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Understanding Bitcoin Currency and Blockchain Technology as a Media System

An integrated systems and foresight model approach

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Abstract

This paper highlights research into the people and communities involved in Bitcoin cryptocurrency and blockchain technology. Applying Marshall and Eric McLuhan's Laws of Media tetrad and Lance Gunderson and C.S. Holling's Panarchy as an integrated systems and foresight model, this research explores the future of economic exchange and of our financial systems in co-evolution with these revolutionary innovations. Building on a review of the literature and field research with subject matter experts from Toronto's Bitcoin community, the authors developed a research framework and an integrated visual model for mapping scenarios and charting system-level impact over time that helps illuminate the impact of Bitcoin as media on the real economy, financial services, and traditional sovereign currency. The results of the study highlight the application of the framework and visual model as a basis for understanding phenomenon, developing scenarios, anticipating adaptive change, and for guiding future social change and innovation. The narratives that emerged are a sample of other narratives that could be crafted from the model, used to guide future studies and engage audience discussion.

Introduction

Inspired by initial research into the evolving complexity of the financial system, the future of open currencies, and the question of how we might reframe money as a technology to facilitate and empower the natural human inclination to trade and share value, we became interested in the potential of Bitcoin and its underlying technology, blockchain, as a means to enabling direct and low-friction exchanges.

The idea of a technology that made it possible to have direct exchange with another person or business without the need for a third party, such as a bank; to do so across transnational borders without the financial cost or wait time of the current system; to have control over and access to one's money from anywhere in the world, at any time; and to have the ability to either spend that money online (in the form of a cryptographic currency) or to translate it into whatever the local fiat currency is, felt like a topic worth investigating further.

The potential and appeal of the technology is expressed well by Don and Alex Tapscott in their

book *Blockchain Revolution: How the Technology Behind Bitcoin is Changing Money, Business, and the World* (2016, p.28):

Imagine a technology that could preserve our freedom to choose for ourselves and our families, to express these choices in the world, and to control our own destiny, no matter where we lived or were born. What new tools and new jobs could we create with those capabilities? What new business and services? How should we think about the opportunities? The answers were right in front of us, compliments of Satoshi Nakamoto.

Satoshi Nakamoto is the elusive author of the original paper, “Bitcoin: A Peer-to-Peer Electronic Cash System”, describing how Bitcoin allowed people to send or receive payments without having to involve a third party. The paper also addressed previously confounding challenges with cryptocurrencies including how to prevent double-spending by publicly announcing transactions and having a single history of the order of transactions using a timestamp server and proof-of-work (Nakamoto, 2008) — what came to be known as the “blockchain”.

With all that potential, we needed to choose a manageable starting point and made the decision to begin by understanding the technology from a local context.

From local to global context

At the onset of the research project, we set out to do an initial inventory of the current community of innovation around Bitcoin and blockchain in Toronto with two primary objectives in mind. The first of these objectives was to deepen our own learning of systems mapping techniques by applying them to the local ecosystem—specifically to the evolution and thinking around Bitcoin and blockchain and how these might play out in the future. This included the intention to map the contributors within the local community and to understand the relationships, influences, motivations, perspectives, and values of that community.

The second objective was to seed future research by developing an understanding of the dynamics and interests within the community beyond a technical focus, and to look for opportunities to facilitate and enable collaboration within and between different interest groups and the public. Underlying this objective was the assumption that the focus on technology tended to supersede the focus on public engagement, and that through enabling broader interaction between technologists and the public there was an opportunity to spread interest and adoption of the technology to address a variety of needs.

The following research questions represented our entry point for discovery:

What are interesting dynamics within the individual, group, and conceptual components of the community?

What interests are forming in the community beyond a technical focus?

Where do the subject matter experts see the technology going? How do they see themselves in that future? What are they doing to enable it?

While the initial boundary of the study was intended to stay within the Toronto community, with an eye on how the Toronto nodes connect to other communities in the national and international context, we quickly learned that any conversation about the community around Bitcoin and blockchain could not be geographically bound. As a result, the study shifted to understanding and mapping how the core concepts, and the different uses and emerging opportunities for the technology might play out in the larger financial system. With this shift, our research question refocused to that system level and fed by the ideas and insights that came from working with the experts and literature on the topic:

What might the potential impact of Bitcoin and blockchain be at different levels of the financial system?

From topic to tool discovery

Throughout the process of discovery around the currency and technology we maintained our objective of deepening our knowledge and practice of systems tools. The key difference was in moving from ‘Systemigrams’ (Boardman & Sauser, 2008)—and what might have yielded local ‘system maquettes’—to taking a beginner’s mind approach and the discovery of a novel research framework that brought together Marshall and Eric McLuhan’s Laws of Media tetrad and Lance Gunderson and C.S. Holling’s Panarchy as an integrated systems and foresight model. The integration of these two tools allowed us to explore the future of economic exchange and of our financial systems in co-evolution with revolutionary technologies, providing a simultaneous view into the system and the future.

We offer this paper as an initial use of the integrated tool and encourage others to explore its potential application to other media and systems.

Context

Useful Definitions

This paper does not attempt to provide an in-depth lesson on money or bitcoin and blockchain, however it is useful to understand some basic definitions.

Money — We have used the classic economist’s definition of money as referenced by Marshall Van Alstyne (2014) as our reference for the attributes of bitcoin. For full technical definitions of the components of money, we recommend those provided by Investopedia. In brief, money is a *medium of exchange* used as an intermediary instrument in trade or purchases between two parties who accept the medium as having a standard value. Money is also a *unit of account*, which represents the standard measurement of the market value ascribed to the medium of exchange. And lastly, money is a *store of value*, which means it can be saved or stored for a period of time and retrieved for use again as a medium of exchange.

The following definitions for bitcoin and blockchain are summarized from bitcoin.org.

Bitcoin — When capitalized, is used to describe the concept, protocol or network supporting Bitcoin.

bitcoin — When used without capitalization, is intended to describe the currency as a medium of exchange and unit of account. BTC and XBT are abbreviations commonly used in other sources to refer to the currency.

Block chain (or blockchain) — Is a public record, or ledger, of all Bitcoin transactions captured in the chronological order they occur. The blockchain is shared across the network of Bitcoin users and is the verification system that captures each transaction and prevents double spending.

More generally, *blockchain* also refers to the unique technological breakthrough that uses cryptography and peer-to-peer computing to incentivize the consensus determination of the order in which digital transactions occur on the network.

Conceptual Foundations

As a starting point, there are three concepts that served as a conceptual basis for the project: money as a technology, demurrage and complementary currencies.

MONEY AS A TECHNOLOGY

The first concept is in seeing money as a technology and what it functionally accomplishes over time, moving from ‘good’ to ‘asset’. To illustrate this concept, we have identified that the relationship between *intrinsic value*, which is embodied or inherent in a good, and *instrumental value*, which is the medium or means (Brennan, 2002; Callicott & Frodeman, 2009) used to purchase, or in exchange for, a good, has taken four coarse structures over time. We have used a visual ‘ring’ structure to exemplify the structure and functional relationship of intrinsic and instrumental value within each historical type of exchange, starting with barter, moving through to gold and the evolving use of fiat-based currencies.

Barter — Intrinsic and instrumental value are equal and inseparable

Although barter is a myth in the historical sense (Graeber, 2012), it is useful to understand the underlying concept of the ‘double coincidence of wants’ which requires that two parties find each other in order to transact (Jevons, 1876). For example, if person A has a cow and is looking for a couple of goats in exchange, person A needs to find someone (person B) who has two goats and simultaneously wants a cow in exchange for the goats. Once person A and person B find each other to make the exchange, the intrinsic value—the ‘good’—of one object (the cow) is viewed as equal to the instrumental value—the ‘medium of exchange’—of the other object (the two goats), and vice versa in the eyes of both persons A and B.

In this type of transaction, there is no separation of the intrinsic value from the instrumental value. Hence, the single ring representation in Figure 1.



Figure 1. Barter can be represented schematically using a single ring.

Gold — Intrinsic and instrumental value overlap but are not equal

When gold was introduced as a medium of exchange or token for enabling trade it had intrinsic value in itself and could be used on its own, or it could be used in exchange for other goods.

Hence, the overlapping rings shown in Figure 2. It had the added virtue of stabilizing currency exchange rates (Godden & Wankel (ed.), 2016).

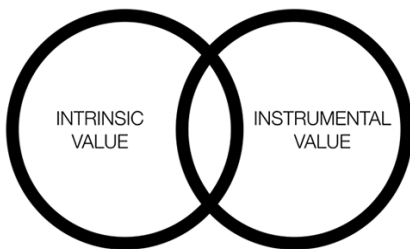


Figure 2. Gold as a medium of exchange used to acquire other goods or be a good in itself can be represented schematically using overlapping rings.

Convertible Fiat — Intrinsic and instrumental value are separated and abstracted

When convertible paper currencies came into vogue in the early 1800s, although pegged to gold, the correlation between good and medium used to purchase was further abstracted ("Fiat money," 2016). Hence the separation of rings shown in Figure 3. Through this decoupling, the control of the money supply moved to decree (fiat) of the issuing nation, and to the monopoly of the nation state.

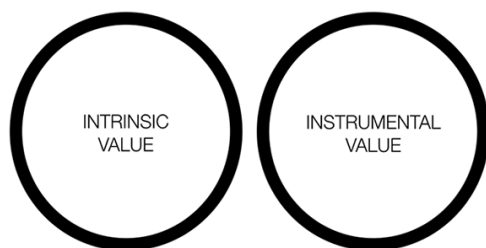


Figure 3. The move to convertible fiat can be represented schematically by separating the instrumental from the intrinsic value as money became further abstracted from the goods it was used to acquire.

Fiat 2.0 — Instrumental value supersedes the value of real goods and is further abstracted

Fiat 2.0 represents financial derivatives, high frequency trading, and 'exotic' financial products. These financial instruments separate and abstract further away from intrinsic value. In the extreme, the focus on intermediaries removes the need to even have real goods and the instrument itself—the money—becomes the good (Mashkov, 2014, p.93). Hence, the large instrumental value and small intrinsic value shown in rings within Figure 4.

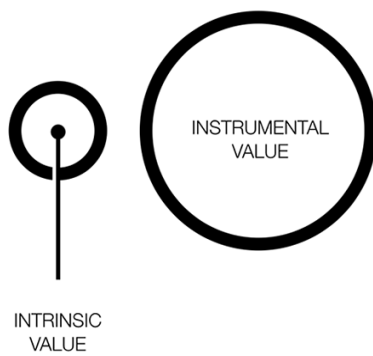


Figure 4. Fiat 2.0 can be represented schematically with instrumental value having more value than the value once held by real goods.

For any financial asset to have tangible value, the expectation is that it will be translated from asset back into the traceable good that is money, and used in trade for real goods. However, over time the instrumental value has been used in replacement of the need for goods, deepening the abstraction of money.

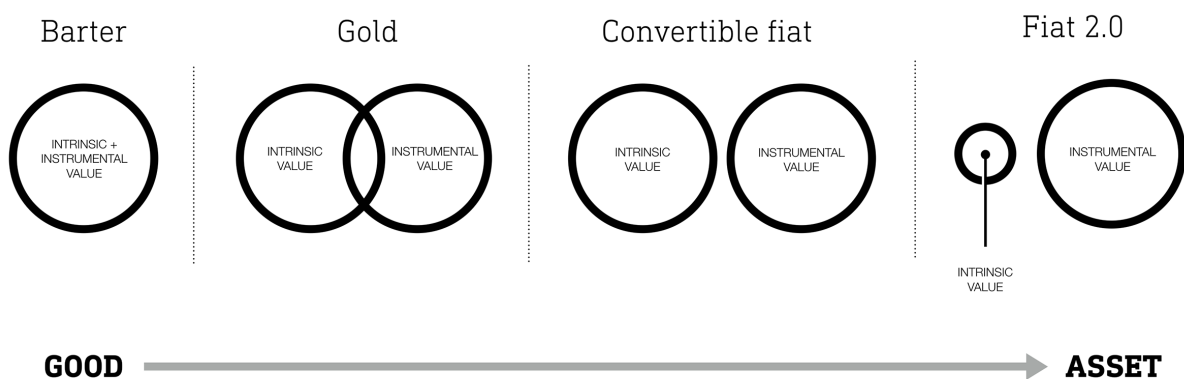


Figure 5. Visual summary of money as a technology with the shift of the functional relationship of intrinsic value to instrumental value over time.

Margaret Atwood conveys the negative side of hoarding assets in her book *Payback: Debt and the Shadow Side of Wealth* when expressing that “*Scrooge’s big sin was to freeze his money; for money, as all students of it recognize, is of use only when it’s moving, since it derives its value entirely from whatever it can translate itself into.*” (Atwood, 2007, p. 99)

DEMURRAGE

There was a time in the middle ages when currencies had an expiry date. If you held a currency beyond the time it was considered useful you carried the cost of holding it, versus realizing its value by spending it (Lietaer and Belgin, 2011). In short, demurrage is the carrying cost of a particular currency, and its obsolescence incentivizes use.

COMPLEMENTARY CURRENCIES

A type of currency that lends itself well to keeping money, and therefore value, in motion is the complementary currency. Complementary currencies are typically used as alternatives to the centralized currency system, are localized—either geographically or within a network—and

serve a particular group or need, and are convertible to fiat currency when needed (Lietaer and Belgin, 2011; “Why money isn’t everything”, 2015). They inherently have flow or movement associated with them.

Examples of complementary currencies include:

1. *Fureai Kippu* (pronounced ‘foray-eye-keepoo’) — a sectoral currency in Japan used as a token system providing elderly care (Hayashi, 2012)
2. *Bristol Pound* — a local currency to Bristol in the UK used as real money designed to support the local economy in and around the city (“Bristol Pound”, n.d.)
3. *Bitcoin* — a cryptocurrency used across the Internet

Why these three concepts? At the core of our findings is the relationship between money’s function as a good and its function as an asset, and how bitcoin currency and blockchain technology have attributes that exemplify and enable keeping value in motion. Although bitcoin has been lauded by some as a strong store of value (“Store of value is the primary function of a currency • /r/Bitcoin,” 2016; Das, 2016)—as an asset—others consider it more effective as a medium of exchange (Lisa Gansky in conversation with Paul Kedrosky, 2016).

As a medium of exchange, bitcoin enables individuals and groups that would not otherwise have access to the formal economy and banking system (Leibowitz, 2016). According to a 2009 report from McKinsey & Company, “Half the world is unbanked”. Add mass human movement to this picture and consider that globally we are experiencing the “biggest displacement of people since the Second World War” (Hallett, 2016). This precarity shows the burgeoning need but also opens opportunities to help people and groups if not participate in the economy, be able to at least move money.

Within this opportunity are the current and potential impacts of Bitcoin and blockchain technology in service to the global remittance market—a prime channel for keeping money and value in motion, and a theme that emerged in both the subject matter expert interviews and literature in the first phase of the project.

In order to understand how both the needs and technologies play out at different levels of the financial system, we needed to enlist tools that would provide a blend of media analysis, hierarchy and time. More focus will be given to the remittance example within the Findings and Discussion. First, it is important to understand the phases of the methodology and how the tools were used to support working with research findings in different dimensions.

Methodology

The research process consisted of two phases.

Discovery of the Concepts, Contexts and Adoption Potential

The first of these was focused on discovery and understanding the concepts, contexts and adoption potential of the technologies. This phase involved a literature review and using semi-structured interviews to engage six subject matter experts in the Toronto community who were working in areas related to Bitcoin and blockchain, and who represented a breadth of

perspectives from the areas of law, policy and compliance, business, software development, angel investment and user experience.

Development of the Research Framework

Processing of the data from the first phase involved analysing the content from each of the interviews, identifying affinities across participants, and distilling a collection of ideas and core insights across the set. These inputs fed into the second phase and the development of a research framework, which came about through experimentation with McLuhan's Media Tetrad and Gunderson and Holling's Panarchy.

ABOUT THE MEDIA TETRAD

The tetrad was developed by Marshall McLuhan as a pedagogical tool for explaining social processes underlying adoption of a technology or medium that asked four questions and displayed them simultaneously, not successively or chronologically:

1. What does the medium *enhance*?
2. What does the medium *make obsolete*?
3. What does the medium *retrieve* that had been obsolesced earlier?
4. What does the medium *reverse into* when pushed to extremes?

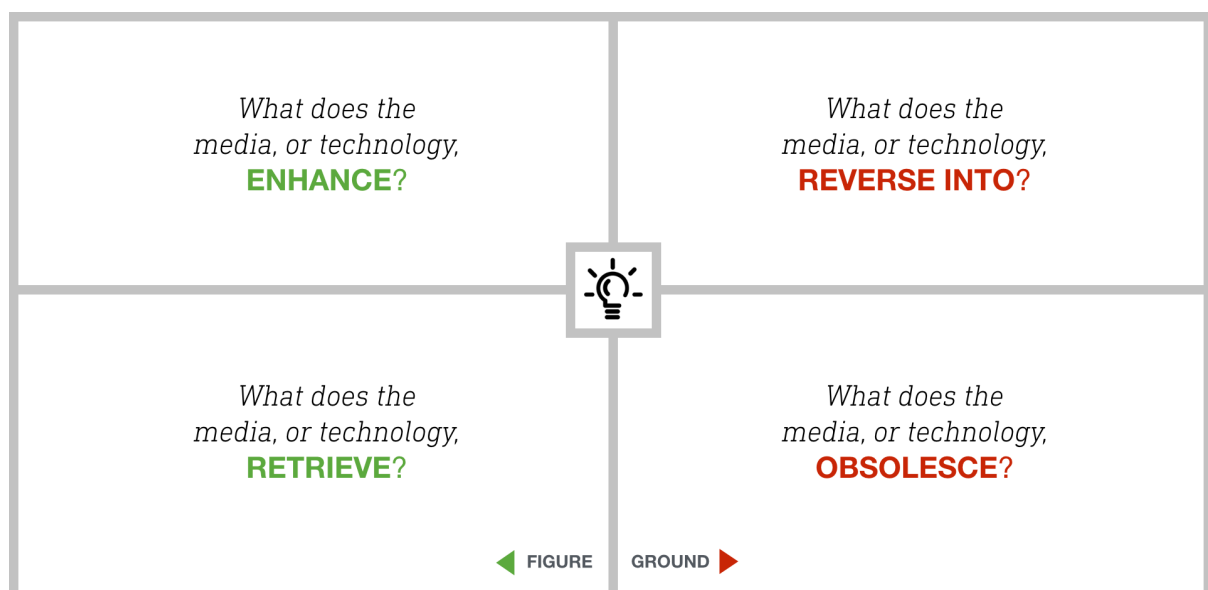


Figure 6. Enhance and Retrieve on the left are 'figure' or foreground elements — they come forward or advance. Reverse Into and Obsolesce on the right are 'ground' or background elements — they retreat or fall back. The image and descriptions are based on McLuhan & McLuhan (1988).

Taking each of the ideas distilled from the first phase, we asked the following question of each of the ideas and placed it in the corresponding quadrant on the tetrad: Does this idea gesture towards something that bitcoin and/or the blockchain *enhances*, *retrieves*, *obsolesces* or *reverses into*? We followed that rhythm of inquiry through three levels of the financial system: the *micro* (real economy) level, the *meso* (financial services) level, and the *macro* (national currency and policy) level, plotting the idea at each level it applied and considered what 'strength' it had or

might have at that level, where ‘1’ was strong, ‘2’ was medium, and ‘3’ was weak. If an idea didn’t apply to the level it was not plotted at that level.

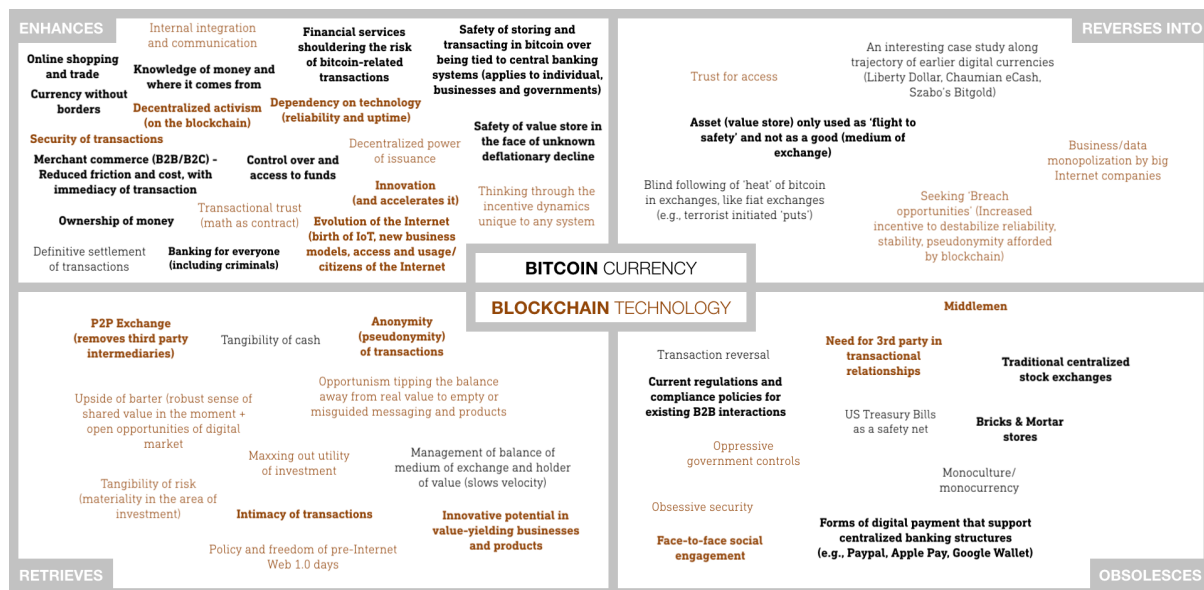


Figure 7. Each idea was assessed and plotted at the levels it applied within the financial system. This image shows the ideas associated with the real economy level.

The simultaneous nature of the tetrad means it asks that everything be real and valid in the same moment, without chronology or specified time beyond the now. To address the question of what the impact of the currency and technology—bitcoin and Blockchain as ‘media’—might be over time, we brought in the panarchy model for understanding adaptive change in complex systems.

ABOUT THE PANARCHY

Gunderson and Holling adopted the concept of ‘panarchy’ to encompass and understand the interactions between multiple hierarchically structured scales of space, time and social organization. With the “cross-scale, interdisciplinary, and dynamic nature of the theory... Its essential focus is to rationalize the interplay between change and persistence, between the predictable and unpredictable.” (Gunderson and Holling, 2002, p. 5).

An essential part of the theory and model is the *four phase adaptive cycle* based on resilience and adaptation in the natural environment. The descriptions shown in Figure 8 were excerpted and condensed from Gunderson and Holling’s description of a forest’s cycle (2002, p. 33-34).

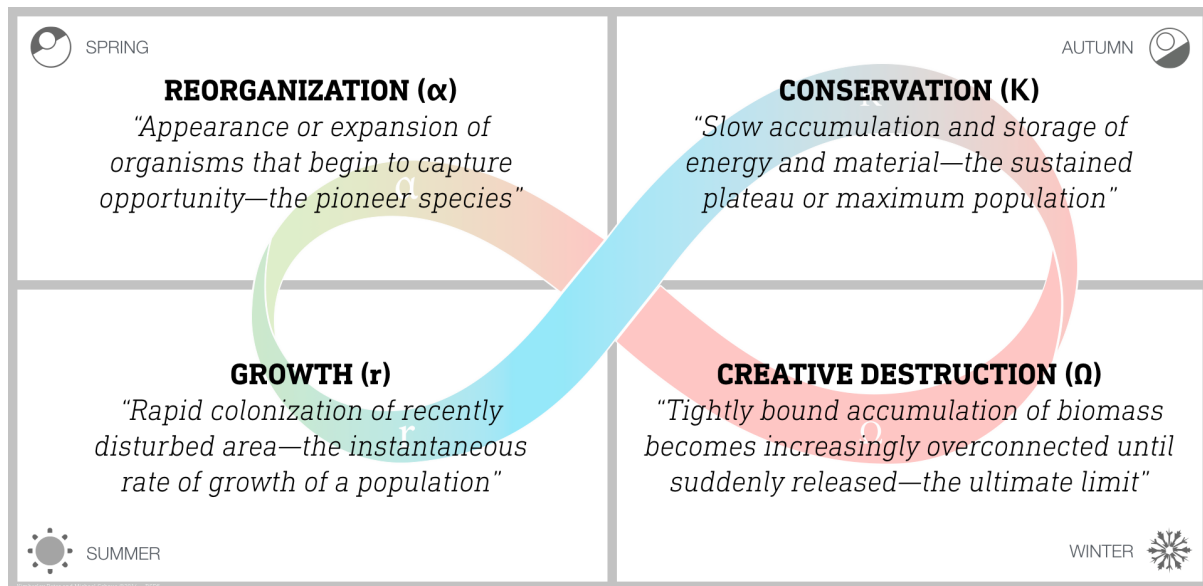


Figure 8. The four phase adaptive cycle as a visual framework. Each cycle's quadrant becomes a container for mapping concepts and activities as they relate to Growth, Conservation, Creative Destruction and Reorganization. The image and descriptions are based on Gunderson and Holling (2002).

In our use of the panarchy model, we add seasonal time as an extended metaphor for each phase and as receptors upon which to sequence the ideas captured in the work with the tetrad. These are reflected in each corner of Figure 8, with the following mapping to the four phase adaptive cycle:

Exploitation (Growth) (r) phase = *Summer*
 Conservation (K) phase = *Autumn*
 Release (Creative Destruction) (Ω) phase = *Winter*
 Reorganization (α) phase = *Spring*

INTEGRATING THE MEDIA TETRAD AND PANARCHY

In bringing the panarchy model to the content outputs of the tetrad, we identified the conceptual alignment between the four quadrants of both models. The conceptual basis of *reverses into* on the tetrad resonated with the concept of *conservation* within the panarchy cycle. *Obsolesces* on the tetrad felt very close conceptually to *release (creative destruction)* on the panarchy. *Enhances* on the tetrad connected naturally to *growth* on the panarchy. And *retrieves* on the tetrad mapped well to the concept of *reorganization* on the panarchy.

To integrate more seamlessly between the tetrad and panarchy, this conceptual mapping led to the necessity of flipping the quadrants on the left side of the tetrad. *Enhances* moved the bottom left and *retrieves* moved to the top left (see Figure 9). With that flip, the mapping across the four quadrants when the tetrad is nested within the panarchy became:

Enhances = Growth, or Exploitation
 Reverses Into = Conservation
 Obsolesces = Creative Destruction, or Release
 Retrieves = Reorganization



Figure 9. For conceptual coherence between the tetrad and panarchy models, it was necessary to flip the elements on the left side. *Enhances* moved the bottom left and *retrieves* moved to the top left.

Flipping *enhances* and *retrieves* maintains the fidelity of both models in their combination because these are both ‘figure’ (foreground) positions. Additionally, the separation between ‘figure’ on the left and ‘ground’ on the right, reinforces the ideas of a currency behaving like a good (figure) and a currency behaving like an asset (ground). Adding the seasonal descriptors, the final integrated model took the following form (see Figure 10):

Enhances = Growth, or Exploitation (Summer)
 Reverses Into = Conservation (Autumn)
 Obsolesces = Creative Destruction, or Release (Winter)
 Retrieves = Reorganization (Spring)

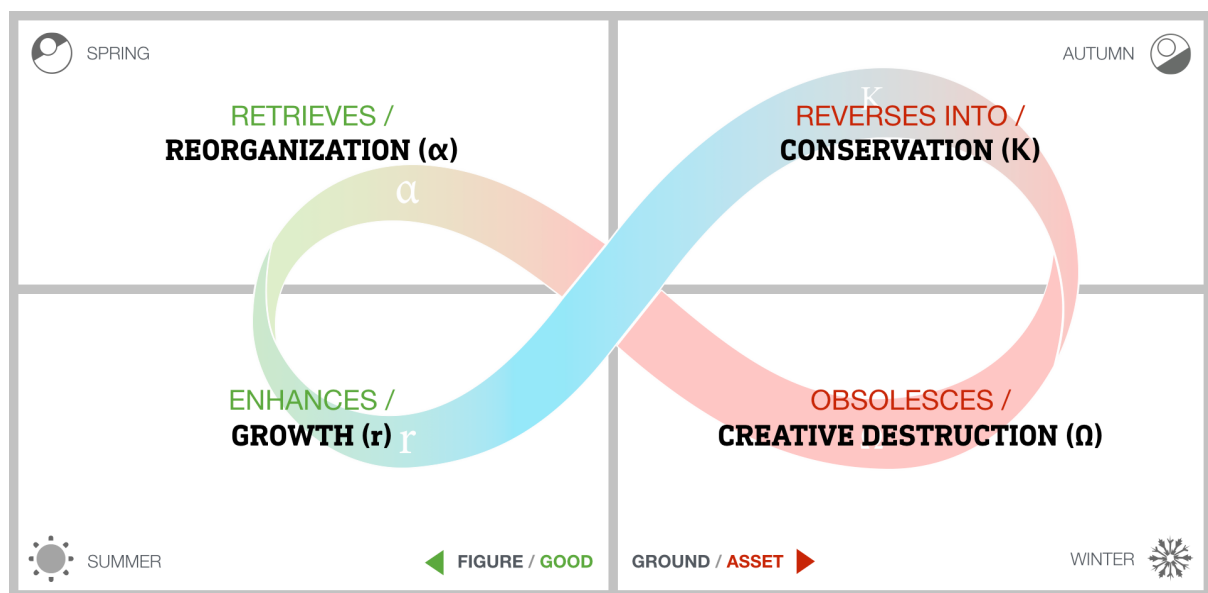


Figure 10. The tetrad and panarchy as a combined visual framework.

With that structure in place, each of the ideas plotted on the tetrad at each level of the financial system (from real economy to financial services and national currency/policy levels) were considered again in the context of the panarchy with the added dimension of time at each level—the horizontal axis—and through hierarchical levels of the system—the vertical axis. This will be described within the Findings and Discussion (see Figure 13).

Findings and Discussion

During the interview process, we learned that while there were adoption challenges, related in large part to the messaging and the context of messaging, some people working in this area were thinking beyond the technology to social challenges of the current system, and to what the technology could, and in some cases does, address.

Both the literature review and subject matter expert interviews planted a seed early in the process to discuss the current and potential impacts of the technology within the context of the global market for remittance payments. The social motivations of some contributors in the community further reinforced the global nature of the efforts, notably that Bitcoin and blockchain enable banking for the unbanked and partially banked, and for remittance payments across a globe of migrating humans seeking a better life for themselves and their families.

Key Insights

The application of the findings to the models is best framed by the two key insights that came out of the research. The first of these insights was that *technology as leading innovation hits up against the slowness of policy innovation*. Early cycles of technological development can be rapid. Velocity is advantaged until the technology gets too much attention, then the push for regulation slows it down. Where once there was value in motion, and freedom for the creators, there is now control from external parties and everything slows down. When policy takes over, ownership can shift, and it tends to favour incumbents. This is not a new phenomenon. It was documented in 1970 by Hasan Özbekhan in a report on the *Predicament of Mankind to the Club of Rome* as one of the 49 Continuous Critical Problems.

The second insight is that *some individuals or groups are early adopters out of necessity*. Learning about the use of bitcoin for remittance payments between migrant workers and their loved ones back home was a big illumination. The remittance market is huge. It is integrated into national policies. It competes with international aid as one of the largest inflows to developing countries. And the fragmented existence of migrant workers makes them a soft-target for price gouging. Using bitcoin reduces the high cost of using Western Union and the banks. It also reduces the friction of sending money when these third parties cut out.

Key Ideas and How They Mapped to the Media Tetrad

While there were several ideas that came out of the first phase of research—and, as described in Methodology section, we mapped all of them to the tetrad using a four-question inquiry through three levels of the financial system—we will limit the focus to eight key ideas only and to how each mapped to the questions posed by the tetrad. The following eight ideas flow into, and emerged from, the narrative prototyping phase with the hybrid model. As a result, not all the ideas are visually highlighted in the tetrad (see Figure 11).

Does this idea gesture towards something that bitcoin/blockchain OBSOLESCEs?

Idea 1: Need for third parties in transactional relationships gestures to the technology's potential to obsolesce the current financial structures, including remittance. At the

wider blockchain level, the idea points to obsolescence of other institutions within existing structures and systems that primarily serve an intermediary function with a centralized and hierarchical structure, e.g., insurance or licensing.

Does this idea gesture towards something that bitcoin/blockchain RETRIEVES?

Idea 2: Increased intimacy of transactions mapped well to the retrieves quadrant of the tetrad because the person-to-person nature of the transaction, facilitated and witnessed by others in the same network, harkens to qualities of transactions from the past.

Idea 3: Anonymity (pseudonymity) of personal transactions. Transactions within the Bitcoin blockchain, and potentially other blockchains, move from one cryptographic key (analogous to an email address) to another, and not from personal identifier to personal identifier. As a result, they are anonymous within the network. More aptly, they are pseudonymous because it is possible to associate the public key aspect of a transaction to an IP address from which an identity could be determined. This is related to the intimacy of transactions as it retrieves a 'between us' quality to the transaction.

Idea 4: Upside of barter (trust contained within transaction) speaks to the technology's unique ability to reorient the position of where trust is in the transaction. A transaction facilitated by a bank puts the trust in the hands of the bank. Trust in a bitcoin/blockchain transaction is, to a greater degree, within the actual transaction between two parties and supported by the trust each has in the decentralized record of the blockchain network.

Does this idea gesture towards something that bitcoin/blockchain ENHANCES?

Idea 5: Currency without borders was considered to enhance the fluidity and reliability of transactions because it allows money to flow internationally at little or no cost. It can be transferred to any locality via internet protocol.

Idea 6: Ownership of money was also considered to enhance by increasing the sense of connection and sovereignty over access to one's wealth. As long as a bitcoin holder knows their personal cryptographic keys and has an internet connection, the technology allows direct access to all of one's wealth. The research showed that with no other intermediary in play, a greater sense of ownership to those holding wealth with bitcoin.

Does this idea gesture towards something that bitcoin/blockchain REVERSES INTO?

Idea 7: Asset only used as a 'flight to safety' and not as a good (medium of exchange). The more people using bitcoin, the greater its value, that value measured in the upward trajectory of the price. With higher prices, bitcoin reverses into asset-like behavior offering a flight to safety for those holding value in other instruments such as US dollars, or government bonds.

Idea 8: Startup culture around bitcoin as a remittance tool gestures towards what this technology reverses into as there starts to be some entrenchment and organization

around how the technology is delivering value. This idea is not in Figure 11 below, it was one from the discover phase that we revisited and included in this quadrant retroactively as we prototyped narrative development with the hybrid model (see Prototyping Narratives below).

The simultaneity inherent to this model was both challenging and exhilarating to work with. The experience is one of engaging deeply into the ambiguity of a particular moment, outside the linear juxtapositions and sensemaking that so unconsciously come with a time frame. This effect of simultaneity loaded one moment with multiple truths, leading to a natural inclination to consider how these impacts, these “media effects”, may play out over time. The purpose of using the panarchy model at this point was to make sense of how these ideas might trigger a subsequent effect—or perhaps more interestingly, an antecedent cause—within a timeframe.

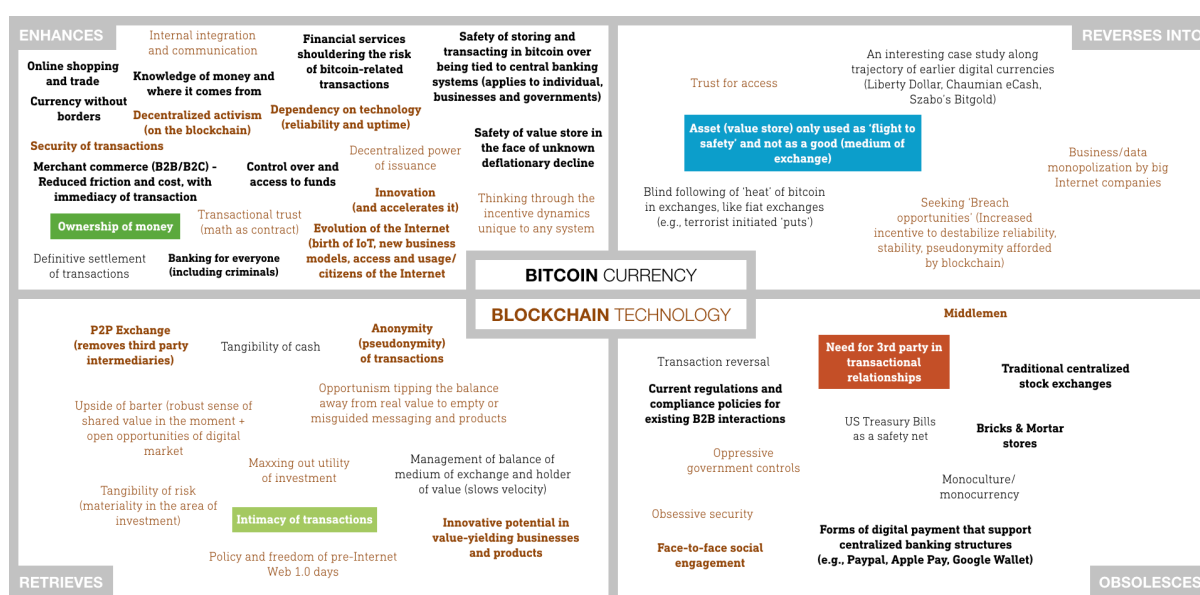


Figure 11. Ideas mapped onto the media tetrad with resonant ideas, based on the ratings for strength, highlighted in each quadrant.

Prototyping Narratives Over Time With the Panarchy Model

Adding the element of time and the dynamics of the larger financial system, we introduce the integrated tetrad-panarchy model as a tool to seed scenarios. The above ideas mapped to the tetrad become the anchors in a narrative framed by the hybrid model's seasonal sequence. To ground this in a real world example, we used the ideas as sequential elements to tell the remittance market story that is already occurring. The story of remittance provides a way to describe how the model could be used to understand an existing system with an eye on generating new future narratives.

REMITTANCE NARRATIVE AT THE MICRO LEVEL

At this *first* or micro level of the model is the Real Economy representing the actual and tangible tasks, behaviours, entities, and interactions, that are involved for a person remitting a payment from one country to another.

There is a huge global market for remittance. The market brings in over 500 billion dollars a year (Buenaventura, 2016) and its largest player, Western Union, charges between 8% and 20% to make transfers (Chan, 2015). The bitcoin blockchain has been applied in this space and offers savings and expediency to current users of other remittance offerings. What follows is a narrative description of the ideas on the real economy level as they would play out over the seasonal timeframe provided by the panarchy (see Figure 12).

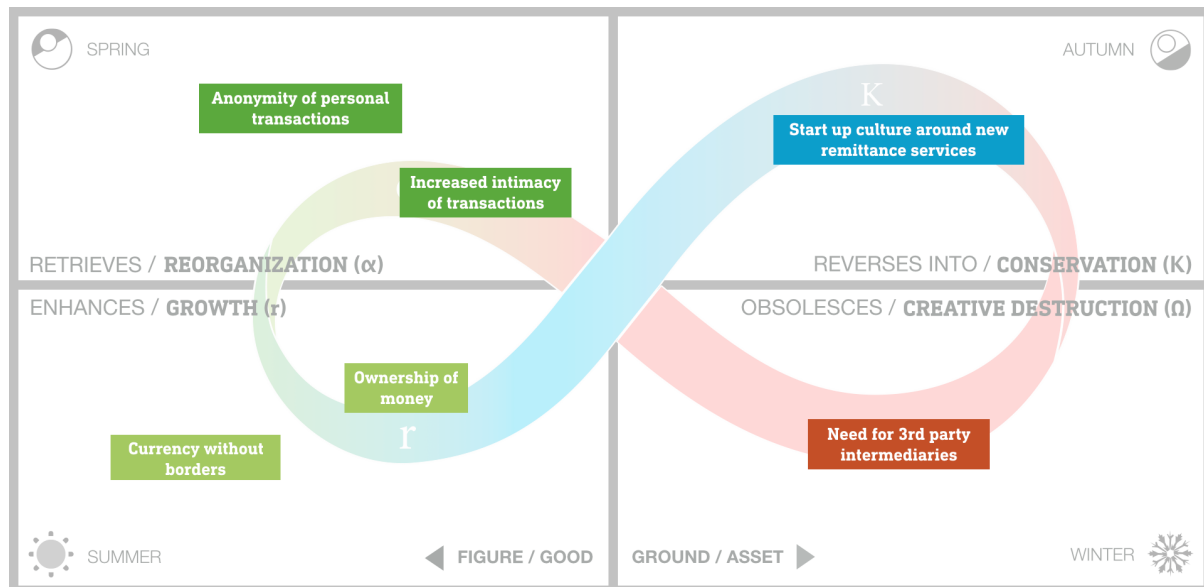


Figure 12. Selected ideas as they relate to remittance and mapped into the integrated model at the micro, real economy, level.

Enhances/Growth (Summer)

Idea 5: Currency without borders — Today, part of Bitcoin's \$800 (USD) price (as of this writing) derives its value from its function as a complementary currency, with an increasing ability to be moved quickly and over borders using the Internet Protocol and then traded into the fiat currency of any particular locality. Within the context of the remittance market, we see migrant workers using bitcoin sometimes via a remittance startup and sometimes themselves using Bitcoin as a way to send money back home for little or no cost.

Idea 6: Ownership of money — For a customer in the remittance market to participate in using bitcoin as a transfer tool, there is necessarily a point in that process where the money they want to send will be denominated in bitcoin. Even if this is a short timeframe, the connection to one's money provides a greater degree of agency and control for the remittance market customer, often a migrant worker sending wages home.

Idea 8: Startup culture around new remittance services — As the technology starts to be used and the enhancement it provides begins to deliver value to migrant workers and the people they transfer money to, the enhancement reverses into a startup culture around this specific function. This may be evidenced by new startup entities delivering services and resources for how bitcoin works. Essentially, we see an initial iteration of a new remittance market maturity as noticeable numbers of people begin to actually use these new ways to remit.

Obsolesces/Creative Destruction (Winter)

Idea 1: Reduced need for third party intermediaries — This emerging startup culture leads to an obsolescing of the current ways in which money is transferred back home. At this first revolution around the loop, we would not expect to see a collapse of Western Union, and in fact they remain the largest company in the remittance space. This first round of obsolescence has manifested as the shifting of some customers from Western Union over to bitcoin as a transfer tool, and Western Union remaining secure and confident in their product offering. We will see more of how that plays out as we move through the meso and macro levels to follow.

Retrieves/Reorganization (Spring)

Idea 2: Increased intimacy of transactions — In the space created from an initial obsolescing of the current remittance service providers, we see *greater intimacy of transactions* play out as the migrant workers use direct person-to-person transactions to send money home.

Idea 3: Anonymity (pseudonymity) of personal transactions — The idea of a migrant worker sending money directly home without the involvement of a centralized platform that would necessarily be party to the transaction, means that the transaction is not only intimate, between only the two parties, but is also essentially anonymous. Without the third party platform, what is more tangibly retrieved is the 8-20% of the remitted wages that go to a third party intermediary for enabling the transaction by providing the trusted platform. With the trust provided by the blockchain network, the migrant worker retrieves what he or she would pay from wages in order to make a transfer. This retrieval might be significant enough to clarify and accelerate the intentions of migrant workers, whatever they happen to be: to be reunited, to move to the middle class, to provide, or to progress.

Back to Enhances/Growth (Next Summer)

Returning to the bottom left quadrant, we see another iteration of the ideas situated in those quadrants (and perhaps the emergence of new ideas). For example, *currency without borders* is further and more deeply enhanced as more people have the experience of using it and the degree to which the outcomes are beneficial to them, within the remittance market and beyond.

REMITTANCE NARRATIVE AT THE MESO AND MACRO LEVELS

At the middle or *meso* level of the model is the Financial Services layer of the system. In the context of remittance, this level would currently include where Western Union and its competitors operate, their policies, their day to day operations and relationships to banks, government policy, and customers.

At the top or *macro* level of the model is the National Currency or Government layer of the system. This would include the elements related to how the government of a nation interacts with the dynamics around its citizens sending money back home from abroad.

To extend the micro narrative to the meso and macro levels, we used a specific real world example to illustrate how the model might serve to build new or describe existing narratives through the vertical levels of the system.

Nigeria has 21 million people in the diaspora, many are sending money home to friends and family (Fawehinmi, 2016). In recent years, they have begun to use new modes of transfer enabled by bitcoin, as well as other digital alternatives. These modes are working and people like them a lot—it means fewer people are using Western Union and other incumbents. This narrative is depicted in the above journey through the real economy level.

As customers want to use bitcoin and related offerings more on this micro level, we see an increase in the speed and intensity through the four quadrants of the real economy adaptive loop. The panarchy model describes that when the micro loop reaches a level of high intensity, there is a ‘revolt’ (“Panarchy”, 2016) from the growth/enhances quadrant on the micro level up to the conservation/reverses quadrant on the financial services level (see Figure 13). In this example, we could describe this narratively as new startups providing new services that are now in visible competition with similar functional offerings at the financial services level. Said another way, the revolt happens when bitcoin as a low to no cost alternative to remit reaches a critical mass of customers, and is therefore seen on the financial services level as a viable alternative, and threat, to the current offerings.

From the national level the panarchy describes the phenomenon of ‘remember’ (“Panarchy”, 2016) where the macro level of a system will respond to rebalance a changing system, moving from the conservation/reverses quadrant at the top level down to the reorganization/retrieves quadrant on the meso level. The narrative of what actually happened seems to fit well into the dynamics described by the model. The Central Bank of Nigeria in July 2016 imposed a policy that requires those offering remittal services to have a 1 billion dollar market cap and have offices in 20 countries (Fawehinmi, 2016). This is the system, from the top, invoking remember in a particularly overt and brazen way. Only one company, Western Union, would be able to comply with the legislation, so it is very obvious the signal being triggered: to remember the current, and incumbent, offerings.

The two key insights introduced earlier—that *technology as leading innovation hits up against the slowness of policy innovation*, and that *some individuals or groups are early adopters out of necessity*—are at the core of this narrative. In the case of Nigeria, the technology is not simply ‘hitting up against’, but with the brazenness of the policy it would seem to be aggressively being shoved back. The higher level of system is saying ‘remember’ to the ‘revolt’ from the real economy level. And for migrant workers spending large amounts just to send those wages home act out of necessity, on the micro level, to ensure their efforts abroad are not in vain.

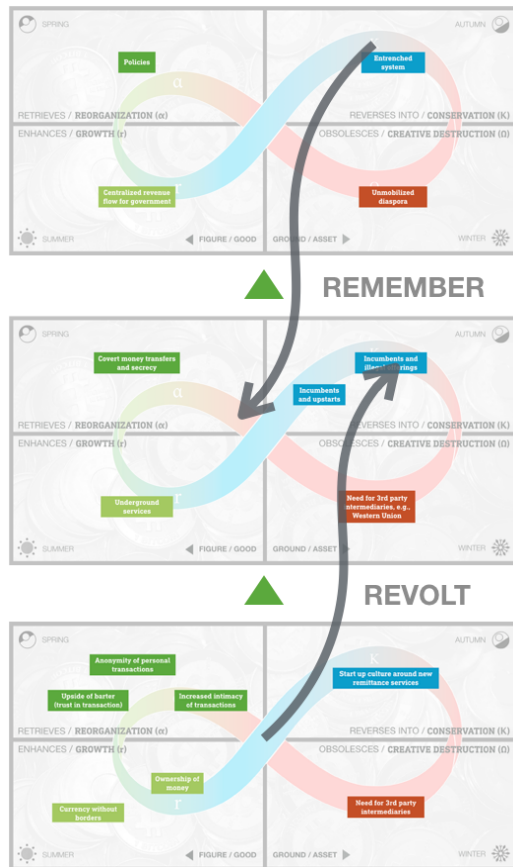


Figure 13. The micro, meso and macro levels of the hybrid model describing the revolt and remember dynamics of the Nigerian remittance industry.

Conclusion

Our project began with an objective to map the local community of bitcoin and then shifted focus to pursue an understanding and mapping how the core concepts and the different uses and emerging opportunities for the technology might play out in the larger financial system. In conclusion we revisit the research question:

What might the potential impact of Bitcoin and blockchain be at different levels of the financial system?

What emerged in our project to answer this question was the development of a framework and methodology into a hybrid model that combines the simultaneity of McLuhan's Media Tetrad with the seasonal timeframe in Gunderson and Holling's Panarchy model.

One of the benefits of using the tetrad and doing the analysis at different levels of a system is the aggregate emergence. The simultaneity of the tetrad enabled seeing connections outside of a timeframe of all the ideas generated from the literature review, the processed interviews, our conversations with each other and with our advisor, Peter Jones.

The benefit we found in using the panarchy was then to take those emergent ideas through time horizontally through one level of the adaptive cycle, and vertically through multiple levels of systems (*micro*, *meso* and *macro*).

The content and insights generated from the model that emerged opened the door to future study in the arena of remittance. In the remittance dynamic depicted in the narrative, it is currently necessary to convert bitcoin to local fiat currency to realize the value as a good. The more one can actually spend bitcoin online to get the local goods one needs or wants, the less one needs to realize its value as a good through local fiat. We see this dynamic as a jumping off point for further study. It is possible that this already sustainable application of Bitcoin could be the entry point for Bitcoin's potential to bank the unbanked towards the emergence of a 'digital middle class'.

We offer this as a first use of a nascent integrated model and would encourage others to try the approach. We would be delighted to hear about any of these further experiments.

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