VALUE CREATION IN CRYPTOCURRENCY NETWORKS: TOWARDS A TAXONOMY OF DIGITAL BUSINESS MODELS FOR BITCOIN COMPANIES

Erol Kazan, Department of IT Management, Copenhagen Business School, Denmark, eka.itm@cbs.dk

Chee-Wee Tan, Department of IT Management, Copenhagen Business School, Denmark, cta.itm@cbs.dk

Eric T. K. Lim, School of Information Systems, Technology and Management UNSW Business School, University of New South Wales, Australia, e.t.lim@unsw.edu.au

Abstract

Cryptocurrency networks have given birth to a diversity of start-ups and attracted a huge influx of venture capital to invest in these start-ups for creating and capturing value within and between such networks. Synthesizing strategic management and information systems (IS) literature, this study advances a unified theoretical framework for identifying and investigating how cryptocurrency companies configure value through digital business models. This framework is then employed, via multiple case studies, to examine digital business models of companies within the bitcoin network. Findings suggest that companies within the bitcoin network exhibits six generic digital business models. These six digital business models are in turn driven by three modes of value configurations with their own distinct logic for value creation and mechanisms for value capturing. A key finding of this study is that value-chain and value-network driven business models commercialize their products and services for each value unit transfer, whereas commercialization for value-shop driven business models is realized through the subsidization of direct users by revenue generating entities. This study contributes to extant literature on value configurations and digital businesses models within the emerging and increasingly pervasive domain of cryptocurrency networks.

Keywords: Digital Business Models, Value Configuration, Cryptocurrency, Bitcoin, Value Networks.

INTRODUCTION

Cryptocurrencies are digital currencies based on cryptographic technology, which regulates the generation, verification and transaction between two or more parties. Transactions involving cryptocurrencies are typically recorded in an open and distributed public digital ledger (e.g., blockchain) (European Central Bank 2012, p. 24). In contrast, fiat payment networks (e.g., Euro) require intermediaries (e.g., central banks) to perform the aforementioned activities, though, often in a centralized manner.

Cryptocurrencies have acquired notable attention as alternate currencies that may complement, if not supplant, contemporary fiat payment networks[1]. For this reason, cryptocurrencies have become an attractive investment vehicle with growing market capitalization. Take bitcoin as an illustrative example. Since its inception in 2008, bitcoin has gained considerable momentum to become one of the most prominent and symbolic cryptocurrencies in circulation with an estimated market capitalization value of USD $4 billion (March 2015). Despite its price volatility, the bitcoin network has given birth to a diversity of start-ups and attracted a huge influx of venture capital. According to recent statistics, venture capitalists have injected USD $550 million globally for bitcoin related start-ups by February 2015 (CoinDesk 2015). Like most other cryptocurrencies, one of bitcoin's core value proposition stems from its open, decentralized, and peer-to-peer (P2P) value network (cf. Stabell & Fjeldstad 1998). The bitcoin network promises substantial efficiency gains (e.g., low fees) as compared to digital payment systems based on fiat money. Furthermore, due to its open and agnostic nature, the bitcoin protocol embodies capabilities to support independent and unsolicited innovations. For instance, bitcoin developers are free to introduce innovative applications to augment the bitcoin network without any third party interference. In this sense, bitcoin and its underlying blockchain technology embody disruptive market capabilities (Christensen & Bower 1996).

Cryptocurrencies like bitcoin offer unprecedented business opportunities. Because cryptocurrency companies (e.g., bitcoin exchanges) are embedded within an interconnected but decentralized innovation ecosystem (cf. Adner & Kapoor 2010; Iansiti & Levien 2004; Nambisan & Sawhney 2011), they tend to modularize the components of one another in order to co-create and capture value through orchestrated digital business models (cf. Bharadwaj, El Sawy, Pavlou, & Venkatraman 2013) — a trend Staudenmayer, Tripsas, & Tucci (2005) labelled as inter-firm modularity. Cryptocurrencies can thus be construed as mediating technological artifacts for companies to achieve their business goals (Stabell & Fjeldstad 1998; Thompson, Scott, & Zald 2011).

Although the value afforded by cryptocurrency companies has received much recognition across various industries and financial markets (e.g., cross-border payments), there is a paucity of studies that investigate how these firms can create and capture value within such networks. Embracing the theoretical lens of digital business model and value configuration, we conduct an exploratory study of bitcoin companies in an attempt to provide an answer to the following research question: *How do cryptocurrency companies create and capture value through digital business models?*

To answer the research question, we draw on focal concepts of digital business model from prior research (Al-Debei & Avison 2010), especially with regards to value creation and capturing mechanisms within value networks (Pagani 2013; Stabell & Fjeldstad 1998). We exclude business strategies, processes, and cost factors from our analysis because our primary motivation is to disentangle the *value dimensions* of digital business models within cryptocurrency networks.

By contrasting fiat payment networks and cryptocurrency networks, we glean insights into how traditional payment institutions and cryptocurrency companies differ in the way value is created and captured. We argue that cryptocurrency companies have the option to apply three different value

[1] URL: http://www.wsj.com/articles/do-cryptocurrencies-such-as-bitcoin-have-a-future-1425269375

configurations (Stabell & Fjeldstad 1998), which is resulting into six generic bitcoin driven digital business models.

This study advances knowledge in three ways. First, our study compliments prior research by uncovering the types of digital business models existing within cryptocurrency networks. Second, we assimilate extant literature on digital business model and value configuration in order to pinpoint and bridge knowledge gaps on value creation and capturing within value networks. Lastly, this paper responds to Bharadwaj et al. (2013) call for an in-depth appreciation of how digital business models should be structured for interconnected organizations within value networks.

THEORETICAL FOUNDATION

In this section, we contrast the business logic of fiat payment networks and cryptocurrency networks in order to highlight commonalities and differences between the two networks. Next, we synthesize extant literature on digital business model and value configuration to derive an analytical framework for scrutinizing the value creation logic and value capturing mechanisms of cryptocurrency companies (Al-Debei & Avison 2010; Stabell & Fjeldstad 1998). In doing so, we hope to shed light on how digital business models are structured within cryptocurrency networks.

Contextual Underpinnings: Contrasting Fiat Payment and Cryptocurrency Networks

Fiat Payment Networks

Payment is the process of transferring money from a sender to a receiver that involves payment instruments, payment processing and payment settlement (Kokkola 2010). Most fiat payment networks are four-party schemes: parties enter into a technical and commercial agreement with a card scheme owner (e.g., VISA), which mediates payment between senders and receivers. In this sense, the payment card-scheme owner dictates the technology (e.g., standards) and commercial (e.g., fees and liability) agreements through which each individual actor participates in this value network. To illustrate the logic of a payment card-scheme (see Figure 1), authorized (1) card issuers (e.g., banks) supply payment cards to (2) cardholders (i.e., sender) that permit the latter to initiate payments for goods or services at (3) merchants' checkout counter (i.e., receiver). To debit the payment from a cardholder's bank account, a merchant sends a debit payment request to (4) its acquirer (e.g., merchant's bank) and the acquirer forwards the debit payment request, via the card scheme owner, to the relevant card-issuer. If the cardholder's (i.e., sender) bank account has sufficient liquidity, the card issuer authorizes and settles the payment request. Ultimately, the merchant (i.e., receiver) gets notified about the successful debit, and the cardholder receives the good or service he/she paid for.

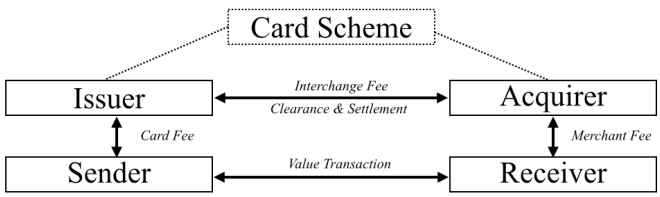

Figure 1. Sender and Receiver of a Fiat Payment Network

Contrary to fiat payment systems, cryptocurrencies like bitcoin is, in essence, a two-party payment system. Bitcoin is an open decentralized peer-to-peer (P2P) cryptocurrency network, where every bitcoin transaction is recorded in an open and distributed transaction log called the blockchain. The rules of the bitcoin network are enforced by protocols and cryptography, which regulates the generation, verification, transaction and ownership of bitcoins. New bitcoins are generated through a process known as mining, which is essentially a race among computing systems to find a solution for a

mathematical problem. In doing so, these bitcoin miners simultaneously, and in parallel, clear and settle bitcoin transactions (i.e., previously mined bitcoins) that has been broadcasted to the P2P bitcoin network. The result from this mining process are: (1) newly minted bitcoins, as well as; (2) the verification, transaction and recording of bitcoin transactions on the blockchain. This culminates in the growth of the blockchain over time with the issue and clearance of new bitcoin units and transactions (see Figure 2).

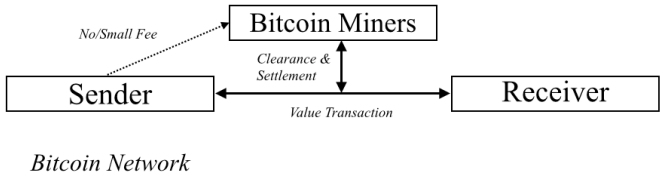

Figure 2. Sender and Receiver of a Bitcoin Payment Network

In contrasting fiat payment networks with cryptocurrency networks, we can deduce that each transaction, be it fiat or bitcoin, involves four generic value adding activities, namely *initiation*, *authentication*, *authorization*, as well as *clearing* and *settlement*. These aforementioned activities can be summarized under the umbrella term *mediation*, as each activity has the attributes of being simultaneous, parallel, and polyadic through the means of a technology artifact. Based on the abovementioned observations, cryptocurrency networks are technically designed to reduce actors in the value stream, as bitcoin miners perform the tasks of acquirers and issuers, presenting thereby disintermediation opportunities.

Digital Business Model: A Conceptual Overview

Information technology has radically altered market structures and the way firms compete (Bharadwaj et al. 2013), thereby leading to complex, dynamic and uncertain business environments. According to Al-Debei and Avison (2010), this shift has opened up knowledge gaps in how digitized firms *create* and *capture value*. Not surprisingly, the technologically-driven transformation of conventional market structures has given rise to novel digital business models that challenge long-standing notions of what a business model constitutes.

The business model research stream has received substantial attention among management scholars in their bid to explain the logic behind how businesses create and capture value (Amit & Zott 2001; Hedman & Kalling 2003; Magretta 2002; Osterwalder & Pigneur 2005; Timmers 1998). Though, the search for definitive constituents of digital business model (e.g., its components, dimensions) is often confounded by conceptual "silos" and "fuzziness" (Al-Debei & Avison 2010, p. 7; Zott, Amit, & Massa 2011, p. 1020). Complicating it further, divergent views use the business model term interchangeably, thereby blurring the conceptual distinction between *business strategy* (Porter 1980) and *business processes* (Barua, Konana, Whinston, & Yin 2004; Porter 1991; Ray, Barney, & Muhanna 2004) in past studies (Al-Debei & Avison 2010, p. 365).

To disentangle the concept of business model, we subscribe to Al-Debei and Avison (2010) conception of business model whereby the *business model* is conceived as a theoretical layer between business strategy (e.g., industry positioning) and business process (e.g., operational activities), which is helping digital enabled organizations to formulate how it creates and captures value.

The notion of business models (i.e., value creation and capture) has been both explored in the information systems (IS) as well as in the strategic management literature. In the following paragraphs we will review and synthesize the commonalities of these two research areas to derive our unified theoretical model for analyzing the data.

Three Different Value Configurations

Within strategic management literature, scholars have introduced the notion of value configurations to depict how firms create and capture value (cf. Casadesus-Masanell & Zhu 2013, p. 464). Building on the seminal work of Stabell and Fjeldstad (1998), firms create value according to three generic *value configurations*: (1) value chain (i.e., transforming inputs into valued outputs), (2) value shop (i.e., solving problems), and; (3) value network (i.e., connecting and/or matching stakeholders).

One of most common and well-known value configurations is the value chain (Porter 1985). The value chain describes how organizations create and deliver value by transforming inputs into valued outputs via a *sequential process* (e.g., manufacturing). Despite its prevalence, Stabell and Fjeldstad (1998) argued that the value chain is an inappropriate theoretical lens to portray those firms' whose value creation logic stems from offering mediation mechanisms (e.g., telecommunication operators). Another instance of conceptual ambiguity is the value creation logic for firms that use their organizational capabilities to solve (customer) problems (e.g., consulting firms).

To better reflect those firms, Stabell and Fjeldstad (1998) proposed, in addition to the value chain, the *value network* and *value shop*. Firms within the value network class create value primarily by connecting and matching different stakeholders (Eisenmann, Parker, & Van Alstyne 2006) through a mediating (IT) artifact. In doing so, these activities are characterized by being *simultaneous, parallel,* dyadic, and/or polyadic. Furthermore, the arrangement of this value configuration illustrates reciprocal (business) interests among interconnected stakeholders (Normann & Ramirez 1993; Stabell & Fjeldstad 1998, p. 429), thereby having the architectural attributes of being layered and modular (cf. Yoo, Henfridsson, & Lyytinen 2010). Firms in the value shop category, on the other hand, create value primarily by assessing a current problem, and modify it iteratively until the desired solution has been reached (Stabell & Fjeldstad 1998).

Arguably, firms follow either the concept of value network (co-create and capture value through the means of *mediating* IT artifact), value shop (utilizing internal capabilities to solve problems), or the value chain (creating value through processing inputs into valuable outputs in a *sequential* manner. To a large extent, these three value configurations apply to digital firms as well. As businesses get increasingly digitized, another instant of missing clarity is how value configurations are linked with digital business models. In this paper, we argue that digital business models are synonyms with value configurations, as digital business models are contextualized within a specific value environment that embodies one or more generic value configurations (e.g., value network).

The Four Value Dimensions of Digital Business Models

To describe generic value creation and capture mechanisms of digital enabled firms, we adapt the *value dimensions of business models* advocated by Al-Debei and Avison (2010). Distilled from a business model literature review, Al-Debei and Avison (2010) identified 22 different business model definitions, which has been further delineated into a taxonomy of 13 mutually exclusive classes. Among these 13 business model classes, four generic value dimensions have been derived, representing core elements of a business model among digital firms: (1) *value creation logic*, (2) *value capturing mechanisms*, (3) *value delivery architecture*, and lastly (4) *value stakeholder network*:

- *Value creation logic* describes the core activities of a digital organization while offering its products and services. Value creation in the value network class perform efficient *mediation* among different stakeholders, firms in the value shop category solve problems, whereas firms in the value chain group *transform* inputs into valuable outputs in an efficient and sequential manner (Eisenmann et al. 2006; Porter 1985; Stabell & Fjeldstad 1998).
- *Value capturing mechanisms* describe the logic of a digital organization in how it extracts value from its value creation (e.g., charging fees) (Osterwalder & Pigneur 2005; Ovans 2015).
- *Value delivery architecture* is the hard to replicate organizational capabilities, and resource configurations of a firm. It represents thereby the architectural boundary, and its organizational

means how digital firms create and capture value. Most digital enabled firms make use of tools (e.g., digital platforms) to deliver value (Yoo et al. 2010).

- *Value stakeholder network* presents a system based on interfirm modularity (Staudenmayer, Tripsas, & Tucci 2005), where various firms in interconnected networks (Adner & Kapoor 2010; Iansiti & Levien 2004) contribute and mediate configured components (resources), and modules to derive value in an orchestrated manner (e.g., bitcoin business network).

To understand how the abovementioned four value dimensions and three value configurations are related and intertwined, we reconceptualize these two concepts into a unified model (Figure 3), which is serving as an analytical lens for our empirical data set.

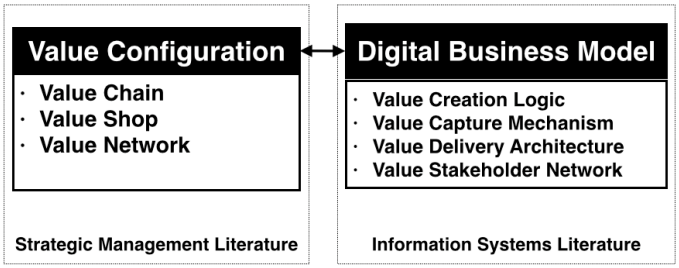

Figure 3. Analytical Framework: Value Creation and Capture in Digital Business Models

RESEARCH METHOD

For data collection purposes, we restrict our empirical context to the bitcoin network as it is symbolic of most cryptocurrency networks with slight variations. Data is gathered through multiple and interpretive case studies to examine how companies within the bitcoin network create and capture value (Walsham 1995; Yin 2009). We hence embrace an exploratory approach to comprehending value configuration within the bitcoin network. We deem the case study approach to be an appropriate mode of inquiry as it can answer "*how*" and "*why*" questions within sophisticated environmental settings (Dubé & Paré 2003; Yin 2009), an exact match with the complex, dynamic, and decentralized innovation ecosystem in which bitcoin companies operate (Adner & Kapoor 2010; Iansiti & Levien 2004).

Selection of Case Companies

To identify generic bitcoin services through which value is created and captured, we distilled reports and archival material from CoinDesk, a reputable and well-known bitcoin news site that maintains a comprehensive list of venture capital investments in bitcoin companies. From these reports, we isolate six bitcoin services that have attracted extensive interest among venture capitalists and are generally reflective of core services provided via the bitcoin network. Because multiple bitcoin companies offer each of these six services[2], we selected five companies that cover the entire range of identified services and have the least overlap in terms of their business models. These five companies are: (1) CEX.io (matching bitcoin buyers and sellers); (2) BitPesa (linking remitters and remittees); (3) Blockchain.info (providing bitcoin wallets, open Bitcoin APIs, and analytics); (4) KNC (bitcoin miners), and; (5) Sirious Money (ATM service facilitating the exchange of fiat money into bitcoin). Figure 4 depicts the relative position of each of the aforementioned companies within the bitcoin network.

[2] URL: http://www.coindesk.com/bitcoin-venture-capital/

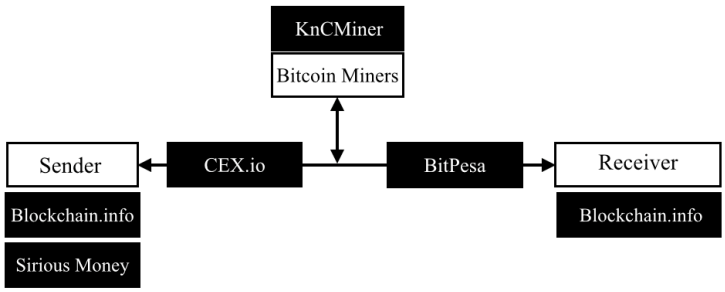

Figure 4. Relative Position of Case Companies within the Bitcoin Network

Data Collection

Data on the five case companies is gathered through primary and secondary data sources. The first author was responsible for: (1) conducting semi-structured interviews with key personnel from three of the companies; (2) eliciting archival data from public sources, as well as; (3) mapping data points to our analytical framework (Figure 3). To begin, the first author approached various bitcoin companies during bitcoin related conferences to try to gain access to knowledgeable interview partners. Three semi-structured interviews, lasting between 45 minutes and 1.5 hours, were arranged and conducted with a founder (Sirious Money), and two CEOs (Blockchain.info and CEX.io). The interviewees are not only equipped to discuss the value creation and capturing mechanisms within their own bitcoin companies, they are also well acquainted with the market and technological aspects of the bitcoin network. All three interviews were digitally recorded and extensive field notes were taken during every interview to aid in the transcribing process. Apart from the interview data, we also scrutinized official online channels of each bitcoin company (e.g., online presence as well as product and service pages) to ascertain their service and pricing model.

To cross-validate our interview data and official information supplied by the five bitcoin companies, we rely on public sources to retrieve relevant data for each bitcoin company that touches on how value is created and captured. Specifically, we leveraged on Google's News aggregator service, CoinDesk's archival records, and official press releases to aid in our extraction of data from public sources. We limit our retrieval of public data to the time period between January 1st, 2015 and March 15th, 2015 for manageability purposes. Data gathered from publicly available online sources has the advantage of being contemporary, accessible and verifiable through replication studies. For KnCMiner, we focused primarily on their bitcoin data center business unit, as the company has discontinued the sale of its mining hardware since fall 2014. Table 1 offers a detailed breakdown of our data sample for analysis.

Bitcoin Company	Primary Data Source	Secondary Data Sources			No. Data Points
	Interview	Press Releases	Google News	CoinDesk	
BitPesa	-	2 x Blog Articles	384	1	387
Blockchain.info	1x CEO	28 x Blog Articles	183	4	215
CEX.io	1x CEO	-	108	1	109
KnCMiner	-	2	48	1	51
Sirious Money	1x Founder	-	-		1

Table 1. Detailed Breakdown of Data Sample

Data Analysis

Thematic analysis was employed to derive overarching themes that correspond to value dimensions in our analytical framework (Boyatzis 1998). As an initial step, the first author identified recurring patterns that outline value creation and capturing market opportunities for each of the five bitcoin companies. These patterns were then filtered through our analytical framework, which acts as a theoretical lens, to arrive at themes that articulate the *value creation logic*, the *value capturing*

mechanism, the *value delivery architecture* and the *value stakeholder network* for each bitcoin company. To overcome potential biases on the part of the first author, we adopted a differentiated role strategy during data analysis (Adler & Adler 1988). As the first author conducted the initial data analysis, the other co-authors play the role of the devil's advocate by coming up with alternative interpretations, and counter-arguments. The entire data analysis process adhered to an iterative cycle and it was only concluded when all authors agree on the placement of data points in accordance with the analytical framework.

THE BITCOIN BUSINESS NETWORK: FIVE BITCOIN COMPANIES

CEX.IO - UK

Founded in 2013, CEX.io is an UK based cryptocurrency exchange that offers cryptocurrency buyers and sellers a platform, to exchange their respective currencies (i.e., fiat or cryptocurrency). Bitcoin is the most prominent among the traded cryptocurrencies. To begin with, users, who are either consumers or professional traders, are required to set up and verify their accounts with their personal details. By ensuring internal and external compliance requirements (i.e., for their banks partners), bitcoin exchanges like CEX.io guarantee access to fiat payment networks to mediate fiat payment transactions. After registration, CEX.io users have two options to start trading: (1) depositing fiat money through bank transfers, or credit cards, or (2) bitcoin owners send their bitcoins to a digital wallet hosted by CEX.io. As soon buyers' and seller's accountants get credited, bitcoin trades can take place. In matching buyers and sellers an efficient manner, CEX.io is charging a fee of 0.2 % for each buy and sell transaction.

BitPesa - Kenya

Founded in 2013, BitPesa is a Kenyan bitcoin remittance service that utilizes bitcoins as a technical means to operate an efficient cross-border payment service between Kenya and UK. In doing so, BitPesa is capable of circumventing traditional payment networks. By receiving bitcoins from the remitter, BitPesa exchanges these bitcoins through various exchanges (e.g., CEX.io) into local currency (i.e., Kenyan Shillings). The final step in this cross-border payment transaction is to transfer the converted (fiat) money with the support of local banks and telecom operators to a fiat mobile money wallet (e.g., M-Pesa, a Kenyan mobile payment service). For its remittance services, BitPesa is charging the sender a fee of 3% from each transaction. The value proposition is based on the notion that BitPesa is more affordable for Kenyan cross-border payments compared to traditional remittance services (e.g., Western Union).

Blockchain.info - UK

Founded in 2011, Blockchain.info is an online bitcoin wallet, bitcoin application programming interface (API), and data analytics and bitcoin search engine provider. The free wallet service allows bitcoin users (consumers and businesses) to store and transfer bitcoin in a secure way. The wallet owners possess thereby full ownerships and control about their bitcoin wallets, as they are the only ones that hold the private keys.

The second service offering are open bitcoin APIs, allowing any third parties (e.g., developers) to create permissionless bitcoin related services. In reducing developmental costs and complexity, Blockchain.info fosters the potential of agnostic innovative bitcoin services. Lastly, Blockchain.info offers real-time bitcoin analytics (e.g., latest transactions, trade volume) to inform and support various data depending bitcoin stakeholders to operate within and across the bitcoin market (e.g., merchants, exchanges). Compared to CEX.io, Blockchain.info is relatively an independent bitcoin firm, as it operates with its own servers, and transacts purely with bitcoin without handling fiat money. Revenues are generated by placing advertisement on its website.

KnCMiner - Sweden

Founded in 2013, KnCMiner is a Swedish Bitcoin mining firm that produces and sells Bitcoin mining equipment, and operates bitcoin data centers (i.e., bitcoin miners) on an industrial scale, which require considerable energy supply. These bitcoin data centers are connected to the bitcoin network in a race with other bitcoin miners to verify transactions and integrate blocks (a single log of bitcoin transactions) to the blockchain. For each successful (block) integration, KnCMiner obtains the reward of newly minted bitcoins. By February 2015, KnCminer obtained, via its data centers, a market share of ca. 5% among its bitcoin mining peers. With regards to its revenues, KnCminer sells these newly minted bitcoins on various bitcoin exchanges, or on a wholesale towards various bitcoin services to ensure their bitcoin stocking. Ultimately, bitcoin miners like KnCMiner ensure and provide liquidity to the bitcoin market.

Sirious Money - Denmark

Founded in 2013, Sirious Money is a Danish bitcoin ATM provider that sells primarily bitcoins to bitcoin buyers. To ensure bitcoin liquidity for its service, Sirious Money buys (i.e., with fiat money) bitcoin from individuals, miners and from bitcoin exchanges. To operate its business, the website (contact form), and its physical bitcoin ATM machines serve as a technical mean to initiate and facilitates fiat to bitcoins conversions. For each successful currency exchange, Sirious Money obtains a percentage in the form of fees. Per se, these bitcoin ATM machines do not store bitcoins. Rather, they are connected to an online bitcoin wallet provider (e.g., Blockchain.info), which autonomously transfers bitcoins to a wallet, after the buyer has deposited fiat money into the ATM.

CASE ANALYSIS

The data analysis suggest that the studied bitcoin firms exhibit six different, and generic bitcoin business models (cf. Osterwalder 2004; Ovans 2015): (1) brokerage, (2) disintermediation, (3) infomediary, (4) service provider, (5) producer, and lastly the (6) transitioner. By delineating these six business models further into their value creation mechanisms, the derived bitcoin business models embody one of the three value configurations (Stabell & Fjeldstad 1998), (1) transforming inputs into valuable outputs (value chain), solving customers problems (value shop) and lastly linking and matching users (value network).

CEX.io – Bitcoin Brokerage

<u>*Value Dimensions*</u>: CEX.io ***creates value*** by matching bitcoin buyers and sellers on its bitcoin exchange. After matching bids and asks, CEX.io ***captures value*** by charging a transaction fee from each trading partner. The CEO of CEX.io states that: *"we get our profits from the transactions fees on our exchange"*. Furthermore, he emphasizes *"our profitability depends on the amount of users who trade, and volume on the exchange"*.

The ***value delivery architecture*** is CEX.io's cryptocurrency exchange, which is the technical mean to accommodate and match bitcoin traders. To finalize its value delivery, CEX.io is largely depending on various ***value network stakeholders***, which comprise security providers (software), financial institutions (e.g., banks, credit card firms), and cloud service providers, as essential business partners in providing financial liquidity (i.e., fiat money), and service flexibility.

<u>*Digital Business Model*</u>: CEX.io's core business activity is efficient matching between bitcoin buyers and sellers on its cryptocurrency exchange. We therefore propose that bitcoin exchanges exhibit the brokerage business model (cf. Osterwalder 2004, p. 29).

<u>*Value Configuration*</u>: The brokerage business model embodies the value configuration of a ***value network***, where value is created in matching users though a mediating IT artifact.

BitPesa –Bitcoin Disintermediator

Value Dimensions: BitPesa ***creates value*** by linking remitters with remittees, while undercutting the pricing model of traditional payment remittance services (e.g., Western Union). To achieve its competitive pricing structure, BitPesa makes use of bitcoins as an alternative and affordable payment network. The CEO of BitPesa states that *"[we take] bitcoin, translating it into the local currency, and dispersing it the way people know"*(Vigna 2014). To ***capture value***, BitPesa charges a fee for each Bitcoin to Kenyan Schilling transaction. The CEO of BitPesa explains that "*it's a percentage of the transfer, not a fixed fee; so that means it works really well for micro-remittance payments […]"*(Anderson 2014).

Bitpesa's ***value delivery architecture*** is based on its technology platform, where remitters send bitcoins to a bitcoin wallet hosted on BitPesa. Afterwards, BitPesa converts these bitcoins into fiat money, and transfers them to a mobile wallet account (e.g., M-Pesa). For the latter, BitPesa has to collaborate with several ***value network stakeholders***, i.e., bitcoin exchanges for the selling the received bitcoins, commercial banks to transfer fiat money from and to Kenya, and the service of telecommunication firms to finalize the payment.

Digital Business Model: BitPesa's core business activity is the linking between remitters and remittees in facilitating their cross-border payments. We therefore propose that bitcoin remittance services exhibit the disintermediator business model, by sidestepping traditional middlemen (Ovans 2015).

Value Configuration: The disintermediator business model embodies the value configuration of a ***value network***, where value is created by *linking* users through IT artifacts.

Blockchain.info – Bitcoin Service Provider & Infomediary

Value Dimensions: Blockchain.info ***creates value*** by offering (1) free bitcoin wallets towards bitcoin holders, (2) open bitcoin APIs for developers, and lastly; a (3) search engine to monitor bitcoin data. As users get subsidized (cf. Eisenmann et al. 2006), Blockchain.info ***captures value*** through advertising revenues. The CEO of Blockchain.info states*: "we are technologists that focus on building APIs that make using bitcoin protocol simple and easy […] our APIs are tool sets for anyone who is impassioned to create innovative [bitcoin] ideas"*. Referring to its free bitcoin wallet service: *"we serve consumers that want a simple and easy way securely store their bitcoins, and transact with anyone they want to*".

Blockchain.info's ***value delivery architecture*** is based its technology platform that is hosting the aforementioned services. With regards ***to value network stakeholders***, Blockchain.info is to a large degree an autarkic bitcoin company, as it does not touch fiat money, and operates its own servers to ensure business independency. Overall, Blockainchain.info's core *stakeholders* are external developers on GitHub, who collaboratively improve the service in regards to security and software experience.

Digital Business Model: In regards to the bitcoin search engine, Blockchain.info aggregates and curates bitcoin data into valuable insights that allows various stakeholders (e.g., merchants) to monitor bitcoin transactions. We therefore propose that bitcoin search engines exhibit the infomediary business model (Osterwalder 2004, p. 29; Timmers 1998, p. 7). Furthermore, Blockchain.info solves the problem to store bitcoins in a secure manner, and reducing the complexity for developers to create bitcoin services (open bitcoin APIs). We therefore propose that bitcoin wallet and open API providers exhibit the service provider business model (Osterwalder 2004, p. 30).

Value Configuration: The service provider and infomediary business models embody the value configuration of a ***value shop***, where value is created in solving problems, and providing insights.

KnCMiner – Bitcoin Producer

Value Dimensions: KnCMiner ***creates value*** by verifying bitcoin transactions through its bitcoin mining data centers, and more importantly by producing new bitcoins. The director of communication at KnCMiner describes:*"[bitcoin miners] process, verify, and secure the transaction that takes place,*

exactly the same as what your payment processor, your mandatory clearing house, companies like Visa and MasterCard, and what your issuing and acquiring bank would do"(Heater 2014).

By verifying these bitcoin transactions, KnCMiner ***captures value*** by receiving transaction fees, and obtaining newly minted bitcoins. The director of communication at KnCMiner elaborates that: "*the transactions get bundled together in one of these [bitcoin] blocks, and there is one block released pretty much every ten minutes and the miners [are] in competition […] to solve the first block. [The first miner, which solves the block] gets basically a reward in 25 bitcoins"*.

KncMiner's ***value delivery architecture*** is based on its hard to replicate bitcoin data centers. As one the few bitcoin mining hardware producers in the world, KnCMiner possesses a significant competitive advantage in the bitcoin mining industry. To operate its bitcoin mining business, KnCminer has to cooperate with several ***value network stakeholders*** in the likes of municipalities and utility providers to receive permission to setup its large data centers, and ensure electricity resilience, as these data centers consume considerable amount of electricity. Besides stakeholders from the public and energy sector, KnCMiner needs business relationships with financial institutions (e.g., banks) to receive fiat money, bitcoin exchanges, and other bitcoin services to sell these newly minted bitcoins in a wholesale manner.

Digital Business Model: KnCMiners's core business activity is the production (mining) of new bitcoins through the process of verifying bitcoins transactions. We therefore propose that bitcoin miners exhibit the producer business model. The producer business model has the logic by creating new valued market outputs (e.g., bitcoins, hardware). In this case, liquidity and technology to support the bitcoin network.

Value Configuration: The producer business model embodies the value configuration of a ***value chain***, where value is created turning inputs (data canters, electricity) into valuable outputs (new bitcoins) in a sequential manner.

Sirious Money – Bitcoin Transitioner

Value Dimensions: Sirious Money ***creates value*** by converting/transforming fiat currencies into bitcoins. During this transition period, Sirious money ***captures value*** in the form of fees. As the founder states: "*Sirious Money buys and sells bitcoins, it works like a currency exchanger, I make my money on this trade"*.

Sirious Money ***value delivery architecture*** is based on its bitcoin ATM machines, which are serving as physical interfaces to the bitcoin network in retrieving bitcoins. As the founder states: "*[The ATM are] connected to a bitcoin wallet, which is operated on blockchain.info […]. So when people go and put in Danish kroner, the [ATM] tells Blockchain.info to send these bitcoins to this [bitcoin wallet] address*".

To operate its business, the bitcoin ATM provider is depending on several ***value network stakeholders***; Sirious Money requires bank relationships, using their bank accounts to channel fiat money from and to the bitcoin exchanges. Furthermore, Sirious Money does not produce its bitcoin ATMs, rather, it has to acquire/lease them from ATM manufacturers (e.g., Lamassu), Lastly, Sirious Money needs the technical service of bitcoin wallet providers, which provides the ATMs the ability initiate autonomously bitcoin transactions to end users.

Digital Business Model Sirious Money creates value primarily by converting fiat currencies into bitcoins. We therefore propose that bitcoin ATM providers exhibit the transitioner business model. The transitioner business model has the business logic by bridging users or organizations from the fiat money network to the bitcoin network. In doing so, the transitioner business model creates value by being an interface between two or more networks.

Value Configuration: The transitioner business model embodies the value configuration of a ***value chain,*** by turning inputs (fiat money) into valuable outputs (bitcoins) in a sequential manner.

		Value Configuration					
		Value Chain		Value Shop		Value Network	
		Producer	*Transitioner*	*Service Provider*	*Infomediary*	*Brokerage*	*Disintermediator*
Value Dimensions	Value Creation Logic	**KnCMiner** Value is created through the production of valued market outputs in the form of new bitcoins	**Sirious Money** Value is created through interfacing networks through bitcoin ATMs	**Blockchain.info** Value is created through solving problems in the form of bitcoin storage, & free developer tools	**Blockchain.info** Value is created by providing valuable market insights	**CEX.io** Value is created by matching users through an exchange IT artifact	**BitPesa** Value is created by linking users through a new intermediary IT artifact
	Value Capture Mechanism	Value is captured through quantifiable value unit transfers in the form of selling bitcoins	Value is captured through quantifiable value unit transfers in the form of bitcoin conversions fees	Value is captured through cross network effects in the form of online ads (money side)	Value is captured through cross network effects in the form of online ads (money side)	Value is captured through quantifiable value unit transfers in the form of exchange trade fees	Value is captured through quantifiable value unit transfers in the form of cross-border payment fees.
	Value Delivery Architecture	Value delivery architecture is based bitcoin data centers	Value delivery architecture is based on bitcoin ATMs	Value delivery architecture is based on a service platform	Value delivery architecture is based on an information platform	Value delivery architecture is based on an exchange platform	Value delivery architecture is based on an intermediary platform
	Value Stakeholder Network	Stakeholders from ***two*** networks (fiat, bitcoin) Municipalities, utility companies, various bitcoin firms (e.g., exchanges), and financial institutions	Stakeholders from ***two*** networks (fiat, bitcoin) Financial institutions, bitcoin exchanges, ATM manufacturer, bitcoin wallet providers	Stakeholders from ***one*** network (bitcoin) Bitcoin developer community on GitHub	Stakeholders from ***one*** network (bitcoin) Bitcoin developer community on GitHub	Stakeholders from ***two*** networks (fiat, bitcoin) Financial institutions, cloud service providers, software security provider	Stakeholders from ***two*** networks (fiat, bitcoin) Bitcoin exchanges, financial institutions, mobile network operators.

Table 2. Multiple Case Analysis: Value Configurations and Dimensions

DISCUSSION

This paper was motivated to advance the value configuration (Stabell & Fjeldstad 1998), digital business model (Al-Debei & Avison 2010), and the emerging cryptocurrency literature by unraveling how bitcoin firms create and capture value through digital business models. To generalize our observations, we identified six different and generic bitcoin business models (Table 2). Furthermore, the cryptocurrency firms of interest to this study exhibit three different value configurations, which determine how the value dimensions of a business models are configured.

Value Creation and Capture Through Digital Business Models

Findings suggest that ***value chain*** and ***value network*** driven bitcoin business models create value through *production*, *interfacing*, *matching*, and *linking* bitcoin related products and services. Based on that, each value unit transfer is quantifiable and monetizable, i.e., each service provisioning leads to a concrete and immediate value capture incident, materialized in the form of bitcoin or fiat money exchange. Conversely, the studied bitcoin business models in the ***value shop*** configuration create value by *solving problems* and *providing insights*. However, these two bitcoin business models do not exhibit the same returns from value capture for their service provisioning as compared to ***value chain*** and ***value network*** driven business models. It can be argued that their value capture incident is largely dependent on revenue generating users (i.e., money side), who indirectly subsidize other users (subsidy side) on the service, to derive their value at the end (i.e., eyeballs for their advertisement). As such, profitable bitcoin *service provider* and *infomediary* business models are reliant on a growing base of returning users on different sides to sustain an attractive bitcoin service.

Value Delivery Architecture and Stakeholder Networks

Differences in creating and capturing value can be argued that bitcoin firms with the *service provider* and *infomediary* business model face intense competition, as their service provisioning is relatively replicable or substitutable by rival firms, prohibiting them from charging price sensitive users. For instance, service providers (e.g., wallet providers) do not require costly organizational capabilities (i.e., value delivery architecture), such as large data centers, or unique business relationships with financial institutions (i.e., value stakeholder networks), as their services are not directly connected to fiat payment networks. To compete, ***value shop*** driven business models have to foster cross network effects by offering a compelling bitcoin services towards users (subsidy side), in order to attract revenue-generating users (money side) (cf. Eisenmann et al. 2006).

On the other hand, ***value chain*** and ***value network*** driven business models provide bitcoin firms with higher value creation and capture possibilities, as their value configurations are build upon costly value delivery architectures (data centers, ATMs), and hard to establish, and privileged value stakeholders network relationships (e.g., financial institutions), which serves to build favorable market entry barriers. Accordingly, bitcoin business models driven by ***value chain*** and ***value network*** configurations ensure the possibility to create and capture value, due to hard to replicate value delivery architectures, and hard to establish value network stakeholder settings. As ***value chain*** and ***value network*** driven business models capture value through quantifiably units, the competiveness is determined by the pricing of each value unit.

Theoretical & Practical Implications

This study bridges knowledge gaps between strategic management and information systems literature, by contributing to the prior research on value configurations (Stabell & Fjeldstad 1998) and digital business models (Al-Debei & Avison 2010). Specifically, we extend research on digital business models into the domain of cryptocurrency networks, by identifying six generic and predominant bitcoin business models. Furthermore, we expand on the value configuration literature, by advancing a framework that relates each of the three value configurations to the four value dimensions of digital business models (see Figure 3). By applying the framework to analyze how digital business models within cryptocurrency networks are configured to create and capture value, we demonstrate the relevance of the value configurations to digital firms. To the best of our knowledge, this is one of the first studies that explicitly studies digital business model configurations within cryptocurrency networks.

A key finding of this bitcoin firm study is that value chain and value network driven business models commercialize their products and services for each value unit transfer, whereas value shop driven business models commercialize through subsidized and revenue generating users. Furthermore, value chain and value network driven bitcoin business models have the capabilities to create market entry barriers by leveraging their value delivery architectures and value stakeholder networks against prospective bitcoin rival firms. From a practitioner's point of view, we provide decision support by increasing awareness for different bitcoin business models configurations. Avenues for future research are studies on combinations of different value configurations (e.g., value chain and value network business models), which may create new and complementary products and services.

Limitations

This study is constrained in its generalizability as utilized five cases. Furthermore, bitcoin may not be representative for all cryptocurrency networks, as other cryptocurrency networks (e.g., Ripple) have a centralized approach regarding generation, verification and transaction of cryptocurrencies. Lastly, the bitcoin companies highlighted in this study are reflective of core services within the bitcoin network and do not take into account peripheral services like BitGo (bitcoin security provider), or Chainanalysis (cryptocurrency compliance services).

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