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BIM+Blockchain: A Solution to the Trust Problem in Collaboration?

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Abstract–

This paper provides an overview of historic and current organizational limitations emerging in the Architecture, Engineering, Construction, Building Owner / Operations (AECOO) Industry. It then provides an overview of new technologies that attempt to mitigate these limitations. However, these technologies, taken together, appear to be converging and creating entirely new organizational structures in the AEC industries. This may be characterized by the emergence of what is called the Network Effect and it's related calculus. This paper culminates with an introduction to Blockchain Technology (BT) and it's integration with the emergence of groundbreaking technologies such as Internet of Things (IoT), Artificial Intelligence (AI), Machine Learning (ML) and Financial / Insurance products. To illustrate this process, we use choose Building Information Modelling (BIM) technology as our model network database for the AECOO industry. Interaction with the BIM database is an activity that generates economic value which may be measured into existence by an electronic token that rewards disassociated parties for maintaining and improving the database for the benefit of all, thereby replacing the 3rd party intermediary characteristic of legacy hierarchies with a simple and efficient "digital handshake". Not unlike feudalism before it, hierarchical structures are being disrupted by emerging network platforms. In the age of the Internet, social network structure are now more efficient and massively scalable. As with all social revolutions, people naturally reorganize to the system that provides better security, greater fault tolerance, ease of regulation, and greater market efficiencies. There is evidence all around that we are witnessing a digital transformation in the AECOO industry. The technologies of this transformation are disruptive to the existing professions, project procurement and building operation processes. The underlying calculus that threatens the AECOO industry is related to the process of legacy organizational structure. Hierarchical structures are being replaced by network structures in many industries simply because networks are more efficient, enjoy higher market valuation, they are fault tolerant, and self regulating whereas hierarchy requires substantial managerial and administration overhead to secure individual nodes. This can be a good thing because the incentive to disrupt older processes will often spring forth new systems and methods that have the potential to be leaner, more efficient, less error prone, and more cost effective across the enterprise. However, there is one essential element that is still problematic. Everyone trusts the old system with its inherent faults and may even be deeply vested in mitigating those faults. The same or greater level of trust must be demonstrated and maintained in any new system in order to be adopted and lead to commercial success.

Keywords– BIM, Blockchain, Collaboration, Trust

INTRODUCTION

Hierarchy is inherently competitive and networks are inherently collaborative. Competition is efficient only where both sides have equal information. Disparities of information have led to the practice of creating government regulations that attempt to keep the game fair. This layer of governance may now be effectively reduced because networks have an inherent tendency to isolate faults by creating alternate paths around them. It is easy to see the challenge that lies ahead. While this conversion began with the Internet itself, more recently, Blockchain technology arriving in 2008, may serve as the integration technology with an ability to account for this new organizational value, independent of hierarchical structures. A blockchain is simply a database that allows everyone to read and write to it at the same time without the need for trusted a 3rd party. Security is managed by cryptography rather than human administrators. The best-known application using blockchain is Bitcoin. Bitcoin are a digital token that is produced by the blockchain to pay for it's own maintenance by a disinterested community of workers called miners. Their activity trying to earn these tokens is what maintains the Blockchain without the need for managerial overhead. As humans are prone to do, Bitcoin are traded in secondary markets and have, quite irrationally, achieved a somewhat volatile market value as high as \$3000.00 dollars per unit on Coinbase in 2017. The dominant feature of Blockchain is the ability to execute contracts, without the requirement of a "trusted" intermediary, replacing this with a digital handshake. Blockchain is here, it cannot be un-invented and while many have predicted its demise, the idea of Blockchain software has only increased in applicability. Many people agree that it will play a major role in the disruption of current centralised systems. The AECOO industry is undergoing a digital transformation. It needs to, (design and) construction has suffered for decades from remarkably poor productivity relative to other sectors, [1] Today in an adversarial economy adjudicated by lawyers, the incentive is to minimize information transfer between parties. In the future world of networks, the incentive will be to maximize the transfer of information between parties. It is now realized that procurement is such a strategic issue that the use of internet based technologies can help achieve significant savings through reduced transaction costs, reduced time and reduced transposition error. [2]. The advancing

technologies of this transformation are increasingly disruptive to the existing procurement process. This creates increasing pressure on process innovation strategies and programs. The AECOO industry in the EU is working towards what is termed BIM Level 3 [3] a multidisciplinary collaborative procurement process that has the potential to be a leaner, efficient and more cost effective process. [4] Up on till now, there have been well-researched reports such as the Latham Report [5] the Egan Report [6] calling for a more collaborative process in building procurement. While these have been accepted by industry as correct and viable an emergent counter current such as the 2011 UK Construction Strategy [7] report made a damning assessment of the industry. The latest report on the state of the UK Construction industry, The Farmer Report: Modernise or Die [8], adds to the criticism. Recommendations from these reports have been difficult to implement. The nature of hierarchal structure greatly inhibits the required cultural change because relatively few people are empowered to make changes, whereas networked organizations have demonstrated a far greater ability to adapt to changes and threats. Asking people who are at the center of the industry to change must be accompanied by new processes that are measurable, workable and exciting to adapt. Fortunately, relevant technologies and process such as Building Information Modeling/Management have already started a groundswell of change in the industry as a response to poor, inefficient practice. BIM/M is a promoter and facilitator of collaborative practice and for true collaboration to be successful there needs to be "trust" in the networked system as there is in the hierarchical system. The intersection of BIM and emergent technologies such as Blockchain, Artificial Intelligence Technology (AIT), Internet of Things (IoT), Machine Learning (ML), may be the opportunity for systemic change that the AECOO industry needs. The establishment of trust is a critical factor in partnering success [9] [10]. Third party facilitators, layers of management consultants currently enjoy prosperity and security in the AECOO Industry precisely because hierarchies are prone to single point failures. Efforts are expended on government legislated certification programs, professional licensure, punitive regulations and obtrusive vetting mechanisms as a means of securing nodes. This comes at great expense, and yet, the single point of failure remains. Networks, on the other hand are fault

tolerant and self-correcting since many people are able to publically review the work of many others on a decentralized ledger. If, and only if, the network system can be trusted, then 3rd party facilitators are likely to become obsolete. It is legitimate to pose a question as to how much these “Trust” industry's actually compound the problem and how much of this “Trust” may be replaced with a technological solution. The difference may amount to a significant percentage savings of project delivery costs and risk.

This paper looks to a most recent innovation that has been invented to solve the “Trust” problem in the absence of administrative overhead, particularly in the financial world. These same technologies may be used in any situation where many people would simultaneously interact with a single database at the same time. These situations include financial ledgers, Insurance pools, and even architectural and engineering modeling sets. In the short time since the introduction of Blockchain technology, it is increasingly apparent that it will have widespread effects on the ways in which society can organize itself as well as the economic consequences of doing so.

Every major innovation from the printing press, interchangeable parts, the Integrated circuit and so on, has been followed by a major reorganization of society and restructuring of enterprise. Blockchain technology further enhanced by Artificial Intelligence, Machine Learning and Internet of Things, will have a similar impact on society and enterprise. The difference is that we are now conscious of these changes and can influence structural change in the way we reorganize. The “culture change” that we hear called for as a mantra of BIM [11] can be considered a call for more trust among the stakeholders in the design, construction and building operations industry. This includes clients, designers, contractors, owners and building operators.[12] In traditional building procurement the industry has developed systems which are heavily reliant on contracts which often pit the client against the contractor in a lowest tender process that is administered by a third party and adjudicated by an adversarial legal system. Often the third party walks a fine line in between acting on behalf of the client and the interest of the contractual requirements of the contractor. When failures occur, blanket legislation overreaches with regulations that introduce friction to the whole system. Nothing new here. However what is new and now disruptive is that the nature of the building information is changing, the industry is

moving from representation to simulation. [13] This shift opens up the AECOO industry to a digital transformation.

Digital Transformation in the AECOO Industry

The term “industrial revolution” has been used to mark significant periods of disruption and innovation in industry that have brought sweeping changes to the economy and society. Humans have lived through 3 recorded industrial revolutions. Today's society is still feeling its way through the changes being wrought the 3rd “digital” revolution and now find themselves facing into a new 4th industrial revolution. [14] Schwab makes a case that humans are now already in this 4th Industrial Revolution. The pattern of disruption and innovation established over the previous three is being repeated but this time it is has differences. It is very clear that the time it takes for the disruption to penetrate the social and economic fabric has been getting shorter and shorter and the innovations more plentiful.

“We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before. 4th Industrial Revolution is building on the 3rd, the digital revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres”.
[14].

The patterns that have emerged from the 3 industrial revolutions can give strong indications as to the potential impact of the now 4th industrial revolution. There are three factors which are common to digital disruptions, 1/ digital disruption knows no boundaries 2/ digital disruption dismantles hierarchies in favor of networks and 3/ digital disruption regularly slays sacred cows. One only has to witness the music industry, the publishing industry, the travel industry, the financial services industry and so on and on. The design, construction and building operation industry is perhaps the last surviving major industry that has not yet felt the full force of a digital transformation. [1] But that is no longer the case [15] and at the heart of this digital

transformation of the AECOO industry is BIM and now a new digital disrupter referred to as Blockchain. While BIM is the current best solution for the collaborative creation and management of building data. Blockchain is a possible solution to the problem of trust for a collaborative design, construction and building operation process. In order to establish trust the stakeholders need to provide evidence of trust. Collaboration based around a shared BIM model is one method to provide visible evidence of trust. A distributed ledger of transactions based on Blockchain technologies is another. “Clash detection” that phrase that AEC professionals use, is actually a visible simulation of a trust relationship sorting itself out. A combination of BIM+Blockchain has potential as a platform for true collaboration where visual evidence of “value transactions” are written into a ledger, timestamped, gathered and thru consensus locked into a block, visible for the stakeholders to see. A platform like this will disrupt the design and construction industry.

Traditional Procurement

The construction industry is highly fragmented and has been deplored for being very adversarial. Construction owners are risk evasive, while contracting parties interpret contract clauses differently and for their own benefit. Productivity levels are low compared to other industries and have even dropped over time in some countries. [16]

A problem that needs to be overcome with the traditional procurement process is around the created data. Data is a commodity, it has value. In a traditional procurement process the architect retains copyright over the design. [17] The representation drawings expressing the building design are licensed to other design stakeholders to do their work. This has the effect of being able to identify who did what, “separation of responsibility”. This process services a current need for control of intellectual property (IP) where this distinction of data ownership sits well in risk insurance industry. A second problem in traditional procurement stems from the control of created data. It remains evident from literature and, in practice, that BIM is still greatly challenged by issues of stakeholder integration, particularly in the way information is managed and controlled. [18] New technologies on an old process is not the way to go. The traditional way information is created

builds a top down hierarchy that tends to put the originators in control of the flow of data (and consequently take the majority share of the fee income). BIM disrupts this process. The control of the data/information now becomes available to all in a (de) centralised collaborative setting. [19] In a fully collaborative project often defined as Integrated Project Delivery (IPD) is a project delivery method where collaboration of project participants during design development is an integral part of the delivery system. [20] The creation of the data set comes about through the interaction of a group(s) of design professionals, making it difficult to separate the groupwork in terms of intellectual property and ultimately causation. This is a disruption to traditional legal frameworks. A legal framework document used in the USA called ConsensusDocs 300 Standard Multi-Party Integrated Project Delivery Agreement (CD300) referred to in [20] contains very specific clauses which delineate the liabilities of the project participants for their respective participation in the design development process. Does this help or hinder collaboration? If you are a member of a domain profession that has been the controller of the information, the culture change to a (de) centralised collaborative process is intimidating, unsettling and difficult. Letting go of control and trusting your professional colleagues is one element and sharing risk and reward is another. Trust is essential for a multidisciplinary collaborative to work and evidence of this trust is a scaffold for the collaboration. Methods to overcome problems associated with data creation and data control must be proposed if true collaboration is to be achieved.

Blockchain

What is a Blockchain? It's a fundamentally different technology for databases with multiple non-trusting writers who can modify the database directly” What problems does Blockchain solve? Simply put it's the trust aspect of an ancient human ritual “the handshake” an agreement for a value transaction. [21]

Blockchain is not without its difficulties in fact if you take Blockchain out of its natural home of cryptocurrencies it is somewhat of a “solution looking for a problem.” The technology can be broken down into its two current iterations Public and Private Blockchain. Public Blockchains are constructed using the theory proposed in a whitepaper by a person or persons using the pseudonym of Satoshi Nakamoto “Bitcoin: A

Peer-to-Peer Electronic Cash System“ [22] in which a purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Applications were built on to transact virtual value. The most successful is Bitcoin which uses blockchain to anchor its cryptocurrency value. Others in the open market are Ethereum [23] and the Hyperledger Project [24] . All transaction on a public blockchain are open by default, although it is common to hide the actual identity of all associated participants using cryptographically generated keys. A public key to mark and timestamp the transaction and a private key to unlock and access its data. Public Blockchain strength is its cryptography underpinning, its distributed nature, Its immutability and its consensus validation. Private Blockchains also know as Permissioned Blockchain allow the network to appoint a group of participants (nodes) or a single person (node) in the network who are given the express authority to provide the validation to blocks of transactions or to participate in the consensus mechanism. [25]. A consensus mechanism is a method of authenticating a value transaction on a blockchain or a distributed ledger without the need to trust or rely on a central authority. Consensus mechanisms are central to the functioning of a blockchain or distributed ledger. [26] There is very little academic work published on Blockchain use in the AECOO industry, a recent published paper which reviewed current research on Blockchain technologies, building design and construction is not mentioned in 41 academic papers reviewed. [27] The authors believe that future research will not only focus on Bitcoin and other cryptocurrencies, but on other possible applications using Blockchain as a solution.

BIM (Building Information Management)

BIM is proving to be a challenge in the AECOO industry. The NBS BIM report is recognised in the United Kingdom as the most comprehensive report into the industry's use of BIM and they have been polling since 2011. [28] The information from the NBS BIM Survey 2017 shows a plateauing of BIM adoption between 2014 and 2017 and this during the lead up to the 2016 mandatory requirement for BIM level 2 on publicly procured projects. The move from representation to simulation in the design, construction and building operation

industry has proved difficult for a lot of people and professions. Looking to the UK, early adoption saw somewhat of a two tier procurement process developing. Reasons for this are many this author suggests problems associated with data creation and data control are a major problem. Gary Sullivan OBE is chairman of logistics contractor Wilson James and in an article for the Construction Manager e zine states: [29]

“The elevation or obscurity of BIM will not be about its power as a tool, or even about the skill of its users, it will be about the culture change that is taking longer than your average ice age.”

While uptake on BIM technology is slowly growing, understanding and utilisation of the process is low. [30] Using BIM technology and not using BIM process is dangerous and is often at the center of failed “BIM” projects. [31] Using BIM based collaborative technology on a traditional cooperative process enforced by “self-serving” contracts is doomed to failure. UK PAS 1192 suite of documents has at its center “collaboration.” Collaborative method in this sense is where stakeholders will work together to achieve a shared goal sharing the risk and reward this means co creating and sharing data (network based). Traditional building projects are silos of data (hierarchy based). This is a co-operative method where a stakeholder will work with another to achieve their goal and that stakeholder will in turn work with another to achieve their goal. BIM is disrupting this process. It is on one side a set of collaborative authoring technologies and on the other side a proven process that provides a methodology for collaboration and the sharing of data. A disruptive move from hierarchical structure to a networked structure.

Another facet of BIM is the added value or as Tobin refers in his AECbytes article see [32]“a disruptive technology and one that creates entirely new “value networks”. He goes on to state:

The notion was that 3D models would be an efficient way to produce 2D documents, the next evolution of CAD enhancement. But it quickly morphed to a point where the model created brand new value networks: clash detection, quantity takeoffs, field BIM, direct fabrication, energy analysis—and, ultimately, BIM models as a store of myriad facility information.

This is the intrinsic value that comes along with digital building model. It is a value transaction and but is difficult to measure because often its

substantive value is only realised during the lifecycle of the artifact and consequently is not rewarded by a tradition fee structure. A BIM is a visualized database. Once creators and consumers of a BIM realize this, a whole new world of possibility opens up. Digital information in a BIM is code, its data, and data is data and in the eyes of a computer programmer it is equal and only distinguished by format. The point of this is that, data produced by a BIM creator is open to the same type of manipulation as data produced by any other authoring computer application and in this way, It lends itself to a Blockchain solution and perhaps an ideal application of Blockchain technology. The BIM, a collaboratively built, visually expressed database can be used to construct stakeholder consensus for any number of “value transactions” on the supply chain ecosystem.

Proposition for a Consensus driven Collaborative Project Blockchain

It is time for a new proposal, a new process proposition for clients and professionals who want to work collaboratively. A “Permissioned by Qualifications Blockchain”, facilitated by an Oracle with a min 4 node (numbers can vary) network for a consensus mechanism to include a collaborative grouping of invested stakeholders: Client, Architect, Engineer, Contractor with consensus categories of Material supply chain (inc Prefabrication), Labour interaction (inc Robotics) and Quality control. Mathews (2017)

What distinguishes the AEC industry from others exploring the potential of Blockchain is that this industry delivers a real world physical artifact. The industry powers its economy by converting created virtual value to a physical real world value. But correspondingly, the industry loses out because there is no method of measuring and converting the intrinsic value of the real world artifact back into a digital value for the AEC collaborative. BIM creates this added value and now Blockchain can provide a mechanism to reward this added virtual value even after the physical artifact has been created.

Construction value transactions (virtual to real) are made up from three subcategories, materials,

labour and quality, all can be managed by a consensus driven permissioned Blockchain. The first two of these are quantitative/tangible and the third is qualitative/intangible. However there is another value transaction happening, one which is harder to measure, it's the intrinsic intangible value of the completed artifact. The fundamental problem is that the value of design/engineering is invisible –there is little or no accounting of ‘true’ design/engineering value in society because there are few tools that accurately measure it. [33]. To put a perspective on this, one can look at the value of a “Bitcoin”. The value of Bitcoin is in all the things that you can do with Bitcoin that you cannot do without Bitcoin. While important, this value is certainly not intrinsic, rather, bitcoins resemble a classic derivative – something whose value is derived from the value of something else. The value of Bitcoin is a derivative of physical manifestations of it's utility. Likewise, the value of a newly created #AECoin cryptocurrency coin would represent all the things you can do with design and engineering that you cannot do without design and engineering. Ultimately, all things upon which society utterly depends could be characterized as such, thus, an #AECoin coin would be intrinsic and may even achieve generalized reciprocity essential as a global medium of exchange. An #AECoin public Blockchain can be used as a technology to measure the intrinsic and up to now intangible value of the artifact and its creator(s) by rewarding the individual/collaboration contribution over the lifecycle of the artifact. This is in essence “the new value proposition”. You can design / engineer and walk away as in a traditional procurement or you can design / engineer and be rewarded over the lifecycle of the artifact using a BIM+Blockchain technology to structure true collaboration and incentivise for a superior outcome.

What the Internet did for society and industry 20 years ago is what Blockchain can do for the next 20 years, that is to provide a platform for application development to drive efficiencies and effect a digital transformation in the targeted industry. Here we have the ingredients:

- BIM, an authoring tool that is a visualised database of code simulating a proposed building bringing with it a host of new value networks,
- Documented digital methodologies supporting a collaborative platform for building/infrastructure procurement,

- Cloud based technology allowing for real time creating and coordinating of the visualised database, a platform for multidisciplinary collaboration,
- Reality capture technologies that allow for verification on the conversion of digital assets to real assets,
- Existing professional set to provide Oracle (certification) services to a consensus mechanism,
- Functionally permissioned public Blockchain that provides a platform for true consensus driven collaboration,
- Internet of Things is becoming simpler and accessible for building operations combined with Blockchain allowing a micro economy develop around an artifact,
- “Smart” contracts, which are a set of coded instructions on a blockchain that allow, when conditions are met, a value transaction to happen,
- A real desire to effect a new paradigm in a difficult industry that is ready to make a contribution to the environmental, social and economic fabric offering a way forward for culture change.
- A Design/Engineering open Blockchain that will reward intrinsic intangible value leading to a “new value proposition” for clients and AEC professionals.

Permissioned Blockchains are a developing trend, particularly now that one can make use of “off the peg” blockchains. Permission can be assigned by a central authority or specialized identity system. Less obvious is that a public blockchain can be “functionally permissioned” where certain users have the specific knowledge to utilize the data. Data driven companies like IBM, Microsoft, Amazon are offering “Blockchain as a Service” (BaaS) where they provide the infrastructure to host developer applications. This is making the blockchain accessible to entrepreneurs to provide assured transaction services to many different industries. The Ethereum Blockchain is an open source platform using blockchain technology to provide programmability that enables developers to build and deploy decentralised applications. [34]. Consensus mechanism applications are being developed for permissioned blockchain and some

are already functioning. (We) believe that consensus mechanisms will evolve to target specific needs, whether those of a particular case, of technical implementation possibilities or of the regulatory kind. [26] The consensus nodes are guaranteed to have an identical copy of the data and the code to run a smart contract once consensus is achieved. If smart contracts are computer coded scripts, then a legitimate question arises as to who writes or approves the use of a smart contract script, or who can over-ride a script “on block” if an unexpected physical condition exists. This entity is referred to as an “Oracle”, a person that generally possesses specialized knowledge and context related to the script being executed. Someone who is a trusted authority who creates the transaction by writing the code and embedding it into the blockchain so all nodes have the same data and can come to a consensus agreement, picture a shared Google document. If smart contracts need external data to trigger the transaction there is a possibility the external data might not arrive in the same format and structure to all nodes so if one node receives something different from the external source then the nodes cannot come to a consensus. [35] Greenspan describes this action as “pushing data onto the blockchain rather than a smart contract pulling it in”.

An Oracle contract is an adjudicated contract with the added requirement the adjudicator “Permissioned by Qualifications” is deemed the most appropriate person to be performing the adjudication. These additional requirements mean that a method is required to establish the most appropriate adjudicator, and the method must likewise be decentralized. The Oracle must make decisions in physical space—not simply assess digital data. The Oracle must be able to be present in time and space, determine causation of an event and deal with significant ambiguity in relation to the facts being observed. The validity of the Oracle is what establishes tangibility and invokes law—therefore, money and property. Securing the pool of decentralized Oracles would be essential to insurability of such contracts on a blockchain [36]. Solutions for this are developing.

Observations

Solving the problem of trust and providing a robust platform for a true collaborative procurement process is a goal worthy of endeavor. True collaboration brings together professionals in the 3 modern pillars of procurement, simulated design,

lean process and energy efficiency design. Blockchain is the glue that brings all these ingredients together. A BIM+Blockchain can provide the “Evidence of Trust” that will scaffold the collaboration between professionals and client, it can be a framework to achieve and record consensus. Collaboration in its truest form is a holy grail for the design and construction industry. Its current iteration is IPD but as long as you have contracts that seek to provide a path to domain or individual causation you won't achieve true collaboration. IPD is all for one and one for all. However, a true collaboration holds more promise than is first evident. Another “new value network”. What is not currently measured is the intrinsic intangible value of design and engineering.. AEC professionals have always struggled to recover the intrinsic value of their labour. Blockchain with its properties of transparency, immutability and consensus validation now offers AEC professionals an opportunity to develop a “new value proposition” to extract reward not just for their collaborative services they have provided but also the intrinsic intangible value of their collaborative professional service over the lifecycle of a building. Created (mined) “blocks” of data transactions on this private blockchain are rewarded with a token say the #AECoin Blockchain. This is administered by the Oracle via a Smart Contract to the consensus/stakeholder group. The tokens value is in its proof of work, a completed parcel collaborative endeavour and the positive repercussions this has on the industry. The technologies to process this are tied up in the hand in glove fit of BIM+Blockchain and the introduction of an #AECoin cryptocurrency enabling micro economies to be developed around the completed artifact to reward the collaborative driven by digital technologies and administered by smart contracts on a Blockchain.

Reputation now is a currency in this digital age and this too can be valued through a coin on a cryptocurrency within a secure foundation of an open #AECoin blockchain. Something like this does not take away from an agreed % fee or lump sum payment for services but it adds a new layer to assign value to intrinsic intangible elements of collaborative professional services. This can also provide a solution to the problem of individual contribution to a collaborative endeavor within professional design services which is the essence of the BIM process. The individual validation from the consensus group, collaborative team and or client to the individual contribution is rewarded by a coin of the #AECoin cryptocurrency and in turn

the individual from the consensus group, collaborative team and or client validating the contribution also earns a coin of the cryptocurrency. A system like this disrupts the existing domain based professional silos in favor of project based Multidisciplinary Collaborative PODS (Professionals Offering Design Service) professionals “contracted” by a Blockchain whose intrinsic intangible value is rewarded through coin on an #AECoin cryptocurrency. This can have the effect of creating a networked “Building Profession” as an alternative to the siloed self centered professional body structure we have today.

Conclusion

This paper sought to examine if Blockchain could provide a solution to the trust problem in a collaborative procurement system. Design and construction will always be first a social partnership with participant communication at its core. Our current hierarchical structures are a legacy that have grown in response to “fire fighting” problems. These structures have separated professionals and caused mistrust, a root cause for a dysfunctional industry. The paper proposes a “new value proposition” for clients and AEC professionals who see the benefit of working together now have at their disposal an array of collaborative tools to allow this happen in real time. Blockchain is a robust technology that will record value transactions of the collaborative and provide a method to reward intrinsic value through an #AECoin cryptocurrency coin. There is much more research to be carried out in this area but it holds great promise. The AECOO industry is making efforts to shape the oncoming digital transformation, BIM and now Blockchain offer real solutions for this endeavour. Society will always reorganize itself in the face of technological change. Blockchain is here to stay, it cannot be un-invented and while many have predicted its demise, the idea of Blockchain software has only increased in applicability. Many people agree that it will play a major role in the disruption of current centralised systems. The AECOO industry apparently has 3 choices, fight it, ignore it, or own it. That said, the convergence of BIM+Blockchain technology will not seek permission to disrupt the design and engineering process. The task before the AECOO industry is to assure that changes occur for the better of the industry. Blockchain core strength is that it can provide a solution to the problem of trust. This is

already happening and disrupting the world of finance, insurance, health and education. It is inevitable that the building and construction industries will also be disrupted.

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