR ended up with a total of 583 relevant literature.

3.3.4 SLR 01: Selecting Primary Studies

A. Process

From the 583 selected relevant literature a further selection was made in order to find the primary studies to carry out the final review. The following selection criteria was developed.

1. **Language:** English
2. **Journal Type:** Scholarly articles
3. **Content Type:** A comprehensive discussion of the various business applications of the blockchain technology

The language needed was set to English as the research was carried out in English and any authentic translation would be difficult to find. The type of journal chosen was scholarly articles as the research itself is carried out in a scientific methodology and therefore the primary papers was desired to be scholarly as well. The type of content of the articles was chosen to be containing a comprehensive discussion about the various applications of the blockchain technology as it was necessary for fulfilling the objective of the SLR to explore and understand the different business applications and their corresponding business models of start-up companies empowered by the blockchain technology.

Mendeley was used in order to sort and filter relevant articles according to the criteria. Following the criteria the title and abstract of the 583 relevant articles were looked into and a total of 30 articles were identified as containing information on blockchain and its applications. The 30 articles were looked into thoroughly in order to verify that it was fully relevant for the research. Only four articles were found to fulfil the set criteria completely. These four articles were chosen for the final review.

B. Results

The chosen papers are shown in the table 2.0.

Paper No	Title	Author	Paper Source
01	Blockchain technology: Principles and applications	M. Pilkington	Social Science Research Network eLibrary & Scopus Business Collection
02	Is Blockchain a General Purpose Technology?	E. Kane	Social Science Research Network eLibrary

03	Blockchain: Blueprint for a New Economy	M. Swan	ProQuest Business Collection
04	Blockchain Technology Beyond Bitcoin	M. Crosby, Nachiappan, S. Verma & V. Kalyanaraman	Social Science Research Network eLibrary

Table 2.0: SLR 01 (blockchain with business model) - Primary Studies

3.3.5 SLR 01: Data Synthesis

The objective of the SLR is to come up with an understanding of the various business applications of the blockchain technology and their adoption by start-ups. The 4 papers are synthesised according to the category of business as commonly defined in the different papers and the different application of the blockchain inside the category.

1. Crypto Currency Services

Crypto-currencies are alternate form of monetary that are virtual and independent of any government regulated monetary authority and blockchain is the underlying technology that supports crypto currency transactions. The crypto currency defines a new type of economy which is not defined and therefore constrained by geographic location, political structure or legal system. (Pilkington, 2016b). Crypto-currency on the blockchain acts as a decentralised ledger, allowing for the peer to peer transfer of funds without the need of a third party such as a bank (Kane, 2017).

Applications & Start-ups

The major application of the blockchain in crypto-currency transaction has been in the generation of authentic crypto-currency that can be traded legally and the first and the best known use of blockchain was for the crypto currency Bitcoin (Kane, 2017). There are several other crypto currency that have come up apart from Bitcoin, like the Ethereum, Ripple and Gridcoin, however bitcoin is the single most used crypto currency in the world today (Kane, 2017; Pilkington, 2016b).

2. Other Financial Services

A prime area for the applications of the blockchain is in interfacing crypto-currencies with traditional banking and financial markets (Swan, 2015). Financial services are empowered by the use of the blockchain in providing fast transfer of funds internationally, with low transfer costs and fast transaction (Kane, 2017).

Applications & Start-ups

The major financial service application of the blockchain has been in providing fast and cheap crypto-currency payment across the blockchain between various business firms and one of the main start-ups providing this service is the start-up Ripple, which allows banks to transfer funds and foreign exchange transactions directly between themselves (Swan, 2015). Another start-up providing similar service is the Remitsy that provides international transfer of funds using the blockchain technology (Kane, 2017). Other start-ups are providing the facility of crypto-currency payment to other traditional financial and markets payments solution like Paypal as in the case of bitcoin payment processors Bitpay, Coinbase and GoCoin (Swan, 2015).

Another application is the crypto-currency trade which deal with accepting crypto-currency from consumers and trading them with others according to the current value of the currency as in the case of Bitpay and Coinbase(Swan, 2015). They also provide banking facility for saving the digital currency as in the case of the start-up Kraken, that allows direct saving and lending services for the bitcoin (Swan, 2015). Other start-ups providing similar services are BTCjam and TeraExchange.

Another application is in private equity exchange as in the case of Chain.com that offers firms like NASDAQ to implement private equity exchange on top of the blockchain, which is fast, traceable and efficient compared to traditional means of trading stocks (Crosby et al., 2015). Start-ups like Medici, Bitshare and Blockstream also offer securities exchange services using the blockchain (Crosby et al., 2015).

3. Contract Management Services

Contract management services in the form of smart contracts are a method of making agreements with people via the blockchain (Swan, 2015). These contracts are specific programs used by a user of a main blockchain in order to decide whether a specific blockchain operation such as payments, should be permitted or not (Pilkington, 2016b). The smart contracts allow users to create self-evaluating and self-regulating codes of contract thus displaying a certain level of autonomy after being placed in the blockchain (Kane, 2017).

Applications and Start-ups

The application of the blockchain in contract management services is in smart contracts where users create self-evaluating and self-regulating codes of contract and the main start-up involved in smart contracts is Ethereum (Kane, 2017). Ethereum is an innovative block-chain based virtual machine featuring stateful user-created digital contracts (Pilkington, 2016b). Ethereum is a fundamental underlying infrastructure platform and programming language for building and publishing distributed applications that can run all blockchains and protocols much like a unified development platform (Swan, 2015). Ethereum is already powering wide range of early applications in areas such as governance, autonomous banks, keyless access, crowdfunding, financial derivatives trading and settlement using smart contracts (Crosby et al., 2015).

4. Asset Management Services

Asset management services in the form of smart property is the concept of controlling the ownership of a property or asset (physical such as cars, house or non-physical such as company shares) via blockchain using smart contracts (Crosby et al., 2015). Blockchain encoded property becomes smart property that is transactable via smart contracts thus enabling trust-less lending and trading of property (Swan, 2015).

Application and Start-ups

The application of the block chain in asset management has been in managing smart property using smart contracts and one start up that deals with smart property application is SwanCoin, where 121 physical-world artworks, crafted on 30 × 30 cm varnished plywood, are available for purchase and transfer via the Bitcoin blockchain (Swan, 2015). Another start up dealing with the application is Ownage, an Ethereum based platform to distribute, collect and trade digital game content (Kane, 2017). Smart property can be used with other blockchain application such as digital identity in order to allow access to use it as in the case of a smart phone or to open the doors of physical assets like cars and homes (Swan, 2015). One of the alternate yet first implementation of smart property is coloured coins where certain bitcoins are coloured or tagged as corresponding to a certain asset (Swan, 2015) .

5. Digital Identity Services

Blockchain, due to its security and permanence, makes a great technology to use for verifying and securing a person's digital identity (Kane, 2017). It benefits from the fact that

all crypto-currency users have a personal e-wallet, and therefore a wallet address which can be used to verify the users (Swan, 2015).

Application and Start-ups

The main application of blockchain in digital identity services has been in online identity verification. This includes verifying an individual's identity to a website using blockchain verification and two start-ups providing these services are OneName, BitId and BitHandle (Swan, 2015). These start-ups provide a trust-less and decentralized service so that one's digital identity cannot be controlled by a central institution or company therefore its more secure for authenticating to websites rather than using social media sites for it (Pilkington, 2016b).

Another application is in insurance where any property/asset that can be registered inside a blockchain (smart property) becomes useful to provide and verify the digital authentication of the ownership(Crosby et al., 2015).

The other application is in using the digital identity services for verifying other blockchain transactions such as crypto-currency, smart contracts and smarty property alike for securely verifying the parties involved in the transactions (Swan, 2015).

6. Crowd-Funding Services

Block-chain based crowdfunding platforms make it possible for start-ups to raise funds by creating their own digital currencies and selling 'crypto-graphic' shares to early backers, where the investors receive a token that represent the shares of the start-up they support (Swan, 2015).

Applications and Start-ups

The main application of the blockchain in crowd-funding services has been to gather funding for blockchain based projects through the blockchain and FunderGrowth is a start-up that allows people to invest their money in Blockchain start-ups (Kane, 2017). Another start-up is Swarm an incubator of crypto-currency focused start-ups that has given rise to several funded projects ranging from development of smart personal drone networks to decentralised crypto-currency workplace (Swan, 2015).

7. Blockchain Development Services

There are many blockchain technology protocol projects that develop protocols for enabling their own blockchain processes and applications while some of them seek out help in creating their own blockchain applications (Kane, 2017; Swan, 2015).

Applications and Start-ups

The main application of the blockchain in blockchain development services is in providing opportunities for new protocol development projects to come up as the technology becomes more popular and widely adopted (Kane, 2017). Start-ups involved in protocol development for their own blockchain and corresponding application are Ripple, Ethereum, etc. while start-ups like NXT, Open transactions, etc. develop for bitcoin blockchain overlay. Some of these Start-ups like Blockchain.info, Stellar and chain offers interfaces and API's seeking out for protocol development for them (Swan, 2015).

8. Traceability Services

Blockchain helps in anti-counterfeiting and ensuring authenticity of an entity by building a shared consensus-based and immutable ledger that helps track the origin and the transformations undergone by the entity by creating a formal registry enabling the identification and the tracking of possession of the entity (Pilkington, 2016b).

Applications and Start-ups

The main application of the blockchain in traceability services is in providing traceability for various business operations and the most prominent one is in SCM. The start-up Everledger is involved in creating permanent ledger of diamond certification and the transaction history of the diamond using blockchain (Crosby et al., 2015). Another start-up involved in proving blockchain based anti-counterfeit solutions is BlockVerify that is finding its applications in pharmaceutical, luxury items, diamonds and electronic industry (Crosby et al., 2015).

Another application of blockchain in traceability services is in proof-of-existence. Putting all legal documents, health records, notary, private securities etc. in the blockchain can be envisioned (Crosby et al., 2015).

The table 3.0 summarises these findings.

Sectors	Application	Service(s)	Start-ups	Bibliography

Crypto-Currency Services	Crypto-Currency Generation	Generating & Distributing Digital Currency	Bitcoin, Ethereum, Ripple	(Kane, 2017; Pilkington, 2016b)
Other Financial Services	Crypto-Payment	Payment Processing	Remitsy, BitPay	(Kane, 2017; Swan, 2015)
	Crypto-Trade	Digital Currency Exchange & Banking	Bitpay, CoinBase, Kraken, TeraExchange	(Swan, 2015)
	Private Equity Exchange	Private Equity Record-Keeping	Chain.com, Medici, BitShare	(Crosby et al., 2015)
Contracts Management Services	Smart Contracts	Platform for Coding and Executing Business & Legal Rules	Ethereum	(Crosby et al., 2015; Kane, 2017; Swan, 2015)
Asset Management Services	Smart Property	Asset Ownership Record-Keeping	Swan Coin, Ownage	(Kane, 2017; Swan, 2015)
Digital Identity Services	Online Identity Verification	Blockchain Identity, Web Identity, Insurance Verification, Etc.	OneName, BitId, BitHandle	(Crosby et al., 2015; Pilkington, 2016b; Swan, 2015)
Crowd-Funding Services	Crowd-Funding	Crowd-Funding & ICO Platforms	Funder-Growth, Swarm	(Kane, 2017; Swan, 2015)
Blockchain Development Services	Blockchain Development	Development Platforms, APIs, Scripts & Tools	Blockchain.info, Stellar, Chain	(Kane, 2017; Swan, 2015)
Traceability Services	Traceability	Supply Chain Tracing & Proof-of-Existence	Everledger, BlockVerfiy	(Crosby et al., 2015)

Table 3.0: SLR 01 (blockchain with business model) – Results

3.3.6 SLR 01: Conclusion

The findings from SLR 01 (blockchain & business model) gives us the different applications of the blockchain technology belonging to various business sectors, the services they provide and the start-ups venturing into each of these applications. Only four research papers discussing business applications of the blockchain technology were found. They most likely do not include the complete list of applications of blockchain technology as new applications of the technology are being increasingly developed as the technology matures.

These findings gives a basis for exploring the business models of the blockchain by investigating the start-ups venturing into these applications by analysing their use cases published in Factiva as seen in section 3.4.

3.3.7 SLR 02: Identifying Relevant Research (Search Strategy)

This systematic literature review was carried out in the area of business models for cloud computing. The main search strategy for identifying relevant literature was to focus on searching for literature on business models and cloud computing. In order to make the search comprehensive eleven popular databases comprising of scholarly articles and peer reviewed publications were chosen as mentioned under SLR approach in section 3.3.1. A combination of search keywords consisting of two separate keywords was used in each databases. The search was carried out in order to find data containing both the keywords. The search keywords and the operand used together were “business model” AND “cloud computing”. The search function provided by each database was used to carry out the search. The search result details from each database is shown in the table 4.0.

Database	No of articles	Included	Excluded	Included Duplicates	Total	Date searched
Academic Search Premier	35	35	0	2	33	7th of May
ACM Digital Library	36	36	0	4	32	7th of May
IEEE Computer Society Digital Library	14	14	0	0	14	7th of May
Informaworld - Taylor & Francis : Social Sciences & Humanities, Science & Technology collections	54	10	44	0	10	8th of May
NCBI	6	6	0	0	6	10th of May
ProQuest: Business Collection	21	18	3	2	16	9th of May
Sciencedirect	25	25	0	4	21	9th of May
Social Science Research Network	11	3	16	0	3	9th of May
Springerlink	34	3	96	0	3	10th of May
Scopus	16	16	0	2	14	10th of May
Web of Science	63	63	0	2	61	10th of May
Total	**315**	**229**	**159**	**16**	**213**	10th of may

Table 4.0: SLR 02 (business model with cloud computing) - Relevant Data Collection

As shown in table 2.0 the search results generated a total of 315 papers from all the databases out of which 229 were included as relevant literature as they were related to blockchain technology due their relevance to the study of business model and digital technologies. These included papers were downloaded and saved inside Mendeley. The selection was done by looking into the title and abstract of the papers. Finally 16 duplicates were found throughout

the different databases using Mendeley's duplicate finder option and therefore the SLR ended up with a total of 213 relevant literature.

3.3.8 SLR 02: Selecting Primary Studies

A. Process

From the 213 select literature a further selection was made in order to find the primary studies to carry out the final review. The following selection criteria was developed.

1. **Language:** English
2. **Journal Type:** Scholarly articles
3. **Content Type:** A comprehensive discussion of cloud empowered business models w.r.t Osterwalder's different components of the business model.

The language needed was set to English as the research was carried out in English and any authentic translation would be difficult to find. The type of journal chosen was scholarly articles as the research itself is carried out in a scientific methodology and therefore the primary papers was desired to be scholarly as well. The type of content of the articles was chosen to be containing a comprehensive discussion about cloud empowered business models w.r.t Osterwalder's different components as the objective of the SLR was to explore and establish a background understanding of the new business models generated by the impact of the cloud computing with respect to the different components of the business model.

The 213 articles were checked one by one starting from their title and the abstract in order to understand the content and verify them according to the set criteria. Few of them were checked for their content when the title and abstract was not enough to verify them. This gave a list of 30 articles and these articles were looked into thoroughly in order to verify that it was fully relevant for the research. Only three articles were found to fulfil the set criteria completely.

B. Results

Paper No	Title	Author	Paper Source
01	Successful Business Model Types of Cloud Provider	S. Labes, N. Hanner & R. Zarnekow	SpringerLink
02	A framework for the classification of Could Computing	S. Lakka, C. Michalakelis, T.	ACM Digital Library

	Business Models	Stamati & D. Anagnostopoulos	
03	Disruptive technologies: A business model perspective on cloud computing Carlos	C. DaSilva, P. Trkman, K. Desouza and J. Lindič	Academic Search Premiere, Informa World, SSRN & Web of Science

Table 5.0: SLR 02 (business model with cloud computing) – Primary Studies

3.3.9 SLR 02: Data Synthesis

The objective of the SLR was to establish a background understanding of the new business models generated by the impact of cloud computing with respect to Osterwalder's nine components of the business model. The three papers are synthesised below according to their discussion of the impact of cloud computing with respect to the nine components of the business model.

The cloud computing empowered business models have been commonly categorised as SaaS (Software as a Service) provider, PaaS (Platform as a Service) providers and IaaS (Infrastructure as a Service) providers (DaSilva et al., 2013). Additionally another business model that's defined is the business models applied by Start-ups i.e. Value-added Resellers (VARs) (Labes, Hanner, & Zarnekow, 2016). Findings of these business models with respect to the nine components of Osterwalder and Pigneur have been synthesised below.

1. Value proposition

The value proposition of cloud computing relates to its special attributes such as cost effectiveness, business scalability, market adaptability, masked complexity, context driven variability and eco system connectivity (Lakka et al., 2015).

The VARs provide limited service portfolio and therefore allows for individual customization while making it easy and fast to setup (Labes et al., 2016). The SaaS providers are able to offer variety of software services while providing individual support and assistance (Labes et al., 2016). The PaaS providers offer service that require little start-up investment, practically no installation burdens, no maintenance or skilled IT team and no requirement to buy additional hardware (DaSilva et al., 2013). The IaaS providers offer services that SME's can use and leverage from these robust and large scale computing infrastructure at a fraction of the cost of owning, upgrading and managing own-premises infrastructure (DaSilva et al., 2013).

2. Revenue Streams

Cloud computing service models are based on either subscription or are usage based (Lakka et al., 2015). The VARs usually have a onetime payment followed by supplementary services or a partner-revenue model (Labes et al., 2016). The SaaS providers have revenues mainly based on subscription of the main services (Labes et al., 2016). The PaaS as well as the IaaS providers mainly follow a usage based pricing model which is enabled by the possibility of a transparent monitoring of services that is provided (Labes et al., 2016). They sometimes have a fermium model where services are free to use for a certain time as in the case of platform service provider Amazon web services and infrastructure service provider Salesforce.com thus building commitment after which they are charged (DaSilva et al., 2013). Amazon also follows a flexible on-demand pricing model where clients are charged based on use which also has the provision of paying in advance for a fixed period and therefore receiving discount per usage (DaSilva et al., 2013).

3. Cost Structure

The main costs for cloud computing services centre around personnel for development, maintaining and managing core software, assets such as servers and data centres and partner costs (Lakka et al., 2015). The VARs induce mainly the initial costs as they do not provide any additional resources later on (Labes et al., 2016). The software-service providers as well as the platform-service and infrastructure-service providers involve investments in proprietary software, hardware and know-how resources and these results in both fixed and variable operational costs (Labes et al., 2016).

4. Customer Segments

The VARs mainly focus on customers located in niche markets while the SaaS providers address both the mass market and the individual firms including the start-ups (Labes et al., 2016). The PaaS providers as well as the IaaS providers address customers in branch-specific and public sectors (Labes et al., 2016). Additionally SaaS providers serve the Start-ups while PaaS providers serve the SaaS providers, and finally IaaS providers serve PaaS providers (Lakka et al., 2015).

5. Channels

The VARs use traditional channels such as print media and personal contacts to get to their customers (Labes et al., 2016). The SaaS providers as well as the PaaS providers employ partner programmes, value-added reseller and system integrator communities in order to reach their customers (Lakka et al., 2015). The IaaS providers primarily employ a self-service direct model, where the delivery is through APIs and a web user interface to those APIs (Lakka et al., 2015).

6. Customer Relationship

Cloud providers maintain relationships through conferences, online communities and analytics, and providing on-premises solutions (Lakka et al., 2015). They also leverage from technological developments (faster, safer and more reliable internet connection) in order to reach newer markets such as SMEs that had been previously ignored while providing those services at a very reasonable price (DaSilva et al., 2013). The VARs offer on-premise solutions and additional support services on demand (Labes et al., 2016). The SaaS providers have well developed support systems as well as online profiles and communities while IaaS and PaaS providers have transparent monitoring services and SLA's helping build trustful relationship (Labes et al., 2016).

7. Key Activities

The key activities for VARs depend upon the type of service they offer such as, comparison and categorisation that include structured data and content in case of database and search engines services, or aggregation and add-on in case of billing services (Labes et al., 2016). The SaaS provider's core activity is to translate customer requirement to functionalities and delivering it to them involving developers and product managers focusing on bringing the features to production and operational staff focusing on maintaining the required assets and operational fabrics (Lakka et al., 2015). The key activity for PaaS providers is to maintain and upgrade the environment for consumers to deploy their application and providing them with the required tools and APIs for the integration of the application (Lakka et al., 2015). Finally the key activity for IaaS providers is highly automated delivery, oversight and resources planning for an optimised asset utilization (Lakka et al., 2015).

8. Key Resources

The VARs rely on programmers and system administrators for carrying out their services. SaaS, PaaS and IaaS providers all rely heavily on software, developers and system administrators while building and maintaining a brand name to ensure reliability to potential customers(DaSilva et al., 2013; Lakka et al., 2015). IaaS providers additionally rely on large-scale hardware resources for providing their services (Lakka et al., 2015).

9. Key Partners

Cloud providers often rely on other cloud service providers, i.e., VARs rely on SaaS providers which rely on PaaS providers while PaaS providers rely on IaaS Providers and therefore there is a consumer/supplier relationship repeating through the technology stack (Lakka et al., 2015). Additionally the SaaS, PaaS and IaaS providers also rely on consulting partners that provide on-site consulting and integration services.

3.3.10 SLR 02: Conclusion

The findings from SLR 02 (business model with cloud computing) gives a background foundation to the research for exploring the business models of blockchain from a holistic perspective by using Osterwalder and Pigneur's business model design. It's seen that the business model design has been successfully used in past literature to discuss the different business models with respect to the nine components of the business model.

Furthermore the customer-partner relationship between the different business models is also seen where the lower level business models serve the ones higher to it. For example the IaaS providers serve the PaaS providers, SaaS providers and VARs. Therefore the IaaS becomes the partner for the other providers (PaaS, SaaS and VARs) which implies that the other providers are customers for the IaaS. This relationship therefore creates an eco-system of the business models empowered by cloud-computing where the VARs act as an orchestrator of the system by using the services provided by all the other providers and thus creating a continued customer-partner relationship between all these business models.

It's also seen that from the total number of articles investigated in the SLR that there are only 3 papers that discuss the business models of cloud-computing from a holistic perspective. This goes on to prove the research gap of having a limited number of studies in the different business models of digital technologies from a holistic perspective. Therefore, it also gives

significance to the objective of the research in exploring the different business models of the blockchain technology from a holistic perspective.

3.4 Use Case Analysis: Factiva

3.4.1 Overview & Objective

News publications published in the research tool Factiva was used to explore the different business models of the blockchain applications. Factiva is a research tool which provides publications and web news of different business companies from reputed sources.

In order to investigate the business models of the blockchain, the different applications found in SLR 01 (table 3.0) were looked into. These applications are: 1) Crypto-Currency Generation 2) Crypto-Payment 3) Crypto-Trade 4) Private Equity Exchange 5) Smart Contracts 6) Smart Property 7) Online Identity Verification 8) Crowd-Funding 9) Blockchain Development 10) Traceability

In order to find relevant news publications a search operation was carried out with the key word for the different start-ups in each of the 10 business application of blockchain technology. In the case were the start-up weren't mentioned or returned less data, the search was carried out directly with the application keyword. In order to get a comprehensive result, publications as well as news articles were considered. The top 300 articles returned by the search operation for each start-up/application was investigated and according to the relevance of the title, the contents were further looked into for the final selection.

3.4.2 Primary Articles

The details of the selected articles is shown in table 6.0.

Paper No	Business Application	Title	Author	Publication	Year
01	**Crypto-Currency Generation**	New cryptocurrencies are gaining momentum	C. Wong	Waterloo Region Record	2017
02		Coinbase tipped at $1b valuation as demand for cryptocurrency soars	B. Roston	SlashGear	2017
03		Ethereum is already using a small	Trade Arabia (org.)	Al Hilal Publishing & Marketing Group	2017

		country's worth of electricity			
04		The dawn of cryptocurrency	R. Jayaseelan, I. Zainul	TheStar	2017
05		Digital developers fund announces fundraising via initial coin offering (ICO)	M2 Presswire (org.)	M2 Presswire	2017
06		Digital currency frenzy crashes Coinbase exchange	Brisbane Times (org.)	BrisbaneTimes	2017
07		Ethereum as a platform has many things that are unique about it	A. Khan	HT Syndication	2017
08	**Crypto-Payments**	BitPay announces Bitcoin payroll API	Business Wire (org.)	Business Wire	2014
09		UK payments start-up integrates Bitcoin after $66 million fundraise	C.Tian	CoinDesk	2017
10		Bitpay adds miner fees to invoices	K. Helms	Bitcoin	2017
11		BitPay; BitPay introduces Copay Bitcoin wallet integration based on Intel technologies	Computer Weekly News (org.)	Computer Weekly News	2016
12		Eye on emerging competition: Xapo's Bitcoin card adds debit interchange to digital Currency	B. Reutzel	Credit Union Journal and SourceMedia	2014
13		Third eye sunglasses now accepting Bitcoin and Ripple	M2 Presswire (org.)	M2 Communications	2017
14		Ripple reaps benefits of payments focus	K. Long	Euromoney Institutional Investor plc	2017
15		Ripple; XRP liquidity to increasewith listings on 6 new exchanges	Investment Weekly News (org.)	Investment Weekly News	2017
16		Bitcoin inches higher while Ethereum pares losses from prior session	Investing.com (org.)	Investing	2017
17	**Crypto-Trade**	Bitcoin's blue chip	L. Shin	Forbes	2016
18		Pursuit of APPiness: Coinbase merchant, briefme and oneshot	Your Story (org.)	Your Story	2015
19		How to actually buy Bitcoin or Ethereum	W. Duggan	Benzinga	2017
20		Bitcoin exchange Coinbase seeks new	Free Malaysia Today (org.)	FreeMalaysiaToday	2017

		funds at $1 billion valuation			
21		3 key things to understand about Coinbase's record-setting raise	S. Lord	The Alpha Pages, LLC Coinbase's	2015
22		Coinbase launches Bitcoin debit card in the US	V. Pai	MixedBag Media Pvt. Ltd	2015
23	**Smart Contract**	Ethereum's double-edged sword: will a rising price hurt users?	A. Hertig	CoinDesk	2017
24		Ethereum 'tokens' are all the rage, but what are they anyway?	A. Castor	CoinDesk	2017
25		BABB app creates banking platform using Ethereum smart contracts	Daily Independent (org.)	Daily Independent	2017
26		YoCoin is the new Ethereum asset with smart contract application	M2 Presswire (org.)	M2 Communications	2016
27		'Smart contracts' to disrupt lawyers	J. Eyers	Fairfax Media Management Pty Limited	2016
28		LaBChain consortium adopts blockchain technology for smart contracts	French Collection (org.)	All Data Processing Ltd.	2016
29	**Crowd-Funding**	Estonia: Funderbeam to unveil crowd funding and trading platform	M-Brain (org.)	Esmerk Baltic News	2015
30		CROWDFUNDING; S'pore startup launching SEA's first cryptocurrency crowdfunding platform	J. Choek	Singapore Press Holdings Limited	2017
31	**Traceability**	IBM offers blockchain services to the supply chain	Emirates News Agency	Emirates News Agency (WAM)	2016

Table 6.0: Factiva - Primary Articles

From table 6.0, it can be seen that there are 31 articles selected as primary articles out of the 300 relevant articles chosen for investigation. The articles were from only 6 applications out of the total of 10 applications investigated in Factiva.

3.4.3 Data Synthesis

The findings from the selected articles are synthesised below.

1. BM in Crypto-Currency Generation

Value proposition: Crypto currency can be used to make payments for transactions over the blockchain while eliminating the middle man and central authority in the transaction (Wong, 2017). The fixed and highly transparent Bitcoin supply is one major element of appeal on the investment level, giving it a solid edge over gold and silver and other valuable items that don't have such a solid and predictable rarity (Roston, 2017)

Revenue Stream: An investment in bitcoin worth $100 in 2010 would be worth over $70m today (M2 Presswire, 2017a). The market capitalisation of digital currencies has increased by around 95 per cent to US$106 billion over the past month as demand for crypto-assets has soared with the creation of new tokens to raise funding for start-ups using blockchain technology (Brisbanetimes, 2017). Crypto-currency providers are investor backed and therefore earn money through crowd-funding and initial coin offerings (ICO) (M2 Presswire, 2017a).

Cost Structure: Ethereum is consuming a small country's worth of electricity and as the cryptocurrency price soar, it becomes more profitable to throw more computing power at mining, which generates new ether (TradeArabia, 2017).

Customer Segment: Crypto-currencies are made available and distributed through ICO to various investors and crypto-consumers alike (M2 Presswire, 2017a)

Customer Relationship: The applications of the crypto-currency is growing, while several services for crypto-trading, crypto-banking and crypto e-wallets have emerged in order to make crypto transactions easier (Jayaseelan & Farhana Zainul, 2017).

Resources & Activities: Providers of crypto-currencies come up with the algorithms for allowing miners to mint new digital-currency (TradeArabia, 2017).

Channels & Partners: Miners at home use their computing resources to generate the crypto currency for bitcoin as well as ether (TradeArabia, 2017). Investors can buy currencies through exchanges spread across the globe and consumers can use an e-wallet for saving their crypto-currency (Jayaseelan & Farhana Zainul, 2017).

2. BM in Crypto-Payment

Value proposition: Crypto-Payments allow instant real-time payments including cross-border payments eliminating third-party and therefore reducing time and cost (Investing.com, 2017). It provides solution to problems related to speed, scalability and costs associated to the older way of conducting global payment (Investment Weekly News, 2017).

Revenue Streams: Crypto-Payment processors like Bitpay take transaction fees for every transaction (Helms, 2017). Most crypto-payment start-ups are investor backed thus providing them with the capital funding (Tian, 2017) .

Customer Segment: Financial institutions and tech companies globally are interested in using the crypto-payment services as it removes the middle man saving costs and time (Long, 2017; Wong, 2017). A number of start-up services accept alternative payments in the form of crypto-currency (M2 Presswire, 2017b).

Cost Structure: The main costs are incurred while paying miners for validating transactions and paying fees for money conversion (Helms, 2017).

Customer Relationship: Crypto-payment providers provide plugins and API for implementing their services in e-commerce platforms. Start-ups like Bitpay have their debit cards and wallets that can be used together allowing users to convert bitcoin funds into dollar, euro or pounds (Computer Weekly News, 2016).

Resources & Activities: One of the main task for Crypto-payment providers is to maintain the network and security therefore requiring high skilled IT engineers (Computer Weekly News, 2016).

Channels & Partners: Almost all crypto-payment providers are venture-backed (Lord, 2015). Crypto-payment providers maintain partnership with a wide range of crypto-traders and merchants alike for widening their use of services (Business Wire, 2014). Similarly they maintain partnerships with crypto-currency providers for able to process payments for different currencies (Investment Weekly News, 2017). Crypto-payment providers use services of miners to validate customer transactions (Helms, 2017).

3. BM in Crypto-Trade

Value Proposition: Crypto-traders provide a quick and secure way of purchasing crypto-currency from crypto-currency providers (Duggan, 2017).

Revenue Stream: Crypto-trading start-ups are investment backed (Free Malaysia Today, 2017). Crypto-traders take fees per transaction (Shin, 2016)

Customer Segment: Start-up companies have been raising millions of dollars through Initial Coin Offerings (ICO) in minutes, or even seconds, from investors wanting in on the next big tech start-up using crypto-currency traders for the exchange (Brisbanetimes, 2017). Merchants accept crypto-payments that they can trade through their accounts with crypto-traders (Your Story, 2015).

Customer Relationship: Coinbase offers debit card services to its customers (Pai, 2015). It also offers online account services to its customers (Your Story, 2015).

Resources & Activities: Coinbase being one of the world's largest digital currency companies needs to maintain their services through high speed and capacity network with the help of engineers and support teams (Brisbanetimes, 2017).

Channels & Partners: Crypto-Currency providers like Ripple have extended their partnership to list its currency on several leading digital asset exchanges therefore extending its payment possibilities globally (Investment Weekly News, 2017). Crypto-traders also partner with banks and other online payment processors in order to receive and make fiat payments for the crypto-exchange (Duggan, 2017). Crypto-traders use services of miners for validating their customer transactions (Helms, 2017).

4. BM in Smart Contracts

Value Proposition: Smart Contracts are self-executing and therefore autonomous while they are unforgeable, public and anonymous. Smart Contracts provide transparency for the dealers, a higher level of security and the opportunity to follow a delivery in real time while being much faster and less prone to errors (French Collection, 2016).

Revenue Streams: Smart Contract provider Ethereum offers tokens that are digital assets that represent anything from loyalty points to vouchers and are programmable and the value of these tokens has been increasing exponentially(Castor, 2017; Hertig, 2017) . Moreover Ethereum takes fees for each transaction in the network (Castor, 2017). Also on Ethereum users have to pay for the computational power they use (Hertig, 2017).

Cost Structure: The main costs incurred are for providing incentives for miners for their services and their computational power used in transactions (Hertig, 2017). Moreover costs are incurred in R&D and maintenance of the applications and platform for smart contract services (Castor, 2017).

Customer Segment: Applications for apps for music distribution, sports betting and a new type of financial auditing are being tested (Eyers, 2016). A consortium of financial institutions have adapted the smart contracts application for collateral management (French Collection, 2016). A number of decentralised autonomous applications and organisations are being informed on the basis of smart contracts (Daily Independent, 2017; Eyers, 2016). Smart contracts enable stock exchanges without central clearing houses; financial record-keeping systems that can be verified without an auditor; and even tamper-proof voting systems that automatically guarantee one vote per person (M2 Presswire, 2016).

Customer Relationship: Ethereum provides platform for smart contract and applications development with API and scripting language and also provides certain de-centralised applications and related services (Castor, 2017; Daily Independent, 2017; Hertig, 2017)

Resources & Activities: Ethereum allows for programming of 'smart contracts' that enforces a set of rules (Eyers, 2016). Ethereum allows liberal scripting facilitating private blockchains and their applications (Eyers, 2016).

Channels & Partners: Crypto-currency provider YoCoin partnered with Ethereum to provide smart contract services by turning into an Ethereum asset (M2 Presswire, 2016). Smart Contract providers depend upon miners for validating transactions (Hertig, 2017). Smart contracts are envisioned to have legal agreements on top of business rules therefore law firms would be potential partners for this activity (Eyers, 2016). Ethereum has many investors investing in their crypto-currency, tokens and in the overall stake of the company.

5. BM in Crowd-Funding

Value-proposition: Crypto-based Crowd Funding supports ICO for every project where start-ups provide their own digital tokens that can be bought by the project backers using crypto-currency (Cheok, 2017). The platform has created a services marketplace that enables entrepreneurs to tap project support from the community and the supporters/investors to be rewarded through the tokens (Cheok, 2017). The blockchain crowd-funding providers can

lower transaction costs by removing the payment middleman (such as PayPal) found on traditional crowdfunding sites (Cheok, 2017).

Customer Segment: The crowd-funding platform, Funderbeam helps bring liquidity to syndicated start-up investments, using blockchain technology to verify and enforce trades (M-Brain, 2015). A Singaporean start-up is providing a crowd-funding platform for entrepreneurs to raise funds for their projects using virtual currencies such as Bitcoin or Ethereum, instead of regular currency (Cheok, 2017).

6. BM in Traceability

Value Proposition: Everledger uses the IBM blockchain to track valuable items through the supply chain, helping to protect suppliers, buyers and shippers against theft, counterfeiting and other forms of corruption (Emirates News Agency, 2016).

3.4.4 Conclusion

From the use case analysis the business models of the blockchain applications is explored with respect to the nine components of the business model. However only four of the investigated applications have complete information with respect to the nine components of the business model while the six other applications have little or no information. These four applications are 1) Crypto-Currency Generation 2) Crypto-Payment 3) Crypto-Trade and 4) Smart Contracts. This can be interpreted as the other applications having a less mature business model as they are still developing and therefore in their infant stages. Therefore considering the limitations of the information, the findings of the business models of these four applications are provided as the final results as seen later in table 8.0.

4.0 Results & Findings

With the help of the findings from the two SLR's and the use case analysis from Factiva, the research came up with 2 models, namely a categorization of business models of blockchain technology and eco-system of blockchain applications. These two models were validated through interviews with two professionals working in the field of blockchain technology.

4.1 Expert Interview

In order to validate the findings from the research two professionals working in the field of blockchain technology were interviewed regarding the findings. Their opinion was used to validate as well as improve the findings. The participants of the research were briefed about the purpose of the study in advance and permission was taken to use their answers and opinion for the research. The permission to use their names as validators was also taken. The relevant details of the two participants are mentioned in table 7.0.

Name	Experience	Interview Type
V. M.	Blockchain Expert	Video Call
M. R.	Blockchain Expert	Questionnaire

Table 7.0: Interview Participants

The blockchain experts were provided with the final output of the research which was 1) The business model of the blockchain with respect to Osterwalder's BM components and 2) The envisioned blockchain business application eco-system. Their opinion was sought regarding the correctness and the completeness of the results. There was a general agreement with the final results for its correctness and completeness with few disagreements and additional insights that have been incorporated in the final output. The insights from the discussions on each of the results are mentioned below. The opinions of both the experts have been integrated and are subjected to the author's interpretation of the discussions.

1) BM's of Blockchain

The different sectors of application and their business model were discussed and these discussions brought about a confirmation on the findings as well as new insights. The main points from the discussion and insights provided by the experts are mentioned below.

Crypto-Currency: Start-ups generally reserve 20% of the crypto-currency and float the rest 80% in the market. The business and therefore value generated by the 80 % gives value to the 20% which is the income. Venture capitalist invest through direct crowd-funding and initial coin offering (ICO). Miners solve complex computer algorithm attached to each block of transaction to validate the blocks and mint digital-currency. They are paid for the computing resources.

Crypto-Payments: Crypto-payment processors have consumers paying transaction fees for payments as well as merchants paying subscription fees for using the processors through API. Every block of transactions is validated in the public network by validators.

Crypto-Trade: Crypto-exchanges benefit from the intention of consumers to buy and sell while taking commissions from between. Miners validate the transactions using their computing resources and get paid for the transactions. They give priority to higher transaction fees as that can substantiate for the costs they incur.

Smart-Contracts: The start-ups providing smart-contract services provide the tools for contract development and charge for the usage fees and other service charges. They use miners to validate the transactions and pay them for the transaction fees.

2) Blockchain Application Ecosystem Model: There was a general agreement to the model while a few minor changes were suggested and limitations of the total business applications in the model were also mentioned. These new insights were used to validate as well as compliment to the final output.

4.2 Blockchain Application Business Models

Following the research design, the research question of the extent to which blockchain technology can influence the business model is answered by investigating and presenting the findings with respect to Osterwalder and Pigneur's business model design. The findings from the SLR's, use case study and the validation interviews is incorporated together to present the final output. As seen earlier only 4 blockchain applications were more prominent in terms of information on them for exploring their business models from a holistic perspective. Therefore, the final output represents a holistic view of the business models of these applications. The business model of the blockchain technology for the 4 prominent sectors of applications of the blockchain technology is presented in table 8.0.

Business Application	Osterwalder and Pigneur's BM Components								
	Value proposition	**Revenue Streams**	**Cost Structure**	**Customer Segment**	**Channels**	**Customer Relationship**	**Activities**	**Resources**	**Partners**
Crypto-Currency Generation	• autonomous currency • fixed & transparent supply	• digital currency reserve • crowd-funding	• network cost • miner fees • R&D cost • marketing cost	• crypto-consumers • crypto-investors • blockchain start-ups	• website/app • ICO • partner programmes • direct marketing	• availability & merchant acceptance	• marketing • product & process dev. (mining algorithms, rules, etc.)	• s/w protocols • R&D team (s/w dev., system adm., business dev., etc.)	• network providers • miners • crypto-exchanges • investors
Crypto-Payment	• real-time • secure • autonomous • cheap & fast	• transaction fees • merchant subscription fees • crowd-funding	• conversion fees • miner fees • R&D cost	• crypto-consumers & merchants • crypto-exchanges • ICO (start-ups & investors)	• website/app • e-commerce platforms • partner programmes • direct marketing	• online account • e-wallet • debit card • API & plugins	• payment processing • product & process dev.(API, plugins, etc.)	• s/w protocols • R&D team (s/w dev., system adm., business dev., etc.)	• network providers • miners • crypto-providers • investors
Crypto-Trade	• secure • cheap & fast	• trading commission • crowd-funding	• miner fees • R&D cost	• crypto-investors • crypto-merchants • ICO (stat-ups & investors)	• website/app • partner programmes • direct marketing	• online account • e-wallet • debit card	• exchange processing • product & process dev.	• s/w protocols • R&D team (s/w dev., system adm., business dev., etc.)	• miners • crypto-providers • crypto-processors • investors
Smart Contracts	• real-time • autonomous • unforgeable • binding • transparent	• transaction fees • platform usage fees • service fees • crowd-funding	• network cost • platform maintenance • miner fees • R&D cost	• blockchain start-ups • business firms • DAO (distributed autonomous organisations)	• website/app • partner programmes • direct marketing	• online platform • scripting language • API • apps	• product & process dev. (platform, API, script, etc.) • support services	• s/w protocols • R&D team (s/w dev., system adm., business dev., etc.)	• miners • crypto-providers • network providers • investors

Table 8.0: The Business Models* of Blockchain Technology **Prominent Applications*

The explanation of the each of the sector and the characteristics as shown in the table is described below.

1. Crypto-Currency Generation

The value proposition is characterised by providing a currency without a central authority and with a fixed and transparent supply. The revenue streams are through reserving a certain percentage and offering/selling the rest to the public (ICO) and the appreciation in the value of the currency in the market gives value to the reserve. The cost structure is mainly for research & development, paying the miners with digital coins and marketing the currency to investors. The main customers are the consumers, people who invest in digital currency and start-ups using the currency for making and receiving payments with the digital assets. The customer channels are maintained by maintaining company website and app, initiating ICO (initial coin offering), direct marketing and having partner programmes with other relevant blockchain application providers. The customer relationships are maintained by increasing the availability and use of the currency in making payments in the blockchain. The main activities are in marketing the business and the currency, and for R&D activities. The main resources are the software protocols for generating and distributing the currency and the R&D team comprising of software developers, system administrators and business developers. The key partners for sustaining the business are the network providers, the miners for minting new currency while validating transactions, crypto-exchanges easing the distribution of the money and investors providing the capital funding.

2. Crypto-Payments

The value proposition is characterised by being able to provide real-time, fast, secure and cheap payment services. The revenue streams are from charging the customers for their transactions, merchants for subscription of payment option through plugins and receiving funds from investors through crowd-funding. The cost incurred are in paying for converting currency (digital to fiat & vice versa), transaction validator fees and R&D. The main customers are consumers who pay in digital currency and merchants who receive these payments, the crypto-exchanges who use payment processor for trading, and start-ups and their investors

while making payments during ICO's. The main channels in reaching out to customers are by maintaining company website and app, through e-commerce platforms via merchant apps, partnering with other relevant blockchain application providers and direct marketing. The customer relationship are maintained by providing services online, offering e-wallet and debit cards while integrating them together and API and plugins for the merchants. The main activities are in processing the payments and in R&D. The resources are the software protocols used for processing the payments and the R&D team comprising of software developers, system administrators and business developers. The key partners are the network providers, the miners for validating transactions, the providers of digital currency and the investors providing the capital funding.

3. Crypto-Trade

The value proposition is characterised by providing secure, cheap and fast trading of digital currency. The revenue streams are from taking commission for the exchange and receiving funds from investors. The costs are incurred while paying the miners for validating the transaction and for R&D activities. The main customers are the people who invest in crypto-currency, merchants who accept crypto-payments and start-ups and their investors while exchanging assets during ICO. The different channels used to reach out to customers are by maintaining company website and app, partnering with other relevant blockchain application providers and through direct marketing. The customer relationship is maintained by providing online account and, e-wallet and debit-card while integrating them together. The activities are mainly in buying and selling digital currency while processing the exchange and in R&D. The resources are the software protocols used for trading the digital currency and in the R&D team comprising of software developers, system administrators and business developers. The key partners are the network providers, the miners for validating transactions, the providers of digital currency, the crypto-processors for making payments while trading and the investors providing the capital funding.

4. Smart Contracts

The value proposition is characterised by contracts enabling real-time, autonomous, unforgeable, transparent and binding transaction agreements in the blockchain. The revenue streams are through transaction fees, usage fees of the platform and service fees for helping

in the development activities in their platform. The cost incurred are in the network cost, maintaining the development platform, paying the miners for validating transactions and, R&D cost. The main customers are the block-chain start-ups trying to automate their services in the blockchain, business firms like financial institutes and tech firms for automating business rules, and the new distributed autonomous organisations (DAO). The different channels used to reach out to customers are by maintaining company website and app, partnering with other relevant blockchain application providers and through direct marketing. The customer relationship is maintained by providing an online platform with API's, scripting language and development applications. The main activities are in R&D and support services related to the provided contract development tools. The resources are the software protocols for running the services and the R&D team comprising of developers, system administrators and business development teams. The partners are the miners for validating transactions, crypto-providers, network providers and investors providing capital funding.

4.3 Blockchain Application Eco-System Model (Envisioned State)

The business model of the prominent application from a holistic perspective was presented as the final output as seen in table 8.0. The research also explored and investigated the other business applications of the blockchain although there were limitations in the information about them. Through SLR 01, the research found 10 business applications of the blockchain technology and was able to understand the overall business approach and offering of each of these applications and also got an understanding of the new developments in the application of blockchain technology.

From the SLR 02 on business model with cloud computing we found a relationship between the different business models of the cloud computing service providers which gives rise to an eco-system comprising of a customer-partner relationship between these models. This eco-system of the cloud based business models forms the base for this research to develop an eco-system model of the 10 blockchain applications found in SLR 01. Therefore an envisioned eco-system model of these 10 applications of the blockchain technology that presents the different applications within a certain role in the eco-system and the interrelationship they have with each other with respect to the overall blockchain application paradigm is developed. The envisioned model of the blockchain application eco-system for the different sectors applications is presented in figure 5.0.

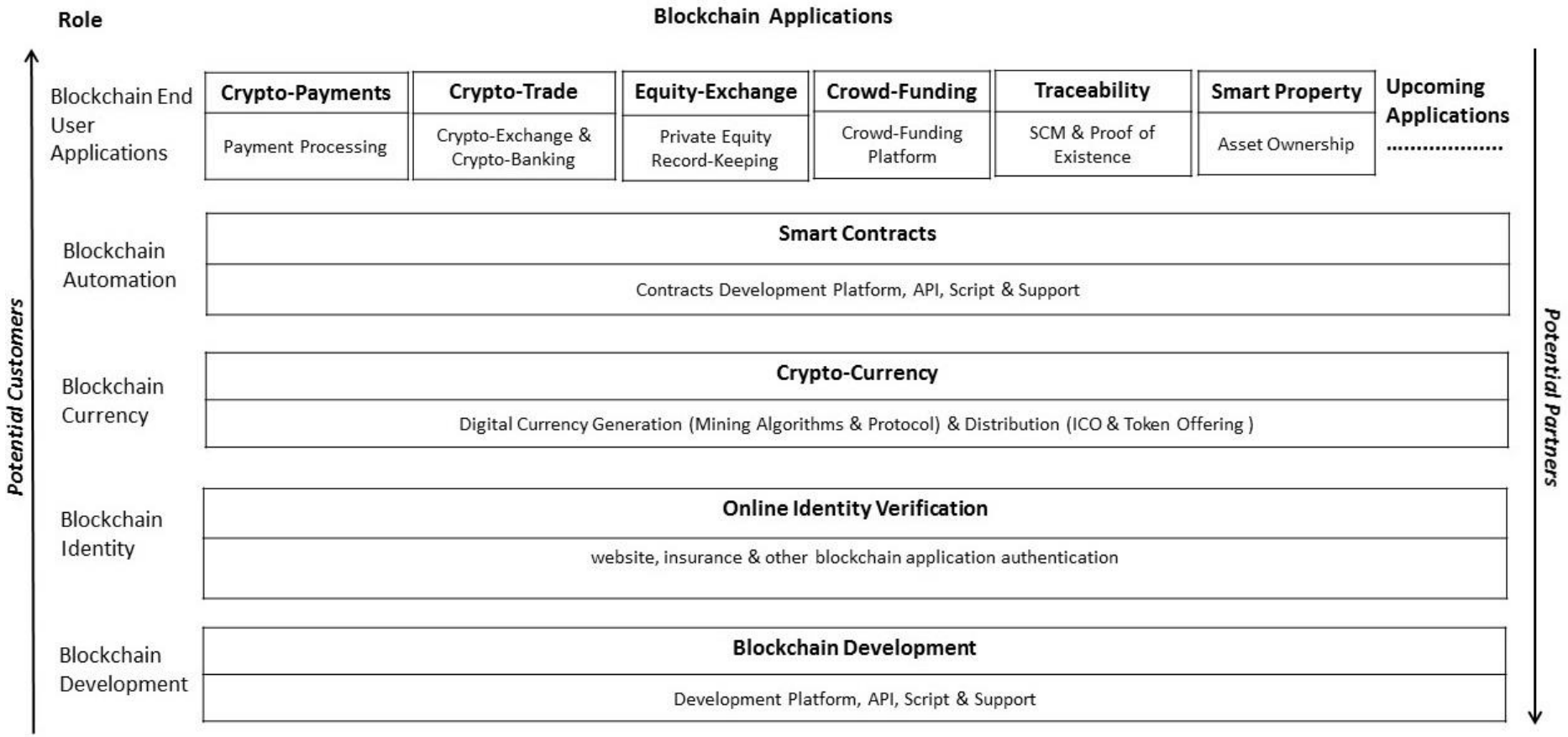

Figure 5.0: Eco-System (envisioned) of the Blockchain Applications

The explanation of the envisioned eco-system model of the blockchain applications is given below.

The model shows an envisioned state of the eco-system that could ultimately exist among the applications empowered by the blockchain technology. Each layer is defined by the role the different application(s) play in the overall blockchain application paradigm. These roles define the interrelationship among them as enterprises dealing with blockchain application in the higher level of the ecosystem model could avail the services of the enterprises dealing with the lower levels making them potential customers. Similarly enterprises dealing with blockchain applications in the lower levels could serve and support the business activities of the enterprises dealing with the higher levels making them potential partners.

Together these applications play a defined role in building an eco-system for the blockchain technology application and corresponding business models of enterprises could fit inside this eco-system. This model is intended to serve potential start-ups and other business enterprises that will venture into the application of the blockchain technology in order to understand the eco-system and position their application of the technology accordingly to quickly leverage from it. This model could also serve future researchers working in the field of blockchain technology applications and corresponding business models to use it as a framework for exploring and defining the potentials of the technology.

The different layers in ascending order and their roles in the eco-system is defined below:

Blockchain Development: This layer is for enterprises that provide the platform, tools and support services for building blockchain applications.

Blockchain Currency: This layer is for enterprises that provide digital currency and therefore serve as a means of securing payments for blockchain application services, transactions, loyalty and memberships.

Blockchain Identity: This layer is for enterprises that provide authentication of each individual user in the blockchain thus providing an identity for securing and validating transactions in the blockchain.

Blockchain Automation: This layer is for enterprises that provide smart contract services in order to automate business negotiations and agreements thus making the blockchain transactions automatic.

Blockchain End User Applications: This layer is for enterprises that provide different category of services corresponding to applications empowered by the overall blockchain application paradigm

5.0 Discussion

5.1 Initial Insights

The research observed in the beginning that blockchain is a new technology and it is considered to be a revolutionary technology in changing the way we carry out our daily lives. It acknowledged the impact of a new digital technology and the need to discover its business potential for making the most out of its offerings and therefore helping the technology expand and reach newer areas in its implementation. Therefore the research was carried out in order to explore and investigate the different business models of blockchain technology. It was also observed that a holistic approach would be able to effectively characterise a business model. The research saw the different elements of Osterwalder and Pigneur's business model and how they comprehensively represent the different entities of a business firm therefore Osterwalder and Pigneur's business model representation comprising of nine elements of a business model design was considered for investigating the business models.

Further the research looked into the past research on the business models of three digital technologies namely social media, cloud computing and big data which highlighted the importance of understanding the adoption of these digital technologies and the business models that have been developed. The research also saw that blockchain technology is the new hype and a field of major study in business globally. The concept of blockchain came about as an underlying technology of bitcoins where transactions of the digital currency is maintained as a distributed public ledger. This technology evolved into providing other substantial business applications in the financial and non-financial sectors. This understanding was important in order to form the fundamental of the investigation as these business applications gives rise to the business models of blockchain. Few research gaps were observed from the background study. The main gap was a lack of a discussion on the different viable business models of the blockchain technology. Also there was limited study on business models of other digital technologies from a holistic perspective. Considering these gaps the research carried out a holistic approach to investigate and explore the different business models of the blockchain technology. In order to explore this the research questions were in the lines of what different business models have come about due to blockchain technology and what's the impact of the technology across the nine components (as defined by Osterwalder and Pigneur) of the business model.

5.2 Methodologies

2 systematic literature reviews were carried out and the findings were further complimented with the help of news publications in Factiva. The findings from SLR 01, i.e., blockchain with business models gave a comprehensive understanding of the different business applications of the blockchain technology. A total of 8 different business applications were chosen to be further investigated as they were discussed more elaborately in several literature and were already being implemented. The business applications of the blockchain that were found from SLR 01 were further investigated in order to understand the impact on each of the components of the business model. News publication on the start-ups that have ventured into each different sector of business application were searched in Factiva and 4 of the business applications had a comprehensive information and discussion related to the different components of the BM. Therefore 4 of these applications namely, crypto-currency, crypto payments, crypto-trading and smart contracts and their holistic business model were presented as the final results. The findings from SLR 02, i.e., digital technologies with cloud computing gave an understanding of the different cloud empowered business models. This formed a background for further investigation to explore and understand the business models of blockchain technology and the inter-relationship between these models. This ultimately helped in identifying and proposing the blockchain application eco-system. SLR 02 also helped understand the impact of these technologies on the nine components of the business model thus providing a background for a holistic approach in exploring the business models of the blockchain. Moreover the findings of the research showed many similarities between the properties of the components of the business model empowered by the cloud-computing services as seen from the findings of SLR 02 and the business model empowered by the blockchain applications.

5.3 The Artefacts: Blockchain BM and Eco-System

From the BM's of the blockchain applications it's seen that the start-ups venturing into providing crypto-currency mainly benefit from the rise in the prices of the value of these currencies. Most of the currencies are offered as ICO and tokens by new-start-ups to fund themselves. Others provide it for serving other blockchain applications in making payments for transactions in the blockchain. Thus the business model of these start-ups are characterised by those aspects. The start-ups venturing into crypto-payments mainly benefit

from the transaction cost for the payment processing services they offer. The payment services are generally required by all start-ups and other business firms including general users intending to benefit from its efficiency in making digital payments. Thus the business models of these start-ups are characterised by those aspects. The start-ups venturing into providing crypto-trading services also benefit from transaction fees the users pay. These business models sustain due to the consumers intentions of buying, using and selling crypto-currency and therefore all start-ups, business firms and general users benefit from it. Thus the business models of these start-ups are characterised by those aspects. The start-ups venturing into providing smart contract services mainly benefit from usage and transaction fees while using their platform and related service. The automation of the transactions generated by other blockchain business applications is the primary use of the smart contract services. Thus the business models of these start-ups are characterised by those aspects.

The blockchain application eco-system compromises of the 10 different applications of blockchain categorised into 5 layers with each layer distinguished by the role it plays in the eco-system. The first layer from the bottom is for applications providing blockchain development services, while the second layer is for applications providing authentication. The third layer is for providing currency for the blockchain while the fourth layer is for automating the blockchain transactions in the form of smart contracts. Finally the upper layer is for end-user blockchain applications powered by the layers below. In the ecosystem model, the applications below can be potential partners for the ones above which in turn can be potential customers for the ones below in the eco-system. T

5.4 Significance

This research has been able to explore the 10 prominent blockchain applications discussed in previous research and has investigated and found the business model of 4 of these applications. It has also proposed an envisioned blockchain application eco-system. The business model and the eco-system both are developed for the reference of new and future start-up companies in order to position their business model in the eco-system according to the blockchain business application they are venturing in. The findings including the business models of the blockchain technology and the eco-system were validated and improved accordingly through 2 interviews with experts in the field of blockchain application. The research proposed to come up with an understanding of the business models of the

blockchain technology from a holistic perspective. The research was able to explore the different business applications and also provide the business model for the main applications of the blockchain technology. It was also able to explore the effect of the technology across the nine components of the business model in-depth. This findings also highlighted the inter-relationship between these components and the business models. This relationship was further seen in the blockchain application eco-system. This findings will be very significant for the further understanding of the technology and its impact in providing new business opportunities and the business models associated to it. Start-ups will be able to understand their position in the overall blockchain application paradigm and understand the different aspects on how to make their business viable and sustainable. This research also contributes towards the academic research on blockchain and can be referred for future research in the topic.

5.5 Limitations

The limitations of the research are mainly due to the technology being new and therefore there are limited research work done in the field of blockchain. Moreover the different applications are still growing in number and most of them do not have matured business models and are still in their early stages due to which there are limited information about these applications. Therefore the research was able to present the business model of only 4 different business applications of the blockchain. As the other applications of the block chain mature there is a possibility for research on investigating the business models for these applications. The other limitation is also the increasing number of new developments in the field which has an effect in the overall application of the technology and therefore also to the business models. Therefore there is a possibility of a lot of changes in the application of the technology which also would provide newer scope for future research in the area.

5.6 Future Research

Blockchain Technology is growing and with it a lot of research and development activities are going on in the field. In the past there has been a lot of research done on Bitcoins and other virtual currency as well as on the technicalities of how the blockchain work. However as the blockchain has moved beyond the application of crypto-currency there has been a keen interest from academicians and business firms alike in trying to discover and understand the possibilities brought-about by this technology. An increasing amount of financial as well as

non-financial applications is seen and the business models of each of these applications are developing and therefore maturing. These developments opens up new areas and scope for future research. The different business models of these applications can be studied in-depth separately. As new blockchain applications come up, this will further evolve the blockchain eco-system and this inter-relationship among the applications and their corresponding business models can also be relevant for future research. Blockchain can be integrated with other digital technologies like Big Data and Internet of Things and therefore this can be an area for future study as well. There is an increasing scope for future study in the field of Blockchain Technology and as the technology grows in application and maturity, several scope for future research will arise.

6.0 Conclusion

The objective of the research was to explore the various business models empowered by the blockchain technology of start-up companies. As new technologies come-up, it becomes crucial to understand the underlying technicalities of the technology and therefore there is a need for a consensus between the different organizations and professionals working in the field. The more mature blockchain gets, the more understanding of the possibilities created by it as well as the challenges of implementing it come about. However it's also very important to understand the business implications of a technology and its viability in generating new business opportunities as well as improving existing operations, services and the overall business model itself. Therefore this research looked into the different business opportunities presented by the blockchain technology by investigating the various business models that have come about due to its application in different business sectors. The research identified the prominent blockchain applications and found a lack of well-defined business models for the less developed blockchain applications. Therefore the business models of more prominent financial applications were presented.

Most of the applications of blockchain technology are seen in the financial sector, private and public record keeping and asset management but applications in many other domains are increasingly coming up. One of the recent developments has been in the concept of Initial Coin Offering (ICO) where increasing number of start-ups are offering their own tokens in order to fulfil funding needs which is a kind of crowdfunding. Smart contract platforms like Ethereum have come up with new value-added offerings such as a platform to develop your own virtual currency, or to build decentralised applications or to run a decentralised autonomous organizations through the smart contracts. Some of the other emerging applications are in de-centralised cloud-storage of data, tracking votes in elections and maintaining decentralised notary through the proof-of-existence of legal documents using blockchain. These developments show possibilities of revolutionising the way business is done. Blockchain can be integrated and used with other technologies to expand its usage. One typical case is where Blockchain is to be used with Internet of Things (IoT) devices and smart contracts initiate and manage automated interactions between these connected devices. This

gives way to a lot of new advanced applications and it's predicted that most business activities as well as our everyday mundane tasks would be one day made automatic and handled through the use of the blockchain partnered with other technologies. Some of the advanced envisioned applications of blockchain include the concept of self-paying cars, usage-based payments and smart cities making extensive use of the blockchain technology. This will slowly evolve the overall blockchain application paradigm and with it the interrelationship between the various business models and their characteristics. As more research and development activities are carried out the technology will mature and therefore there will be a much clear and stable understanding on the implication of the technology on business applications and their business model. This will help professionals and companies venturing into the technology to take more informed decisions and therefore make the most out of the benefits offered by the blockchain technology.

This research is meant to be a contribution towards understanding the business models of blockchain in its early stages of adoption. It hopes to have provided a meaningful finding and contribution that can be used as part of the ongoing research in the field of this revolutionary technology. Blockchain is very promising and it has been able to already deliver in some of those aspects and considering the hype, rapid development and investments in the technology, it is very near in being the next technology that will be a significant part of our daily lives and almost completely change the way we live.

7.0 References

Agnihotri, R., Kothandaraman, P., Kashyap, R., & Singh, R. (2012). Bringing "Social" into Sales: The Impact of Salespeople's Social Media Use on Service Behaviors and Value Creation. *Journal of Personal Selling and Sales Management*, *32*(3), 333–348. https://doi.org/10.2753/PSS0885-3134320304

Amit, R., & Zott, C. (2009). Business Model Innovation: Creating Value In Times Of Change. *Universia Business Review*, *3*, 108–121. https://doi.org/10.2139/ssrn.1701660

Breitman Kathleen. (2017). What's next for blockchain and cryptocurrency | TechCrunch. Retrieved May 16, 2017, from https://techcrunch.com/2017/01/23/whats-next-for-blockchain-and-cryptocurrency/

Brereton, P., Kitchenham, B. A., Budgen, D., Turner, M., & Khalil, M. (2007). Lessons from applying the systematic literature review process within the software engineering domain. *Journal of Systems and Software*, *80*(4), 571–583. https://doi.org/10.1016/j.jss.2006.07.009

Brisbanetimes. (2017). Digital currency frenzy crashes Coinbase exchange. Retrieved July 25, 2017, from http://www.brisbanetimes.com.au/technology/technology-news/coinbase-digital-currency-exchange-has-outage-as-trading-soars-20170613-gwpw8s.html

Brownlow, J., Zaki, M., & Neely, A. (2015). Data-Driven Business Models : A Blueprint for Innovation. *Cambridge Service Alliance*, (5), 1–17. https://doi.org/10.13140/RG.2.1.2233.2320

Business Wire. (2014). BitPay Announces Bitcoin Payroll API. *Business Wire*, p. 1.

Castor, A. (2017). Ethereum "Tokens" Are All the Rage, but What Are They Anyway? Retrieved July 28, 2017, from https://www.coindesk.com/ethereums-erc-20-tokens-rage-anyway/

Cheok, J. (2017). CROWDFUNDING; S'pore startup launching SEA's first cryptocurrency crowdfunding platform. *Singapore Press Holdings Limited*, pp. 1–2.

Chesbrough, H. (2010). Business model innovation: Opportunities and barriers. *Long Range Planning*, *43*(2–3), 354–363. https://doi.org/10.1016/j.lrp.2009.07.010

Computer Weekly News. (2016). BitPay; BitPay Introduces Copay BitcoinWallet Integration Based on Intel Technologies. *Computer Weekly News*, p. 1.

Crosby, M., Nachiappan, Verma, S., & Kalyanaraman, V. (2015). Blockchain Technology Beyond Bitcoin. *Blockchain Technologies*, 1–27. Retrieved from http://www.blockchaintechnologies.com/blockchain-definition

Daily Independent. (2017). BABB App creates banking platform using Ethereum smart contracts. *Daily Independent*, p. 1.

DaSilva, C. M., Trkman, P., Desouza, K., Lindic, J., & Lindič, J. (2013). Disruptive technologies: a business model perspective on cloud computing. *Technology Analysis & Strategic*

Management, *25*(10), 1161–1173. https://doi.org/10.1080/09537325.2013.843661

Duggan, W. (2017). How To Actually Buy Bitcoin Or Ethereum. *Benzinga.com*, p. 1.

Emirates News Agency. (2016). IBM offers Blockchain services to the supply chain. *Emirates News Agency (WAM)*, p. 1.

Eyal, I., & Sirer, E. G. (2014). Majority is not enough: Bitcoin mining is vulnerable. (S.-N. R. & C. N., Eds.). Department of Computer Science, Cornell University, Ithaca, United States: Springer Verlag. https://doi.org/10.1007/978-3-662-45472-5_28

Eyers, J. (2016). "Smart contracts" to disrupt lawyers. *Fairfax Media Management Pty Limited*, pp. 1–3.

Fletcher, R. H., Fletcher, S. W., Jiménez, V., Díaz De Salas, S., Mendoza, V., Porras, C., … Noor, K. B. M. (1997). Case study as a research method. *Academy of Management Review*, *5*(2), 301–316. https://doi.org/10.1177/15222302004003007

Free Malaysia Today. (2017). Bitcoin exchange Coinbase seeks new funds at $1 billion valuation. Retrieved July 26, 2017, from http://www.freemalaysiatoday.com/category/business/2017/06/04/bitcoin-exchange-coinbase-seeks-new-funds-at-1-billion-valuation/

French Collection. (2016). LaBChain consortium adopts Blockchain technology for smart contracts. *All Data Processing Ltd.*, p. 1.

Giesen, E., Berman, S. J., Bell, R., & Blitz, A. (2007). Three ways to successfully innovate your business model. *Strategy & Leadership*, *35*(6), 27–33. https://doi.org/10.1108/10878570710833732

Helms, K. (2017). Bitpay Adds Miner Fees To Invoices. Retrieved July 26, 2017, from https://news.bitcoin.com/bitpay-miner-fees-invoices/

Hertig, A. (2017). Ethereum's Double-Edged Sword: Will a Rising Price Hurt Users? Retrieved July 28, 2017, from https://www.coindesk.com/ethereums-double-edged-sword-will-rising-price-hurt-users/

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design Science in Information Systems Research. *MIS Quarterly*, *28*(1), 75–105. https://doi.org/10.2307/25148625

Hurlburt, G. (2016). Might the Blockchain Outlive Bitcoin? *IT Professional*, *18*(2), 12–16. https://doi.org/10.1109/MITP.2016.21

Investing.com. (2017). Bitcoin inches higher while Ethereum pares losses from prior session. *Investing.com*.

Investment Weekly News. (2017). Ripple; XRP Liquidity to IncreaseWith Listings on 6 New Exchanges. *Investment Weekly News*, pp. 1–2.

Jayaseelan, R., & Farhana Zainul, I. (2017). The dawn of cryptocurrency. Retrieved July 6, 2017, from http://www.thestar.com.my/business/business-news/2017/07/01/the-dawn-of-cryptocurrency/

Kane, E. (2017). Is Blockchain a General Purpose Technology? *SSRN Electronic Journal*, 1–27.

https://doi.org/10.2139/ssrn.2932585

Ketonen-Oksi, S., Jussila, J., & Kärkkäinen. (2016). Industrial Management & Data Systems For Authors Social Media-Based Value Creation and Business Models. *Industrial Management & Data Systems*, *116*(8). https://doi.org/10.1108/IMDS-05-2015-0199

Kitchenham, B. (2006). Guidelines for performing Systematic Literature Reviews in Software Engineering. In *Proceeding of the 28th international conference on Software engineering - ICSE '06* (Vol. 2, p. 1051). https://doi.org/10.1145/1134285.1134500

Labes, S., Hanner, N., & Zarnekow, R. (2016). Successful Business Model Types of Cloud Providers. *Business & Information Systems Engineering*, 1–11. https://doi.org/10.1007/s12599-016-0455-z

Lakka, S., Michalakelis, C., Stamati, T., Anagnostopoulos, D., Venizelou, E., Michalakelis, C., & Venizelou, E. (2015). A Framework for the Classification of Could Computing Business Models. In *Proceedings of the 19th Panhellenic Conference on Informatics* (pp. 221–226). New York, NY, USA: ACM. https://doi.org/10.1145/2801948.2802028

Lee, J., Long, A., McRae, M., Steiner, J., & Handler, S. G. (2015). BLee, J., Long, A., McRae, M., Steiner, J., & Handler, S. G. (2015). Bitcoin Basics: a Primer on Virtual Currencies. Business Law International, 16(1), 1-2-48. Retrieved from https://search.proquest.com/docview/1687833680?accountid=27026itcoin Basics: a P. *Business Law International*, *16*(1), 1-2-48. Retrieved from https://search.proquest.com/docview/1687833680?accountid=27026

Lindgardt, Z., Reeves, M., Stalk, G., & Deimler, M. S. (2009). Business Model Innovation: When the Game Gets Tough, Change the Game. *Boston Consulting Group*, (December), 9. https://doi.org/10.1108/10878570710833714

Long, K. (2017). Ripple reaps benefits of payments focus. *Euromoney Institutional Investor Plc*, pp. 1–3.

Lord, S. (2015). 3 key things to understand about Coinbase's record-setting raise. *The Alpha Pages, LLC Coinbase's*.

M-Brain. (2015). Estonia: Funderbeam to unveil crowd funding and trading platform. *Esmerk Baltic News*, p. 1.

M2 Presswire. (2016). YoCoin is The New Ethereum Asset with Smart Contract Application. *M2 Communications*, p. 1.

M2 Presswire. (2017a). Digital Developers Fund announces fundraising via Initial Coin Offering (ICO).

M2 Presswire. (2017b). Third Eye Sunglasses Now Accepting Bitcoin and Ripple. *M2 Communications*, pp. 1–2.

Matt, C., Hess, T., & Benlian, A. (2015). Digital Transformation Strategies. *Business and Information Systems Engineering*, *57*(5), 339–343. https://doi.org/10.1007/s12599-015-0401-5

Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation*. *Booksgooglecom* (Vol. 30).

https://doi.org/10.1523/JNEUROSCI.0307-10.2010

Pai, V. (2015). Coinbase launches bitcoin debit card in the US. *MixedBag Media Pvt. Ltd*, p. 1.

Pihl, C., & Sandström, C. (2013). Value creation and appropriation in social media – the case of fashion bloggers in Sweden. *Int. J. Technology Management*, *614*(34), 309–323. https://doi.org/10.1504/IJTM.2013.052673

Pilkington, M. (2016a). Blockchain technology: Principles and applications. In *Research Handbooks on Digital Transformations* (pp. 225–253). University of Burgundy, Burgundy, France: Edward Elgar Publishing Ltd. https://doi.org/10.4337/9781784717766

Pilkington, M. (2016b). Blockchain technology: Principles and applications. In *Research Handbooks on Digital Transformations* (pp. 225–253). University of Burgundy, Burgundy, France: Edward Elgar Publishing Ltd. https://doi.org/10.4337/9781784717766

Roston, B. A. (2017). Coinbase tipped at $1b valuation as demand for cryptocurrency soars. Retrieved July 25, 2017, from https://www.slashgear.com/coinbase-tipped-at-1b-valuation-as-demand-for-cryptocurrency-soars-02487305/

Schallmo, D., & Brecht, L. (2010). Business Model Innovation in Business-to-Business Markets - Procedure and Examples. *Proceedings of the 3rd ISPIM Innovation Symposium: "Managing the Art of Innovation: Turning Concepts into Reality,"* 1–24. Retrieved from https://www.uni-ulm.de/fileadmin/website_uni_ulm/mawi.inst.125/documents/research/pubications/Business_Model_Innovation_in_Business-to-Business_Markets_-_Procedure_and_Examples_V08_DSC.pdf

Schroeder, R., & Halsall, J. (2016). Big data business models: Challenges and opportunities. *Cogent Social Sciences*, *2*(1), 1166924. https://doi.org/10.1080/23311886.2016.1166924

Shin, L. (2016). Bitcoin's Blue Chip. *Forbes*, pp. 1–4.

Sultan, N., & van de Bunt-Kokhuis, S. (2012). Organisational culture and cloud computing: coping with a disruptive innovation. *Technology Analysis & Strategic Management*, *24*(2), 167–179. https://doi.org/10.1080/09537325.2012.647644

Swan, M. (2015). *Blockchain: Blueprint for a New Economy*. *O'Reilly Media*. https://doi.org/10.1017/CBO9781107415324.004

Teece, D. J. (2010). Business models, business strategy and innovation. *Long Range Planning*, *43*(2–3), 172–194. https://doi.org/10.1016/j.lrp.2009.07.003

Tian, C. (2017). UK Payments Startup Integrates Bitcoin After $66 Million Fundraise. Retrieved July 26, 2017, from https://www.coindesk.com/uk-payments-startup-integrates-bitcoin-66-million-fundraise/

TradeArabia. (2017). Ethereum Is Already Using a Small CountrysWorth of Electricity 928.

Webster, J., & Watson, R. T. (2002). Analyzing the Past to Prepare for the Future : Writing a

Literature Review ANALYZING THE PAST TO PREPARE FOR THE FUTURE : WRITING A. *MIS Quarterly*, *26*(2), 13–23. https://doi.org/10.1.1.104.6570

Wong, C. (2017). New cryptocurrencies are gaining momentum. *The Canadian Press*, pp. 1–2.

Yli-Huumo, J., Ko, D., Choi, S., Park, S., & Smolander, K. (2016). Where is current research on Blockchain technology? - A systematic review. *PLoS ONE*, *11*(10), 1–27. https://doi.org/10.1371/journal.pone.0163477

Your Story. (2015). Pursuit of APPiness: Coinbase Merchant, BriefMe and OneShot. *Your Story*, pp. 1–2.

Zott, C., Amit, R., & Massa, L. (2011). The Business Model: Recent Developments and Future Research. *Journal of Management*, *37*(4), 1019–1042. https://doi.org/10.1177/0149206311406265