

**DISCUSSION DRAFT**

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**The Role of IFIs and NGOs in the Diffusion of  
Blockchain Innovations<sup>©</sup>**

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## Summary

It is not uncommon to read about potentially disruptive technologies and in every case, we find apostles, skeptics, potential beneficiaries and potential losers. Today, it is a daily occurrence to read about blockchain as the next disruptive technology.

This paper comments on some claims and observations advanced in a recent meeting of advocates, skeptics, and neutral observers and concludes that if the disruptive promise of blockchain is realized in terms of lowering costs, providing simple and secure ways to protect data and consummate commercial transactions, blockchain technology may be one of the truly disruptive technologies of our time, as significant as the internet and perhaps even more valuable.

The issue for business people, policy makers and stakeholders is to learn how to harness that power to serve their pecuniary, social, educational, ecological, environmental, and economic goals. And while a big task for the thousands of change agents seeking to satisfy their own objective function, commercial entities will advance the technology and applications faster than most large organizations hobbled by legacy systems and organizational inertia.

It is a truism that the *status quo* is a vicious competitor against any new idea. Yet if one “follows the money” and follows opinion leaders, it is natural to conclude that blockchain’s power should be harnessed by both the private and public sectors and leveraged, because the inevitable is unlikely to be hobbled.

International financial institutions (IFIs) and non-governmental organizations (NGOs) have a unique opportunity to participate in launching blockchain-based applications. The author suggests these entities promote a variety of pilot projects to test blockchain applications and to learn how to best benefit from blockchain’s power.

## What is blockchain technology?

A blockchain is a data structure that represents;

- Something created like a title to a parcel of land, a birth certificate, a will, or a patent application, or
- A transaction such as a purchase, sale or transfer.

A blockchain is a trusted ledger that keeps track of the creation and transfer of data in a way that cannot be erased or modified after the fact.

Each transaction on the chain is digitally signed by each party, thus ensuring the data’s authenticity. As a result, all transactions within the blockchain are assumed to be of high integrity. By employing certain cryptographic features, the blockchain data becomes highly trustworthy and therefore replaces trust-intermediaries such as notaries or certain aspects of financial institutions, where trust is paramount.

In October 2015, The Economist published, “The great chain of being sure about things: The technology behind bitcoin lets people who do not know or trust each other to build a dependable ledger. This has implications far beyond the cryptocurrency.” This story and others flowing from investor excitement and a flurry of potential applications together make a simple statement... blockchain has arrived.

Blockchain has come fully into the consciousness of entrepreneurs, businesspeople, policy makers, and the mainstream media.

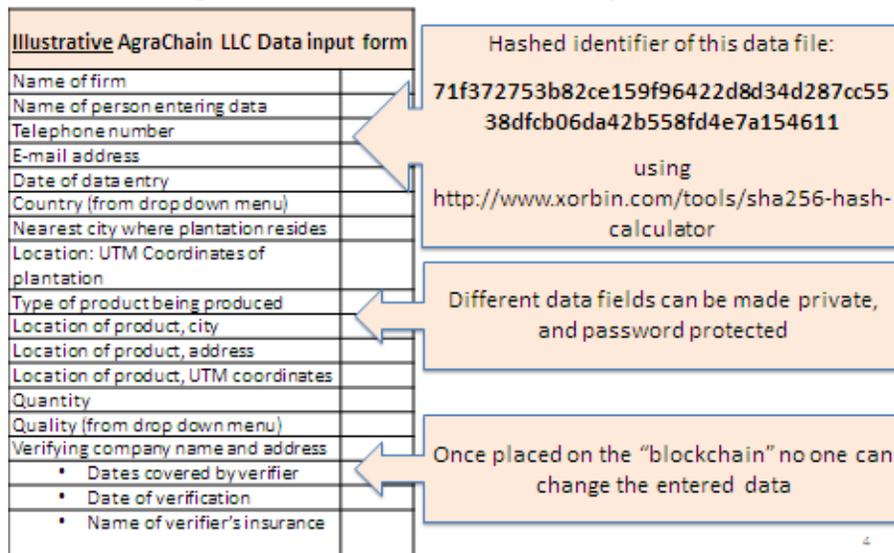
Blockchain provides a way for people who do not know or trust each other to create a record of who owns something in a secure and immutable way, thus bypassing intermediaries. Blockchain provides a way to buy and sell and create smart contracts that simplify buying and selling, make it faster, more secure and less expensive than traditional human brokers of stock, bonds, ships or commodities.

There are many commercial and policy implications associated with trillions of dollars of peer-to-peer blockchain-based transactions. These blockchain transactions can replace brokers, can produce an easily accessible history of all transactions and can create faster and more secure transfer of funds. These applications and more have implications well beyond just saving money. Blockchain applications will change a myriad of social interactions and institutions.

Below we give one example of how blockchain technology can be used to verify the existence of good environmental deeds such as the avoidance of deforestation associated with producing, for example, palm oil or wood products. The example is based on using a patent-pending cell telephone technology for data entry, storage and transmission on to a blockchain. Note that the cell telephone technology we use to send information on attributes of an agricultural supply chain is operational today and is used to send mobile money. This technology can also be used to support cell telephone based micro-loans or micro-crop insurance.

1. Data is entered by a grower using a cell telephone. The data file is digitally signed and protected.

### Data is entered from the point of product origination - - the farm or plantation



- The data are entered into the blockchain by the transporter whose ID is verified and the date, time location, and attributes of the product are entered in the blockchain.

Data is entered from the transporter who picks-up the palm nuts, cocoa, cottons, fish pharmaceuticals, etc.

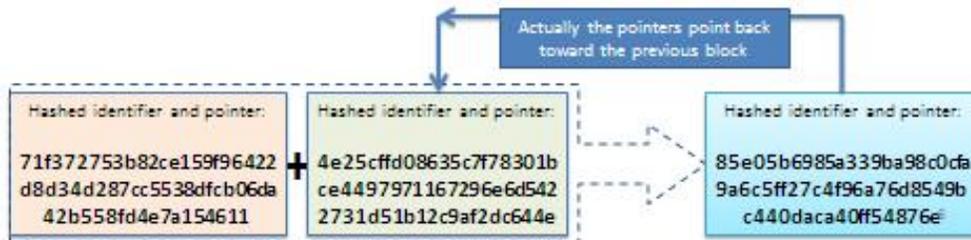
Illustrative AgraChain LLC transporter data input form	
Name of firm	
Name of person entering data	
Telephone number	
E-mail address	
Date of data entry	
Country (from drop down menu)	
Date of pick-up	
From: Plantation	
Location: UTM Coordinates of plantation	
Location of product, UTM coordinates	
Quantity	
Delivered to firm (X)	
Time	
Date	
Year	
Verified by (X) person	

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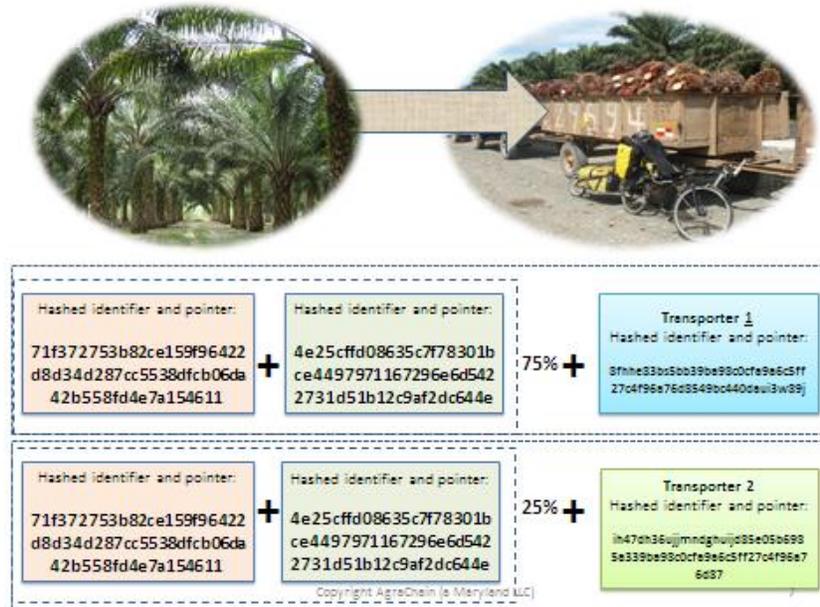
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5

### Transporter logs-in data using a mobile telephone



3. As loads are divided, the blockchain keeps track of every sub-division, transferee, location, etc. Each step of the supply chain gets entered into the system and is securely “hashed” and immutably stored for future auditing and verification.



4. The aggregator gets a product from the transporter. Both the transporter and aggregator log in the transaction. The chain, therefore, gets longer and is stored for future auditing/verification by buyers, governments, certifiers or NGOs.

### Transporter brings a certain quantity to an aggregator



By providing an auditable trail of all transactions, the simple example above shows how blockchain can benefit buyers of products that purport to be environmentally or ecologically friendly, or amenable for granting tradable greenhouse gas credits. The blockchain-based

supply chain provides for verification of good-deed doing claims and help assign liability, in every step of the process so long as data is entered and is truthful.

Just as Bank of America has been aggressive in patenting blockchain technology, eTrios is protecting their IP. Nevertheless, diffusion does not depend on the patents but on finding hospitable regulatory and legal circumstances in which these solutions can be implemented with on the ground partners.

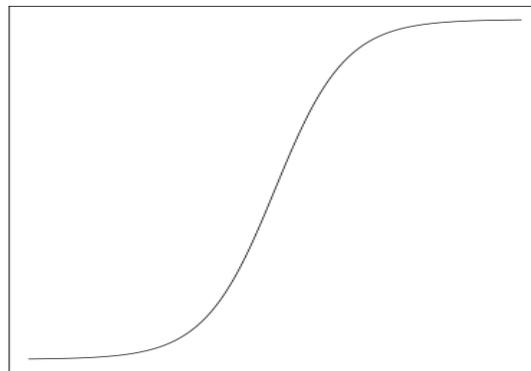
### What does innovation theory tell us about the diffusion of innovations?

It is unlikely that the blockchain genie will get back into the lamp, so how might we anticipate its application?

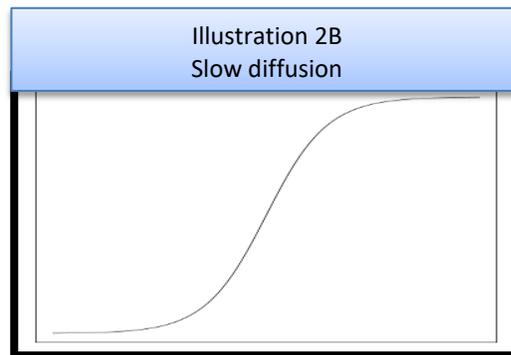
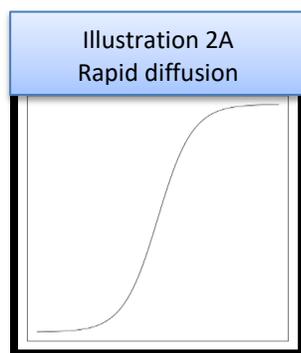
First, we must bluntly state that discussion of blockchain should not be confused with a discussion of bitcoin. While bitcoin, as the first well-known application of blockchain, has a separate literature and perspectives among advocates and skeptics, bitcoin and its “altcoin” applications are just one of many potential blockchain applications.

It is common knowledge that innovations will diffuse according to a logistic curve (see Illustration 1 in which the horizontal axis is time and the vertical axis is the percentage of adopters). The question potential beneficiaries and potential economic losers might ask is, will the diffusion be rapid as illustrated in Illustration 2A or slow as in Illustration 2B?

**Illustration 1**  
A stylized diffusion curve



**Illustration 2**  
Two stylized diffusion curves: rapid and slow

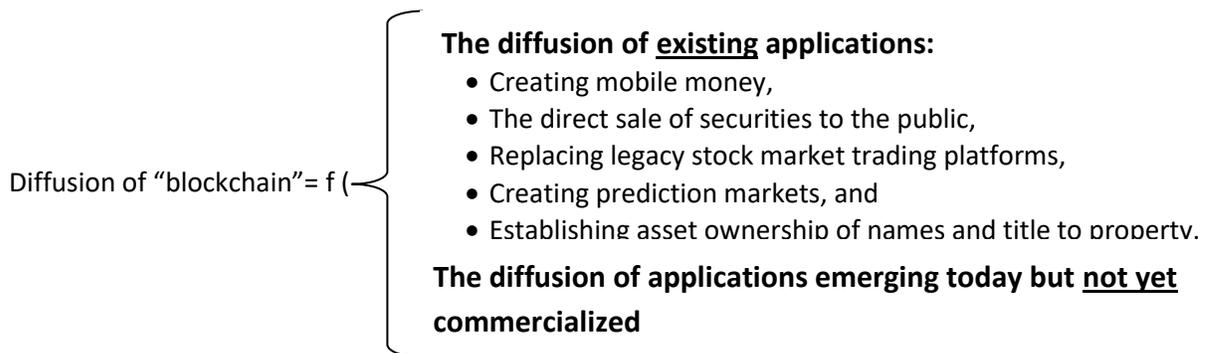


Blockchain is not like the PC or cell telephone or Facebook. Blockchain is spawning a myriad of applications, each of which has its own pattern of adoption. So if we ask what will be the rate of adoption of blockchain, we must look at two factors: (1) the rate of adoption for each application and (2) the rate of growth of software engineers who have expertise in developing and perfecting blockchain applications.

So consider that today there are several blockchain applications that are working in the real-world but have not taken off yet because early round adopters are launching them just now. These applications include, but are not limited to:

- Creating mobile money,
- The direct sale of securities to the public,
- Replacing legacy stock market trading platforms,
- Creating prediction markets, and
- Establishing asset ownership of names and title to property.

So the diffusion of blockchain relates to the diffusion of its constituent parts:



With each successful application, the body of software engineers with blockchain fluency will increase, the cost to design applications will decrease and the rate of adoption will increase “blockchain diffusion.”

The successful adoption of blockchain technology is not a technical matter; it is a cultural, legal, regulatory and institutional matter and this is where IFIs and NGOs can help.

Constituencies (current financial beneficiaries) associated with high transaction-cost activities will use every legal lever to thwart adoption of any new technology that threatens their revenues and power. Thus, barriers might arise to stop some blockchain applications from being implemented, even after reliability, speed, security, flexibility and cost issues have been addressed. Evidence of the resistance of legacy-system rent-seekers is clear: witness the current “Uber” debates in big cities around the world where there is tension between legacy system beneficiaries and new entrants or follow the attempts to hobble Airbnb. Again, the *status quo* is a vicious competitor against any new idea.

E.M. Rogers (in Diffusion of Innovations) suggested four adoption/diffusion theories.

- *Innovation Decision Process theory.* Potential adopters of a technology progress over time through five stages in the diffusion process. First, they must learn about

the innovation (knowledge); second, they must be persuaded of the value of the innovation (persuasion); they then must decide to adopt it (decision); the innovation must then be implemented (implementation); and finally, the decision must be reaffirmed or rejected (confirmation). The focus is on the user or adopter.

- *Individual Innovativeness theory.* Individuals who are risk takers or otherwise innovative will adopt an innovation earlier in the continuum of adoption/diffusion.
- *Rate of Adoption theory.* Diffusion takes place over time with innovations going through a slow, gradual growth period, followed by dramatic and rapid growth, and then a gradual stabilization and finally a decline.
- *Perceived Attributes theory.* There are five attributes upon which an innovation is judged: that it can be tried out (trialability), that results can be observed (observability), that it has an advantage over other innovations or the present circumstance (relative advantage), that it is not overly complex to learn or use (complexity), that it fits in or is compatible with the circumstances into which it will be adopted (compatibility). (See, Technology Adoption and Diffusion, V.H. Carr Jr.)

Today, two innovations now conspire to facilitate all four theories in the real-world, and collapse what was once months and years to accommodate information transfer into days and weeks. First, the internet provides access to the latest information for anyone with access to a search engine. Now the population of search engine users is over a billion people and is growing fast every hour. Second, cell telephone technology provides access to direct speech and message technology and in many cases provides direct access to the internet. What previously took years to diffuse in pre-internet and pre-cell telephone days, now takes hours, days or weeks.

Where would we expect certain types of blockchain applications to appear? We would expect to see early adoption of some applications in the developing world where legacy systems might not be entrenched. In other cases (the developed OECD countries), where efficiency gains or privacy concerns are paramount, we might expect diffusion of some application to appear there. In both cases, the expectation is that where individuals or entities can internalize the benefits -- simplify supply chains, document ownership, create immutable identities, etc. -- is where we would expect the implementation and perfection of blockchain systems and its subsequent diffusion.

### **What can change agents do?**

There are many institutional change agents that can advance their goals by leveraging blockchain solutions. These change agents include, but are not limited to, the World Bank, IFC, the United Nations (UNICEF, UNDP, and UNEP), US AID, EBRD, and GIZ. These are just a few of the entities whose mission is to help developing countries and transitional economies gravitate toward new economic, environmental, health, and civil society models and provide multiple benefits to underserved peoples.

Many programs supported by these organizations address property right issues, promote better health, better educational, environmental and economic matters. Many initiatives address finance, insurance, employment and day-to-day commercial matters affected by selling crops or raw materials, enhancing the efficiency of supply chains and provide better access to markets. In every case, blockchain applications can improve the desired outcome.

**The most important work that these change agent organizations can provide is to enhance the legal, regulatory and institutional soil in which new innovations can take root. That is their role. That is their areas of expertise.**

Providing the legal, regulatory and institutional soil in which new innovations can take root is something the private sector is not equipped to achieve. Just as lighthouse-building falls mostly to governments, because the externalities cannot be internalized by private sector profit-seeking actors, creating institutions and laws that accommodate new technologies is the purview and domain of those entities that care about externalities. New systems such as proper land title systems, better management of birth certificates, better access to economic tools for citizens, and more secure management of personal information and documentation of property rights while important, provide externalities that the private sector cannot always internalize. And with questionable regulations and laws, the private sector is unlikely to step-in. This fact contributes toward perpetuating inefficient and inequitable systems. What is the result of maintaining the *status quo*? Simply put, the cost of perpetuating inefficiencies and inequities produces billions of misspent dollars and the continued retardation of economic progress for hundreds of millions of people.

Some applications of blockchain such as creating a repository for wills or birth certificates have little or no effect on institutions. Other applications such as remittances based on cell-telephone technology, facilitating more and cheaper micro-finance or taking middlemen out of the commercial equation by granting individuals access to buyers or sellers can save hundreds of billions of dollars and can affect institutions.

#### **What is to be done?**

Diffusion of blockchain solutions to a myriad of problems is a tremendous new opportunity for social and environmental good. The role of the private sector is clear - - provide better solutions to problems and earn revenues from these applications. The role of the public sector is complex, both protecting entrenched constituencies and enhancing the betterment of the people governments serve. The role of IFIs, NGOs and donor organizations is usually clearer.

The role of IFIs and NGOs is primarily to seek to help their target clients improve their lives through a variety of means, among them is the use of new technologies, creating the institutional circumstances in which new technologies might blossom, and helping local stakeholders better understand and better use innovative systems to achieve their desired educational, health, environmental and economic outcomes. Unfortunately, in some circumstances, change agents might be in conflict with legacy constituencies that secure economic rents from existing inefficient or inequitable systems. Knowledge as to how to transfer commercial and social systems predicated on blockchain and other disruptive technologies largely resides within academia, IFIs and within the NGO community. That knowledge needs to be secured to help the private sector better design and better implement blockchain applications.

**Through pilot projects, in a variety of countries and cultures, IFIs and NGOs should partner with the private sector to transfer blockchain technologies, create lessons learned and provide democratization through the diffusion of blockchain based systems.**