Glass Shield

**Blockchain technology's potential
to facilitate governance**

Cameron Grams

Global Master of Arts Program

Fletcher School of Law and Diplomacy

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1. Introduction

This paper seeks to examine the use of blockchain technology as a trust building mechanism in post conflict Afghanistan by exploring the blockchain's potential role in facilitating transparent land registration in a manner that enhances the integrity of the state. Peace building and reconciling formerly hostile parties is always a fragile process, and Afghanistan has repeatedly slid back into war just as it appeared stability was returning. Trust in new institutions can present an obstacle to establishing the larger trust required to cease violence--especially if there is a tradition of predatory governance in the area. Blockchain technology suggests a model where trust in institutions could be improved by enhancing the transparency, accountability, and integrity of institutions, government officials, and official actions. This increased confidence by the people in the state opens the possibility for additional services being made available to citizens and greater integration with legitimate external economies. In 2016 we have seen the refinement of blockchain technology to the point where it suggests a model of how the blockchains's distributed ledger could be used to foster trust, fight corruption, strengthen new institutions, and facilitate the integration of the post conflict area into the world economy. This paper will discuss this objective and some of the issues surrounding implementation.

2. Problem Statement
Trek Nawa Case study

In 2009-10 I was a Marine serving as an advisor to the Afghan Police in Helmand Province Afghanistan. I had served previously as a Police Adviser in Iraq and this was my second tour in Afghanistan. Working with police forces brings you in contact with citizens as they interact with the government at it's most fundamental level. This experience highlighted some key concepts surrounding governance, rule of law, property, and basic requirements for a stable society.

One of the more interesting people that I worked with in 2009-10 was a tribal elder named Hakim Khan. He was the senior patriarch of his tribe and represented the most pure example of traditional Pashtun tribal authority that I saw in my two tours in Afghanistan. "Khan" is a traditional honorific (in addition to being an adopted name) and historically signified "he who

feeds the people".[1] The Khan was the traditional decision making authority for questions of resource allocation. It was claimed that in the 1970s the nature of this role changed with the monetization of Afghan culture, and that the authority of Khans decreased.[2] In 2010 in Helmand province Hakim Khan's authority was still very real; in addition to being a tribal elder Hakim Khan was a colonel in the Afghan Police. Unquestionably monetization of the economy had changed the traditional tribal roles, but I would contend that the extended period of conflict in Afghanistan reinforced tribal authority in ways that are still not entirely clear with regards to the modern nation.

Afghan culture in Helmand province is still heavily tribal. Formal government as recognized internationally sits on top of other arrangements that are more decisive in the citizens daily lives. The periods of greatest stability in the past 30 thirty years were ones where the central government recognized a role for tribal leadership and permitted a degree of autonomy for tribal decisions and actions.[3] Tribal dynamics continue to shape Afghanistan today and directly impact government legitimacy. One strong undercurrent of the conflict with the Taliban has been the competition between Durrani and Ghilzai Pashtun tribes and their struggle for power.[4] This conflict can be traced to the 1800s and pre-dates both Soviet and US involvement in Afghanistan. In Helmand in 2010 a reliable predictor of anti-government activity was the sentiment of senior members of the Ishaqzai tribe (a Ghilzai subtribe aligned with the Taliban). Access to land, water, other resources, and loyalty were all filtered through tribal power arrangements.

Hakim Khan was very much the tether for his tribe to the Afghan government. Many members of this tribe occupied an area called Trek Nawa to the west of the provincial capital of Lashkar Gah. General Ayub, the Personnel Officer of the Afghan Provincial Police force, stated that this tribe was illegally occupying government land.[5] It was only due to Hakim Khan's influence that they were able to maintain their presence unmolested. Hakim Khan was at the apex of the relationship with the government; he was the point of articulation for his tribe into the modern Afghan economy. Hakim Khan protected the members of his tribe from pressure, both

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[1] "There are no Khans anymore: Economic Development and Social Change in Tribal Afghanistan", Jon W. Anderson, Middle East Journal, Vol. 32, No. 2 (Spring 1978)
[2] "There are no Khans anymore: Economic Development and Social Change in Tribal Afghanistan", Jon W. Anderson, Middle East Journal, Vol. 32, No. 2 (Spring 1978)
[3] Barfield, Thomas J. *Afghanistan: A Cultural and Political History*. Princeton: Princeton UP, 2010. Print. Pg 220-2
[4] Ibid. pgs 225-6
[5] Personal conversations with Gen Ayub in 2009-10.

from the government officials responsible for security in the province and other tribes seeking access to arable land.

The issues that I witnessed in 2010 continue unchanged; in June of 2015 the United States Institute for Peace (USIP) released a report summarizing a two year project they conducted attempting to strengthen formal land registration in Afghanistan and develop objective procedures for dispute resolution.[6] In their report they state that possibly only 20% of the land in use in Afghanistan has a formal title for registration. The project identified many structural problems that originate from current Afghan land law, specifically that if citizens do not have formal registration for their land they can not obtain formal recognition of ownership, USIP explicitly called this a Catch-22. The most dangerous part of this law is the proviso that any land without formal title defaults to being considered government land. The default position has the potential to deliberately disenfranchise 80% of landholders if USIP's estimate is accurate. Additionally the law favors the state of affairs in 1978 and defaults to land registration efforts from the 1960-70s that compiled an initial Basic Book of land registration, before the Russian invasion.[7] This policy does not account for either the impact of forced migration due to the prolonged conflict or the reality of communal tribal ownership or other tribal dynamics such as the conditions exemplified by Hakim Khan and his people. The USIP report explicitly states; "The basic issue *(...with the inefficiency of the law...)* is that the law is so narrowly written that, in most cases, the state is a threat rather than a protector of rights".[8] This rigid approach undermines the legitimacy of the state, establishes conditions conducive to predatory local officials, and prevents citizens from enjoying the full benefits of their labor in a modern economy.

Land rights in less governed regions

The problems faced in rural Afghanistan are not unique. Hernando de Soto's body of work documents how much of the world is disconnected from the international economic system due to a lack of formal rights to their land.[9] This was the situation in Helmand in 2010; tribal relations largely defined the access to land and roles within society, the power dynamics that determined what was and was not possible for individual Afghans were largely out of their

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[6] Gaston, Erica. "Land Conflict in Afghanistan." *USIP Special Report* 372 (2015): n. pag. Web. 3 Jan. 2017.
[7] Ibid., page 3
[8] Ibid. page 10
[9] Soto, Hernando De. *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*. New York: Basic, 2000. Print.

hands. Without the protection of tribal elders individual farmers were left to fend for themselves against the rule of force. This inability of the individual to access the full potential of his efforts, what should be available through modern economic innovation, is the topic of de Soto's "The Mystery of Capital" and his current work with the Institute for Liberty and Democracy.[10]

Hernando de Soto identifies what he defines as "dead capital" to be the possessions of poor people throughout the world that are inadequately documented and therefore not able to be realized for their potential as capital. He states: "Because the rights to these possessions are not adequately documented, these assets cannot readily be turned into capital, cannot be traded outside of narrow local circles where people know and trust each other, cannot be used as collateral for a loan, and cannot be used as a share against an investment."[11] This situation perfectly captures the local nature of the economy in rural Afghanistan.

De Soto goes on to outline key features of documenting ownership that underpin the modern economy:[12]

- Fixing the economic potential of assets
- Integrating dispersed information about assets
- Establishing accountability for ownership
- Deriving monetary value from assets
- Networking people into a larger economic system
- Protecting transactions

All of these functions can be ascribed to developing a trusted abstraction, such as a land title proving ownership, that can be managed in a larger economic system. The key feature for developing this representation is trust in the system of representation. Much like currency, the underlying system that holds this representation of value must be trusted. Traditionally that role has been provided by the stability of the state, through government officials performing various functions in the overall process of the integration of assets into the overall economy. Afghanistan has suffered from a lack of legitimacy in the government due to both corruption and competing models for governance. Blockchain technology provides an alternative to state authority to provide trust in the representation of value; by harnessing a strong cryptographic

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[10] http://www.ild.org.pe/, just wait out the pop-up countdown

[11] Soto, Hernando De. *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*. New York: Basic, 2000. Print. Page 6.

[12] ibid.

system that ensures stability the representations of value, land titles for example, are ensured by the system itself. The stability and integrity of this system grows with additional users. This impedes the ability of any single local official to perform his duties in a corrupt manner. If used as a tool for integrating currently dispossessed individuals blockchain technology can remove one component of uncertainty in the process of economic integration and ensure that transactions can be taken in a reliable manner. If employed effectively, removing uncertainty can reinforce the overall stability of the government by ensuring the integrity of government officials.

National Sovereignty and Government Legitimacy

The statements by Gen Ayub that Hakim Khan's people were living illegally on government land was a reflection of the weak governance of Helmand province in 2010, and the rigid nature of the official land law of the Afghan government. The inability of the state to control the land and how it was being used, and to reflect the reality faced by the people, was the result of the long period of war that Afghanistan has known, and the fact that hungry people will seek resources to feed their families. The social contract between the state and the people was not reflected in the reality on the ground.

The ability of the state to effectively govern is limited by many factors, security is only the most obvious. In southern Afghanistan many of the functions that should have been well defined as part of national authority were still largely driven by personal relationships, and encompassed many factors, including tribe and key personalities. Over the last 40+ years many Afghan government officials sought to profit from their role in the government, either through bribes to perform official duties or by selectively enforcing regulations in line with personal agendas.[13] In 2015 Transparency International rated Afghanistan 166 out of 168 countries examined for perception of public corruption.[14] Predatory governance by local officials has provided a major impetus to continue the insurgency and drive Afghan citizens to seek a more reliable authority to organize their lives. The lack of government integrity is a contributing factor to the continued instability; citizens are inclined to seek justice and protection where they feel it can be provided most reliably, and that is not always from the recognized government authorities. Formal law can work against the legitimacy of the state if it is too rigid to accommodate reality; the USIP report stated that the land law established by the Taliban was

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[13] Giustozzi, Antonio . *Koran, Kalashnikov, and the Laptop*. New: Columbia U Press, 2008. Print, pgs 15-21
[14] "Afghanistan Country Rating." *Transparency International*. N.p., 2015. Web. 6 Jan. 2017.

more responsive to informal land claims and more responsive in adjudicating conflicting claims. [15]

Afghanistan's international legitimacy has also suffered due to the inability or unwillingness of government officials to control the use of land for opium production. The tradition of opium production and the economic relationships established surrounding it are a feature of many of the weakly governed parts of Afghanistan. This has undermined Afghanistan's place in the larger world economy.

Effective record keeping is a tool for governance; without a solid record of who has rights to the land there is no way for the government to protect those people and no way to ensure that the people contribute fairly to the maintenance of the state in a lawful manner. Developing effective records of land-ownership not only benefits the people working the land by providing an element of security in their lives, but enables the state to assert sovereignty by claiming taxes on the productive use of the land. Legitimate taxation should be an objective fact and not an arbitrary levy imposed locally. Effective record keeping ensures that this transaction between the state and the people is conducted in a just and transparent manner. This paper examines the possibility of bringing the distributed ledger capability of the blockchain technology to Afghanistan in order to provide stability by delivering transparency and integrity in the record keeping process of land ownership.

3. Premise

This paper seeks to examine a potential set of tools that can be employed to reinforce stability, specifically the potential role in post conflict areas where trust is lacking. The assumption is that there have already been steps taken to reconcile adversaries and an initial framework for governance is taking shape or already established. There is a critical minimum level of buy-in required by former adversaries; a strong argument can be made that the current round of conflict in Afghanistan has persisted as long as it has because the members of the former Taliban government were not allowed representation during the drafting of the 2004 Afghan Constitution. [16] That lack of participation undermined their willingness to negotiate. The fact that their acceptance of that constitution has been a precondition for negotiations from the

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[15] Gaston, Erica. "Land Conflict in Afghanistan." *USIP Special Report* 372 (2015): n. pag. Web. 3 Jan. 2017, page 15, note 46. This is in agreement with personal experience from 2010.

[16] "Afghanistan's Flawed Constitutional Process." *International Crisis Group* 56 (2003): n. pag. Web. 5 Jan. 2017.

US created a further obstacle.[17] This paper assumes that the obstacle of non-participation has been cleared and seeks to outline a tool that will ensure continued endorsement of government institutions. This level of buy-in would not be required throughout the entire county to make a pilot blockchain project a viable option, only local stability and buy-in would be necessary. With time, ideally, the utility of the system would become apparent as stronger records facilitated greater economic activity and greater stability. However some measure of initial stability is required to start.

The goal here is also less ambitious than those of some visionaries working with the blockchain who see the potential to cede a great deal of human decision making to precise algorithms. Here the focus will be on how the distributed ledger technology of the blockchain can *support institutions by providing assured transactions, transparency and accountability over the performance of administrative functions.* This model will seek to outline ways that this technology can reinforce the role of government and the implications for citizens.

One component of any political reconciliation has to be an acknowledgement that the post conflict time period starts as **Year Zero for property ownership**. In Afghanistan in 2010 I met many elders who had documents from multiple authorities that established property rights over their land, from the post-Soviet regime of Najibullah, to the Taliban, to the Karzai administration there were multiple legitimate claims to land. Significantly, all of these documents had been issued after 1978. Afghanistan is an extreme example since it has had 40 years of near continuous conflict. During that time different central and regional authorities were able to assert control over a given area and publish acknowledgement of resource rights accordingly. *In order to move forward there has to be a recognition that the past is past and everyone is working towards the future from a single starting point, and an acceptance that people who have been occupying government land have some rights based on their current activity. A default to conditions in 1978 impedes the goal of moving forward because it denies Afghanistan's recent history.*

At present the Afghan land law has provisions for citizens who occupy and improve government land under a policy of "adverse possession".[18] However this law states that citizens must have occupied the land for 35 years. This is an unrealistic amount of time given that most

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[17] Kane, Sean. "Talking with the Taliban." *USIP* 356 (Jan 2015): n. pag. Web. 6 Jan. 2017.
[18] Gaston, Erica. "Land Conflict in Afghanistan." *USIP Special Report* 372 (2015): n. pag. Web. 3 Jan. 2017, page 7.

of the past 40 years has seen war in Afghanistan. There has to be an official acceptance of present conditions rather than using those from 1978 as the basis of law.

Establishing a Year Zero for property rights sets a clean slate moving forward. It also has the potential effect of disenfranchising those not engaged in the reconciliation process; dispute resolution has to be acknowledged as part of the governance process. The rights of refugees and the claims of willful ex-patriots both must be scrutinized as part of the process of establishing a Year Zero baseline. It is essential that these issues are recognized as part of the reconciliation process and incorporated in governance from the beginning.

The blockchain distributed ledger technology can facilitate the process of reconciling government records with reality by providing transparency, security, and accountability over the administrative and economic status of property. This process is still subject to all of the pressures of any region where the rule of law is contested. The goal should be to bring the land into a productive capacity for the benefit of the people. If security concerns can be abated the land should be used in a manner most conducive to the welfare of the people in the region.

4. The Technology of the Blockchain[19]

Transparency and integrity of information are the most essential aspects of blockchain technology. Development of this technology can be credited to the initial work with Bitcoin. Bitcoin is the most widely recognized implementation of blockchain technology because it was the first, but Bitcoin has since been followed by other implementations that are further driving what is possible. In 2008 the Bitcoin whitepaper that described this technology was published by Satoshi Nakamoto on a cryptography mailing list.[20] The initial whitepaper explained the concept of a distributed blockchain.[21] Shortly after explaining the technology the software to perform the calculations was released and the community of cryptographers began experimenting with "mining Bitcoin", or growing the blockchain as described in the paper. Blockchain technology began as a niche practice among cryptographers and technologists but has grown into something truly unique.

One of the unique applications of the blockchain is the "distributed ledger" feature of the technology. The United Kingdom's Government Office for Science released an assessment of

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[19] A good 5 minute primer on the blockchian technology was produced to support the UK's Government Office for Science, https://www.youtube.com/watch?v=4sm5LNqL5j0&feature=youtube
[20] Davis, Joshua . "The Crypto Currency." *The New Yorker*. N.p., 10 Oct. 2011. Web. 6 Jan. 2017.
[21] Nakamoto, Satoshi. "Bitcoin: A Peer-to-Peer Electronic Cash System." *Bitcoin*. N.p., 2008. Web. 6 Jan. 2017.

the potential for blockchain implementation of a distributed ledger in January 2016.[22] They provided a succinct definition: "A block chain is a type of database that takes a number of records and puts them in a block (rather like collating them onto a single sheet of paper). Each block is then 'chained' to the next block, using a cryptographic signature. This allows block chains to be used like a ledger, which can be shared and corroborated by anyone with the appropriate permissions."[23] The fact that the chain grows in a cryptographically secure manner ensures the integrity of the entries made in these successive blocks.

A blockchain is a record of calculations based on the state of the network at successive points in time. Each record, the block, is calculated based on the block that precedes it by reading the header information of the block (like a label or title) and the transactions or other information for that time period. These calculations are performed by computers linked on the network each trying combinations of values to solve the current problem represented by the state of the network. These calculations are largely trial and error so the speed of computing power that achieves these calculations drives the evolution of the blockchain.[24] Once a given set of calculations is recognized it is confirmed by the other members of the network. This ensures that there is a consensus on the state of the information in the blockchain. Confirming the block is a matter of more straight-forward calculation and does not require the computing power needed for the trial and error of initially solving the block.

All of the blocks are visible and able to be authenticated by all of the participants in the network. This is how blockchains provide transparency and integrity for information. The network recognizes the longest version of the chain that reflects the most recent calculations and continues building from there. This provides all of the participants in the network visibility into the overall state of the network and an assurance in the soundness of the entries in the actual blocks.

The calculations that produce the actual blocks are hard cryptographic problems that require a great deal of computational power to accomplish the trial and error of possible solutions. This requires a great deal of hardware and electrical power. Completing these calculations is rewarded with tokens, proof of work, for performing these calculations by the network, growing the blockchain provides a greater investment in the blockchain; Bitcoins are

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[22] "Blockchain Technology." *UK Government Office for Science* . N.p., 19 Jan. 2016. Web. 6 Jan. 2017.
[23] "Blockchain Technology." *UK Government Office for Science* . N.p., 19 Jan. 2016. Web. 6 Jan. 2017.
[24] This is a "proof of work" blockchain model. Other models, such as a "proof of stake" where greater responsibility for blockchain integrity is performed logically by software on the actual blockchain are under development.

the tokens in the case of the Bitcoin network, Ether (Eth) in the case of the Ethereum network, or some other incentive mechanism defined by a local network on another blockchain.

The original implementation of a blockchain with Bitcoin only sought to provide a record of ownership of the proof of work tokens in the Bitcoin system; the individual blocks of information captured between calculations was designed to reflect transfers of ownership of the tokens. What is possible with a blockchain system has evolved to the point where the value of the information entered into the blocks is now the object of focus. This is the concept of a distributed ledger that will be considered in this paper.

The original Bitcoin system allows all participants able to make entries and engage in token exchange freely. Subsequent systems have defined roles and established restrictions on the capabilities of network participants. This has expanded the potential use of the blockchain; it is possible to provide all network participants full visibility of the entries, but restrict who can make successive entries, or require multiple entries to validate an action. This has the greatest potential as a tool for governance, where administrative accountability is provided through transparency and permissioned entries are defined in accordance with roles in the government.

Security of the system

The blockchain has evolved in the open source software development community. The technology involved and the practice of growing the blockchain have been publicly available, discussed and examined by the community of experts best qualified to ensure it's integrity. Andreas Antonopoulos, one of the more prominent blockchain innovators, likened blockchain to the "sewer-rat", since it's immune system has been exposed to continuous assaults it has developed a high degree of resilience.[25]

The greatest source of that resilience is the network effects achieved by having many participants in the system; by having a large number of people performing the calculations that grow the network there is greater assurance in the system's integrity based on the consensus of the large number of network participants. No one is able to change a previous entry without alerting the entire network and consensus is required for new entries to be recognized by the network.

There are theoretical threats to the information in the blockchain; if a single participant captured more than 51% of the computing power of the network it would theoretically be

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[25] Antonopoulos, Andreas. "Andreas Antonopoulos DevCore: Bitcoin, the Bubble Boy, and the Sewer Rat, a must see speech!" *YouTube*. N.p., 9 Nov. 2015. Web. 6 Jan. 2017.

possible to control the entries that were made in the network by establishing a single source of authority, rather than network consensus. This would enable that actor to control future entries, but they would still not be able to alter the past record. This threat is mathematically possible but the amount of computing power being employed from the large number of sites makes this threat less likely. Blockchain networks benefit from the network effects of large numbers of users; more users ensure more efforts at computation and more locations of the past record.

Ethereum

The Ethereum blockchain is an evolution of the blockchain concept first employed by Bitcoin. Originally proposed by Vitalik Buterin[26] in 2014 the Ethereum system expands on the original concept of the blockchain employed by Bitcoin by embedding a complete scripting language in the blockchain itself, so that individual blocks can contain additional information.[27] This enables the ledger to capture information complete with instructions for actions to be taken at a later time, or when given conditions are met. This enables entirely new forms of social organization and economic activity, such as the Distributed Autonomous Organization (DAO) and Smart Contracts. The DAO is a collection of users who have pooled value in the form of Eth tokens and make collective, decentralized investment decisions.[28] Smart Contracts are the conditions based instructions encoded in the actual blockchain itself, for example: transfer X to Y if conditions A, B and C take place. The transfer would take place only if conditions are met and without further human interaction.

This further expansion of what is possible with the blockchain is very new and still has significant pitfalls associated with implementation. In June 2016 a malicious actor created a Smart Contract with the DAO that caused him to be repeatedly paid without termination. This led to the DAO being effectively robbed of the Eth tokens from the network that had a value of $50 million at the time.[29] These tokens were never converted to conventional currency or removed from the Ethereum network; it was possible to identify exactly where the misappropriated funds had been placed, they were just no longer able to be accessed by the rightful, previous owners.

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[26] Mr. Buterin was 19 years old when he first drafted the concept. By any measure he is a mathematical genius.
[27] A Next-Generation Smart Contract and Decentralized Application Platform." *Ethereum*. GitHub, 2014. Web. 6 Jan. 2017.
[28]" ibid.
[29] Price, Rob. "Digital currency Ethereum is cratering because of a $50 million hack." *Business Insider* 17 Jan. 2016: n. On-line.

The theft of these tokens presented the network development team with a significant test; although the tokens were taken against the will of the previous owners, the Ethereum blockchain system had performed exactly as it was designed. The fault or cause of the incident was that the DAO had accepted a Smart Contract with a script that took more than they realized it would.

The incident provided a challenging test for the governance of the Ethereum community; many embraced blockchain technology out of a Libertarian ethos that eschewed central authority, they felt that the incident should be allowed to proceed and serve as a lesson to other members of the community. Others felt that the Ethereum community should collectively go back in time to the point on the blockchain before the script became active so that the tokens never left the DAO account. This is possible by establishing that the blockchain will proceed from the block that was previous to when the theft occurred; the process is called "forking" and is a matter of changing the orientation of network participants. In the end there was a split between these two views; the blockchain that included the theft proceeded as "Ethereum Classic" and another chain forked, or established it's new record from the point before the incident. The difference between the two blockchains is now a matter of where the tokens are located. Both have been proceeding since the fork took place.[30]

Implications for Use

The virtue of the blockchain is that it provides a mechanism to establish trust in an objective, transparent, and secure manner by creating a cryptographically secure record of activity. The incident with the DAO was resolved in a very public manner that reinforced the consensus of the community, with those who disagreed for ideological reasons moving in a different direction. But the incident does highlight the danger of automating too many functions that are deemed critical. The technology is still evolving and will be from here on out. There just has to be an acknowledgement of the risk involved with trusting the technology without human supervision of critical processes. The potential uses of the Smart Contracts are limited only by the imagination; everything from drought insurance, crop provenance (where goods are tracked from field to consumer), to futures contracts or investment funding are being developed with the blockchain technology. Participants just have to be cognizant of the risks.

Due to these risks, applications in Governance should retain human supervision and rely on the more tested features of the blockchain for the time being; the technology can reinforce

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[30] Buterin, Vitalik. "Hard Fork Completed." *Ethereum*. N.p., 20 July 2016. Web. 6 Jan. 2017.

the role played by officials by compelling integrity in their actions without ceding governance to full automation. The more stable functions are the features of the blockchain that provide a record embedded in the blockchain itself, the distributed ledger. The entries in the blocks that compose this ledger can be scripted in a way that reinforces the roles of those involved in governance, by enabling specific roles and permissions for activity (this will be discussed further in Section 6, the Afghan Model). This provides both an immutable record and supervision of those performing these actions in the government. This sort of guarantee can be the basis of trust when all involved understand the process. There is unquestionably an education requirement involved, but there is also a growing body of precedent for this application.

5. Current Perspectives on Implementation

In 2016 there have been several notable studies and projects that explore the use of distributed ledger technology, the uses of tokens as cryptocurrency, and the blockchain in general. The purpose of this paper is to examine how the blockchain technology can be leveraged as a potential trust-building mechanism in areas of weak governance. With that in mind the following studies and efforts that will be discussed.

United Nations and the International Monetary Fund

In 2016 both the United Nations (United Nations Research Institute of Social Development, UNRISD) and the International Monetary Fund (IMF) completed studies on blockchain technology.[31,32] Both studies focused on the use the blockchain to produce cryptocurrencies from the blockchain tokens and the potential role and impact of these units of exchange not backed by a national government.

The UNRISD study focused on the use of Bitcoin as a potential mechanism for "social solidarity-based finance". The IMF study was more concerned with the implications for governance and taxation. Each study did address the distributed ledger provided by the blockchain but that aspect of the technology was not the focus of these studies.

One significant contribution from the UNRISD report was the definition of terms such as "techno-evangelism" and "solutionism" as emanating from the circles of technology developers, where they are proponents for the potential of blockchain technology and envision a variety of

[31]Scott, Brett. *How Can Cryptocurrency and Blockchain Technology Play a Role in Building Social and Solidarity Finance? UNRISD*. United Nations Research Institute for Social Development, Feb. 2016. Web. 5 Jan. 2017.
[32] *The Future of Financial Infrastructure*. World Economic Forum, Aug. 2016. Web. 5 Jan. 2017.

social changes with it's implementation. The social aspects of new technology and the impacts on existing institutions and stakeholders within society is not a trivial issue. The study identified this fact but did not explore it fully due to the high level scope of the report. The study discussed Hernando de Soto's work and the potential to provide an incontrovertible mechanism for trust among a population.

Another significant point raised by these reports is the role of trust and network effects. In many historical settings the authority of a nation (in the case of currency) or an accredited intermediary (in the case of lawyers or notaries) has been necessary for two parties to establish trust in their interactions. The strong cryptography of the blockchain algorithm and the open nature of the distributed ledger have the potential to expand the scope of interactions where trust is required. The network effects achieved by expanding the number of people or sites involved in these sorts of interactions, and how this increases the overall value of the network as a whole, was also discussed. This transparency and belief in the integrity of the record is the aspect of blockchain technology that has the greatest potential for improved governance.

The Government of Sweden's Lantmateriet

In July of 2016 the private companies of Telia, ChromaWay, and Kairos Future released a report for the Swedish Mapping, cadastre and land registry authority on the potential use of blockchain technology in land registration.[33] The focus of this report was the process of land sales in Sweden and the prospects for making the process more efficient with the use of distributed ledger technology enabling all parties to share information more rapidly. The report is the first stage of a larger project for the Government of Sweden, the second stage is an actual proof of concept demonstration that facilitates the process of land registration using a local blockchain.

The Government of Georgia

In April 2016 the Government of Georgia's National Agency of Public Registry announced a partnership with the company BitFury and Hernando de Soto's Institute for Liberty and Democracy devoted towards providing land registration using the blockchain.[34] The

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[33] Report available on request from company's site: http://chromaway.com/landregistry/
[34] Prisco, Guilio. "BitFury Announces Blockchain Land Titling Project With the Republic of Georgia and Economist Hernando De Soto." *Bicoin Magezine*. N.p., 27 Apr. 2016. Web. 6 Jan. 2017.

Georgian government stated that their goal was to provide reliable transparency over the administrative actions of the state in order to eliminate corruption.[35]

The Government of Estonia

Estonia is the most advanced country in terms of moving the interaction between citizens and the government into the digital domain. Estonia has developed a system of governance where citizens can accomplish nearly all of their government related tasks online; from voting, to registering a vehicle, changing a residence or accessing their health care information from anywhere in the country. The country provides an excellent example of what is possible.

Estonia accomplished this integrated system by issuing all of it's citizens an identification card that has two stage strong encryption and enables them to reliably access, and more importantly protect, their personal information. Culturally the Estonian attitude of trusting the government with such a concentrated amount of personal information is probably unique to Estonia. It is hard to imagine something that pervasive being accepted in the United States, let alone a country like Afghanistan where violent resistance to the government is still the reality in many parts of the country. But Afghanistan, and the United States, should look at what has been possible and realize that tailoring these capabilities to local conditions will result in optimized outcomes for the future.

The services provided by the Estonian government reside in 900 databases.[36] The key to the Estonian approach has been to establish standards centrally and allow integration to be performed in a decentralized manner by the offices that are responsible for those databases. One key component of this distributed database system is the Keyless Signature Infrastructure developed by the Government of Estonia in partnership with the Estonian company GuardTime. [37,38] This system employs a blockchain as a component of data integration, ensuring that citizens are able to access a uniform baseline of certain information and that that information is stored in a manner that is uniformly replicated and secure.

Compared to having a central government responsible for a single database this has resulted in a significant cost savings; 2015 estimates for Estonia's costs were between 50-60

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[35] Shin, Laura. "Republic Of Georgia To Pilot Land Titling On Blockchain With Economist Hernando De Soto, BitFury." *Forbes*. N.p., 21 Apr. 2016. Web. 6 Jan. 2017.

[36] Reynolds, Mathew. "Welcome to E-stonia, the world's most digitally advanced society." *Wired Magezine*. N.p., 20 Oct. 2016. Web. 6 Jan. 2017.

[37] "Keyless Signature Infrastructure." *E-Estonia*. Government of Estonia, 2007. Web. 6 Jan. 2017.

[38] "KSI Technology." *GuardTime*. N.p., n.d. Web. 6 Jan. 2017.

million Euros, compared to Russia's efforts at e-government that ran an estimated 90 million Euros or those of Kazakhstan which cost 150 million Euros.[39] Estonia has several distinct advantages that enabled them to produce such a robust system relatively cheaply, the most significant being a small population size with no legacy infrastructure or administration that had to be accommodated. But that said they serve as the best example of what is possible between a government and the people in the digital age.

The Government of Ghana

Possibly the best example of what is possible for Afghanistan are the efforts at land registration on a blockchain by the Government of Ghana. In a partnership between the national government, a non-governmental organization named Bitland, and the Crypto Currency Exchange Denmark (CCEDK), a project for land registration using blockchain technology was started this year.[40] Rural Ghana also struggles with a history of predatory local governance, poor documentation of existing land ownership and unreliable infrastructure. Tribal dynamics also play a part of people's lives and impact the realities of land ownership. These are similar features found in Afghanistan worth noting.

The Bitland Ghana land registration project is based on the OpenLedger[41] blockchain.[42] The ability to use this system has to overcome local challenges, such as public acceptance and local infrastructure. This has been the focus of the NGO, Bitland, where they plan to establish local centers with solar power, wifi, and a staff trained to educate local landowners on the details of the system.[43] Currently they have one center operational in Ghana, and another in Mauritius[44]. This sort of bottom-up approach is the only realistic path to success in areas of weak governance.

The final intent of the project is to enable local landowners to access a system of micro-credit based on their equity in their landholdings, precisely as described by Hernando de Soto. The economics of this is definitely a work in progress, but involves a blockchain specific

[39] Leonid Bershidsky. "Envying Estonia's Digital Government." *Bloomberg* . N.p., 4 Mar. 2015. Web. 6 Jan. 2017.
[40] Aitken, Roger. "Bitland's African Blockchain Initiative Putting Land On The Ledger." *Forbes*. N.p., 5 Apr. 2016. Web. 5 Jan. 2017.
[41] Open Ledger, https://www.openledger.info/
[42] Aitken, Roger. "Bitland's African Blockchain Initiative Putting Land On The Ledger." *Forbes*. N.p., 5 Apr. 2016. Web. 5 Jan. 2017.
[43] Ibid.
[44] 8 Dec conversation with BitLand's Chief Operations Officer, Elliot Hedman

token (called Cadastrals in this case) tied to the actual land. This currency will facilitate the interaction between registration and the conventional economies of fiat currency.

Summary of current projects and looking ahead

2016 has seen a variety of projects that attempt to utilize the distributed ledger features of the blockchain in an effort to provide transparency and integrity for government services to the people. It is notable that these projects are based on a variety of public-private partnerships that match technical competence with the legal authorities of the sovereign state. Different blockchains have been used, from the OpenLedger, to Bitcoin, to private proprietary blockchains provided just for the government in question. The variety of efforts highlights the flexibility of this technology. Time will tell which of these efforts proves most effective.

Personal identity as legal fact is a component of any notion of ownership. In May there was an announcement that several blockchain providers will be working in partnership with the UN towards the goal of establishing a system of universal identity through the ID2020 program. [45] The goal is to universally provide the protections that are possible when individuals can be identified and claim their rights. The driving impetus for this program was to fight human trafficking and slavery, but there are considerable implications for governance in many areas that will be derived from a stronger definition of the individual in relation to the state and larger world. This program could support and facilitate blockchain land registration in Afghanistan by ensuring the identity of Afghan citizens and thereby their relation to the state and their property.

6. Considerations for an Afghan Model of Blockchain Land Registration

The reason that blockchain technology is appealing for land registration in Afghanistan is that this system can provide a much needed source of reliability and confidence. This has been missing and is needed to establish trust between the government and the people. This discussion of an Afghan model for employing blockchain technology to facilitate land registration will look at three main areas; the organizational considerations for adoption, infrastructure requirements, and the technical competence required to effectively employ this technology. This is only intended as an initial start for framing what would be required to implement this technology, the single most important consideration for using new technology is a dialog with

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[45] "ConsenSys, Microsoft, and Blockstack Labs collaborate to create opensource, selfsovereign, blockchainbased identity system." *Consensys*. Consensys, 31 May 2016. Web. 2 Jan. 2017. <https://consensys.net/static/Con-MSFT-BL.pdf>.

the people who will be employing it; user requirements should drive the process. That said a system that is free from corruption and can be relied on for it's integrity should have a universal appeal.

Adoption

As noted in the UNRISD study[46] in their discussion of "solutionism", the best intentions do not always bring good results; if an idea or concept is not fully embraced by the local people adoption will be problematic. Blockchain technology has the potential to provide transparency and integrity to systems of local governance, but it is essential that the Afghan officials embrace the decision to move forward with these tools. With that in mind it is essential that a model is developed with local Afghan government officials taking ownership of the process.

As stated initially in this paper it is my position that in post-conflict Afghanistan, any new tools and technology should reinforce and strengthen the existing system of government with as few changes as possible, as opposed to injecting elements of further change. Traditionally Afghanistan has a highly centralized system of government, where permission from national level offices is required for most local actions[47]. This tradition of centralization can be traced to the past monarchy and the perceived requirements to maintain sovereignty. Previously the realities of distance and poor communication meant that there was still a high degree of local autonomy in spite of the officially centralized system.[48] Today with improvements in communication the conflict between the central authority and local action is felt more strongly. The Afghan people will have to find their own balance in terms of what roles and functions the national government is willing to cede to local action in the interest of facilitating economic activity. What is certain is that this discussion of local versus national roles will be more equitable and effective if there is reliable, shared information about what is actually taking place in the nation. This is a requirement that is well suited to the distributed ledger functions of blockchain technology; by having a secure transparent mechanism to represent the reality on the ground roles, authorities, and resources will be able to be addressed more effectively from shared information.

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[46] Scott, Brett. *How Can Cryptocurrency and Blockchain Technology Play a Role in Building Social and Solidarity Finance? UNRISD*. United Nations Research Institute for Social Development, Feb. 2016. Web. 5 Jan. 2017. <http://www.unrisd.org/brett-scott>.
[47] Barfield, Thomas J. *Afghanistan: A Cultural and Political History*. Princeton: Princeton UP, 2010. Print, pg 220.
[48] Ibid.

Since Afghanistan is still in a state of active conflict in much of the country transparency and the integrity of the system of government deserve a high priority. Trust will only be established if all stakeholders can have confidence in the same set of facts. Due to the sensitive nature of government functions it is likely that a private, permissioned blockchain is best suited to Afghan land registration. This would be a closed system where only designated individuals, such as government officials, were able to make entries onto the blockchain. It would be a decision for the Afghan government how much visibility into this system they were willing to tolerate, the technology supports a range of options; from a great deal of transparency as in Estonia to the more restricted access employed by banks, the nature of the blockchain employed can be designed to fit the circumstances. It is my opinion that greater visibility will foster greater confidence, but this is a decision for the Afghans.

A permissioned blockchain has the advantage of ensuring that economic transactions only take place within a prescribed scope of activity permitted by the government, such as limiting the amount of land that can be sold to foreign interests. Some thought would have to be given to how landowners could best access secondary capital markets from a closed system. It is possible to enable an Afghan blockchain to make a limited set of information available to a public blockchain such as Ethereum in order to facilitate Afghan economic activity. The degree and nature permitted without government oversight are again decisions for the Afghan government.[49]

It is possible to envision a system where the Afghan government registers landownership on a blockchain through a system of multiple signature contracts, where each entry that recognizes ownership requires an entry by the landowner (possibly new and old if reflecting a sale), the District Official responsible, the Provincial Official responsible, and the National Official responsible for land registration, all performed digitally. Because all of these entries would be made on the same distributed ledger, information would be synchronized across great distances and could be reconciled within hours (or less) instead of days or weeks. Based on what I saw of landownership in 2010 and the USIP report from 2015, a space for a narrative surrounding how the property came into possession would be a helpful of part of the official record; there have been so many sequential authorities responsible for governance of the land over the last 30 years that a narrative would provide a helpful component for resolving

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[49] It is worth stating that in the past the Afghan government has defaulted to less local control and more regulation from the national level. This prior model will restrict the full potential of what is possible by reducing friction for transactions at the local level.

future contested claims. Space for the endorsement of neighbors in the official record would further establish legitimacy. With time the blockchain record would establish legitimacy as government authority is more firmly established. However what items are recorded (narratives, tribal affiliations or authority, etc.) are all items that will have to be established by the Afghan people. The Annex to this paper identifies a possible set of initial issues to begin planning.

In the past each level of the District, Provincial, and National system was an invitation for corruption, where officials could charge a personal fee for performing their duties. This sort of corruption will be more difficult if the process of land registration is conducted using a transparent decentralized system, oversight is built in; there is no need for a landowner to ever meet the Provincial or National Officials involved in approving the process if the database, the distributed ledger, is always accessible simultaneously from any member location. This removes potential points of contact between Afghan citizens and officials seeking to profit from their positions. Further there is visibility over the entire conduct of the process, backlogs are immediately apparent which forces all officers in the government to perform their tasks of approval in a responsible manner. Finally having an indisputable record of landownership forces a recognition of land usage; government authorities could compare what is registered with what agricultural activity is taking place, as observed physically. The potential accountability for crop harvests should be able to lead to a reduction in opium production, as well as an objective system of taxation.

Effective registration permits the landowners to manage their economic activity with the layer of abstraction described by Hernando de Soto as necessary in the modern world economy; by being able to establish a record of ownership and crop harvest farmers can obtain credit, insurance, or enter into futures contracts. All of these economic actions require an effective system of information management. This is only possible if the Afghan people identify this as a priority, but blockchain technology can accomplish all of these functions.

Infrastructure

Because the blockchain is a protocol that runs on the conventional internet the minimum physical infrastructure requirement for implementing blockchain land registration in Afghanistan is internet access at the local government level. This is not an insurmountable obstacle, even at the remote District level. Ghana's land registration project with BitLand has demonstrated that the use of solar powered systems make it possible to perform these accesses in remote or austere locations.

Internet access is the minimum, but should only be seen as a starting point; by having land registration in a publicly available form the ability of citizens to interact with the value of their holdings becomes more accessible, precisely as Hernando de Soto described. As stated previously, the nature and extent of transactions permitted will be a decision that the government of Afghanistan has to make.

There are projects under development to enable blockchain access over the smartphone.[50] Smartphones represent still greater control of ownership. Incorporating a fungible cryptocurrency associated with land value is a further abstraction to liberalize the local economy (translating land value into BitCoin or Ether for example). Bitland and Ghana's use of Cadastrals as a local economic unit separate from the underlying blockchain architecture is an example of this currency level abstraction.[51] Due to the current state of the economy of Afghanistan these goals should be viewed as part of a future evolution; having the essential record of land registration facilitates these objectives, but does so by providing utility short of these more ambitious targets.

Technical competence

The blockchain land registration in progress in The Republic of Georgia and Ghana are both being approached through a government partnership with private entities. This is necessary in the near term since the technology is esoteric and evolving quickly. The technical expertise required by Afghan officials will be driven by the functions that will be performed in the various locations. This is an educational requirement and the investment in Afghan officials should be seen as a component of any future system.

Human capital is the critical shortfall in Afghanistan, in terms of integrating into the modern world economy. Basic literacy requirements were waived for Afghan Police in Helmand in 2010 simply because there were not enough literate candidates. The USIP report on land registration reflected similar challenges.[52]

However the hurdles of literacy and technical competence are not insurmountable; currently in Herat and Kabul there are at least two organizations devoted to training Afghan girls

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[50] Rampton, John. "8 WAYS THAT THE BLOCKCHAIN WILL CHANGE MOBILE PAYMENTS." *Due*. N.p., 12 Mar. 2016. Web. 5 Jan. 2017.

[51] *Bitland World*. N.p., n.d. Web. 5 Jan. 2017. <http://www.bitland.world/overview/>.

[52] Gaston, Erica. "Land Conflict in Afghanistan." *USIP Special Report* 372 (2015): n. pag. Web. 3 Jan. 2017, page 5

as software engineers, and both specifically mention employing BitCoin technology.[53] This is an obvious starting point to find Afghans to support a system of blockchain registration. Working in partnership with an organization that focused on a role for women would have the added advantage of increasing the contribution of Afghan women in what could become a vital tool for Afghan citizens to enter the larger world economy. Anything that strengthens the position of Afghan women in their society has to be seen as exponentially more valuable.

7. Challenges and Future Research

Afghanistan's land law with regards to the relation of the state, the people, and the land is in need of reform. First and foremost this is a question of will on the part of the Afghan leadership. An unwillingness to reform the law is likely a reflection of the weak position of the government; reforming such significant legislation will require extensive negotiation among lawmakers. At this stage it is likely few feel they hold the political capital to extend themselves into such a contentious issue. Blockchain technology can contribute an element integrity and stability within the land registration process, but initiating the process of reform is entirely dependent on Afghan leadership.

As mentioned, employing blockchain technology to facilitate land registration and improve governance requires a degree of stability in terms of security. The use of the blockchain's distributed ledger functions will improve the effectiveness, efficiency and integrity of government actions, but all government functions are still subject to the realities of violence; in order for government to establish the rule of law the state must command the monopoly on violence. The insights provided into government action, in terms of the integrity, transparency and accountability of functions performed, should facilitate reconciliation, but buy-in is a necessary requirement.

Perhaps a greater obstacle to adoption of blockchain technology to perform these functions is an adequate vision from government officials that will be required to embrace the new technology.   The distinction between a natural skepticism of something new and largely unproven will be a complicating factor that hides officials who do not want greater accountability over their actions. Again, education and effective communication are key.

Any future project at registering land on the blockchain will have to consider how to measure the effectiveness of the overall effort. Acreage registered, and claims issued are

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[53] The Digital Citizen Fund (http://digitalcitizenfund.org/) and Code to Inspire (http://codetoinspire.org/team/)

obvious metrics, but the nature of the blockchain should also measure the expectation of expanding economic access into secondary markets and the utility of providing an abstraction to manage land value.

This technology is still in it's infancy; the original concept paper that started this iteration of blockchain development is less than 10 years old, and the most promising applications were only initiated in 2014. But this technology has been embraced and a great variety of problems are being addressed with tools designed to establish trust between disparate parties.

8. Conclusion

The range of countries that are embracing blockchain technology continues to grow; the Russian Bank of Russia has established a "Masterchain" off of the Ethereum blockchain for inter-bank transfers,[54] Russia has additionally established a consortium to harmonize financial blockchain employment and development,[55] Chinese insurance companies have begun incorporating blockchain technology into operations,[56] in 2015 Dubai began a government initiative with the goal of establishing a digital infrastructure similar to that of Estonia,[57] and German banks have begun studying blockchain's financial potential as well.[58] The World Economic Forum estimated that the value of goods managed on blockchain systems will just continue to grow in the near future, with an estimate of 80% of the banks that they surveyed predicted to initiate blockchain projects in 2017.[59] What all of these countries share is a vision of what is possible through technology; that the ability to employ strong encryption in a wider range of interactions will collapse the distance between parties and permit greater confidence in these interactions.

If Afghanistan can begin the process of land registration on a blockchain it will facilitate greater economic integration in the future and help combat the debilitating tradition of predatory governance. Blockchain technology can contribute integrity and accountability to local governance and protect the rights of the people. Employing this technology will have to be part

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[54] Tciriulnikova, Alisa. "Blockchain Revolution in Russia: Bank of Russia Tests Masterchain." *Cointelegraph*. N.p., 13 Oct. 2016. Web. 5 Jan. 2017.

[55] "Tzars of Blockchain: Five Facts About New Russian Blockchain Consortium." *COINFOX.info*. COINFOX, 15 Jan. 2016. Web. 5 Jan. 2017.

[56] "Minsheng Insurance Retains ConsenSys and BlockApps to build Blockchain Loyalty Reward System." *Consensys* (23 Sept. 2016):

[57] "Comprehensive Data Initiative." *Smart Dubai*. Government of Dubai, n.d. Web. 5 Jan. 2017.

[58] *Joint Deutsche Bundesbank and Deutsche Börse blockchain prototype* . Deutsche Bundesbank, 28 Nov. 2016. Web. 5 Jan. 2017.

[59]*The future of Financial Infrastructure*. World Economic Forum, Aug. 2016. Web. 5 Jan. 2017.

of a larger legal reform of the official orientation towards land ownership. What the technology can contribute is a means of ensuring that the agreement between the state and the people is protected.

Establishing trust and confidence in basic governance within the country is the only way that Afghanistan can transition from aid recipient to economic partner. The Economist magazine called the blockchain "the Trust Machine" due to the way the distributed ledger cannot be altered.[60] In Afghanistan trust is a scarce commodity. Incorporating the blockchain for land registration to foster greater transparency, integrity, and accountability could become a key component of improving basic governance in Afghanistan.

Additionally establishing land ownership in an irrefutable form would have all of the benefits cited by Hernando de Soto at the beginning of this paper; ownership provides the layer of abstraction required for citizens to participate in the modern world economy. Without a guarantee of these rights landholders are not owners and their personal power is always subject to pressures out of their control.

The technical requirements for Afghanistan to join this economic future are not as significant as the political ones. Without some measure of stability the mechanisms of effective government will not survive. Blockchain technology can be an essential tool to reinforce stability, but it can not overcome the realities of violence. It can however offer a measure of assurance and trust that has not been possible up until now, providing an incentive to fully participate in the social contact. The transparency and the confidence in government actions that are provided by blockchain technology should inspire greater cooperation and act as a foundation for a more stable, more productive role in the world economy. Once conditions are met the Afghan people should be prepared to harness this fast moving technology. That will require the imagination to believe that a better future is possible, something Afghanistan has been repeatedly denied.

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[60] "The Trust Machine." *Economist* 31 Oct. 2015: 21-24. Print.

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Annex: Essential Components to consider for a Land Rights System

As mentioned in the paper before blockchain technology can be optimized in land registration the Afghan government will have to reform the land law. This list is intended to highlight some of the potential information that would benefit from employing the blockchain's structure. Some of the underlying questions that the Afghan Government must answer in order to construct an effective system of land registration employing the blockchain:

1. Fully document who has a claim[61] on the economic activity of the land:

    a. Individual

    b. Tribal affiliation

    c. National tax obligation

    d. Legitimate fees from the government (registration, processing, etc.)

2. What economic activity is permitted: agricultural, industrial, etc.

3. What method of documentation is planned for this economic activity[62]

4. What secondary uses (re-sale, collateral for credit, futures contracts, crop insurance, etc.) are permitted or need to be documented

5. Mechanism for documentation: private vs public blockchain, roles and permissions, integration and interaction with other blockchains, etc.

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[61] Conflicting claims are a reality in Afghanistan due to the long period of conflict. There will need to be a conscious decision made as to what constitutes adequate documentation of a claim (historical narrative, record of land use, record of sale, third party attestation, etc). Transparency and documentation are the key to resolving the conflicts that will inevitably arise.

[62] The ability to provide a record of the source and exchange of materials is one of the current use cases of blockchain technology. The UK company Provenance (https://www.provenance.org/) provides this sort of product accountability as a service.