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Thinking of Blockchains as Accounting Information Systems

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At a high level, we think of accounting information systems as computerized systems that process business transactions, collect and store them as data, typically in proprietary databases, and report on demand the results of operations. At a higher level, we think of accounting information systems interacting with other systems as part of an enterprise information system that supports short and long-range decision making to run a business entity. And, since business entities interact with other business and regulatory entities, their internal information systems need to be able to interact with those outside of their corporate boundaries, forming an ecosystem of information systems. Blockchains are a relatively new form of information system that are becoming part of a business entity's information systems ecosystem. This article will discuss blockchains and how they interact with traditional accounting information systems (AISs) to become part of redesigned business information ecosystems.

At a basic functional level, blockchains exhibit the basic characteristics of traditional AISs – they collect transactions, store them and report them on demand. In addition, they exhibit a number of characteristics not normally associated with traditional AISs. To name a few, they process transactions based on agreed-upon rules in digital contracts, they validate and combine transactions to form blocks, which are then linked together, and they share transactions in an open ledger.

Since business entities interact with other business and regulatory entities, their internal information systems also need to be able to interact with those outside of their corporate boundaries.

The phrase “accounting information system” refers to a functional type of information system – one that processes accounting transactions, without reference to the technology involved. The word “blockchain,” on the other hand, refers to a particular type of technology without reference to a functional business purpose. Blockchain is both a concept and a technology with

which to implement it. As a concept, “blockchain” literally refers to transactions that have occurred over a period of time being collected to form a block of transactions, validated, time stamped, stored as a block, and connected to previous blocks to form a “chain.” As explained in this article, the way a blockchain functions varies depending on the purpose of the blockchain. For example, it can be a stand-alone accounting information system or, more typically, it can interface with an entity’s existing internal information systems. In either case, a blockchain can add significant value to a business entity and its information systems ecosystem.

Bitcoin **As a Functional AIS**

A good example of a blockchain that acts as a functional AIS is *Bitcoin*. *Bitcoin*, with a capital *B*, is a network on which users buy and then spend *bitcoins*, with a small *b*. The *Bitcoin* network is a blockchain and *bitcoins* are its cryptocurrency – they exist only in digital form. We refer to the *Bitcoin* blockchain as a “permissionless, trustless network,” meaning that anyone can join by simply downloading the app and purchasing *bitcoins* from a broker. Each user does not,

however, have to trust any other user on the network. Instead, users trust the *Bitcoin* blockchain itself because of the way that transactions are validated and secured before they are added to a block that then is added sequentially as the next block on the blockchain.

From a user transaction perspective, the way it works is quite straight-forward. Users purchase a number of *bitcoins* for their digital *wallet* and then spend them by sending *bitcoins* to another user, to buy coffee at *Starbucks*, for example. A little more technically, a *bitcoin* transaction to buy a *Starbuck's* coffee consists of the purchaser's public digital address on the *Bitcoin* network, the number of *bitcoins* equivalent to the price of a cup of coffee, *Starbucks'* public digital address, and the purchaser's private digital signature to authorize the transaction. Behind the scene, on the *Bitcoin* network, the transaction is collected, validated, timestamped, combined with other transactions to form a block, timestamped again, and added as the next block on the chain. All transactions on the entire blockchain are available as a public ledger (see www.blockchain.com/explorer). At this site, you will notice that, while each transaction, and the block to which it belongs, is publicly available, the identity of individual users is not revealed, only the "From" and "To" digital addresses. Individual users are anonymous to the public, but address owners have access to their data.

From an AIS perspective, the *Bitcoin* blockchain acts as a functional accounting information system. It collects each transaction, validates it, records it, secures it and reports it on a public ledger that can be queried by individual users to generate on-demand reports. *Starbuck's* could, for example, query it to report all *bitcoin* transactions for their accounts for the month of April 2022.

Further, the *Bitcoin* blockchain interacts with other information systems to form a business information system ecosystem. Since it is a digital currency, the value of a *bitcoin*, as measured in a fiat currency, is inherently volatile – which is potentially bad for both a customer and *Starbucks*. For a customer to pay a fixed price as listed on a menu, the customer's *Starbucks'* app sends an amount in a fiat currency to a third-party's information system for a real-time conversion to an amount of *bitcoin* at its current value. That amount of *bitcoin* is then sent to the user's *Bitcoin* wallet to create the *Bitcoin* transaction. This is possible because the data representing a transaction on the *Bitcoin* blockchain is stored in *JSON* format (*JavaScript Object Notation*), a standard, name-value pair format for moving data between disparate information systems. So, the *Bitcoin* blockchain meets the basic definition of an accounting information system – it processes transactions, stores and secures them and interacts with other information systems in order for it to operate in the business world.

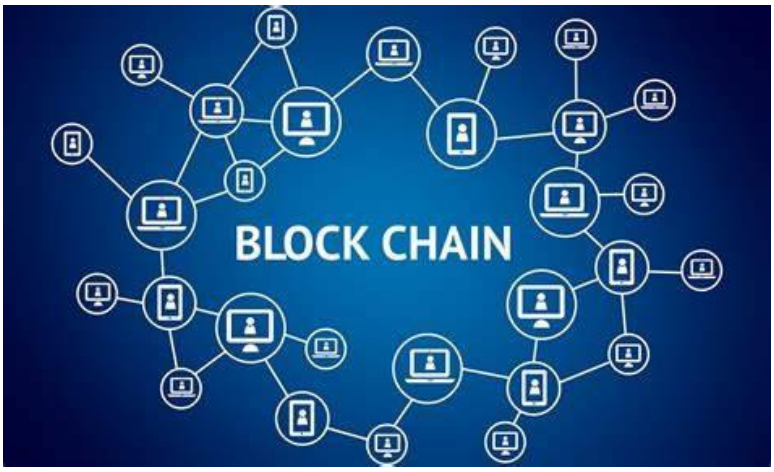
Business Blockchain As an AIS

The *Bitcoin* blockchain can be used by anyone – it is permissionless, but it is limited to simple transactions representing an individual user spending *bitcoins* by sending them to another user on its peer-to-peer network. Business blockchains are different on both a conceptual level and a technology level. Conceptually, the *Bitcoin* blockchain exists to enable cryptocurrency transactions between any disparate parties, whereas business blockchains exist to enable collaboration in support of business objectives between trusted participants. While there are

many examples of business blockchains, each with its own objectives, I will focus on *Tracr*, created by the *De Beers Group* (www.tracr.com).

Each participant is an invited entity on the blockchain, each interacts with the blockchain using a simple app, and each has an inherent interest in the authenticity and accuracy of the transactions it submits to the blockchain.

The stated objective of the *Tracr* blockchain is to "assure the provenance, traceability, and authenticity of natural diamonds." All entities in the natural diamonds industry are faced with the problem that their diamonds may have been mined in a country with a history of warlords using child and slave labor and ill-gotten gains to support war and genocide. Being able to prove to a potential customer that a diamond in a jewelry store is authentic, and not a "blood diamond," is inherently difficult and requires the collaboration of business entities from mine-to-retailer.



The *Tracr* blockchain is a collaborative platform on which business entities submit documents and interact to accomplish the objectives of provenance, traceability and authenticity. As with many information systems in business, the *Tracr* blockchain is a digital representation of the operation of a physical system. It operates as follows:

- A trusted, ethical mining operation is invited to join *Tracr*. The entity mines raw material, extracts a diamond and creates a diamond registration document, including the date, time, location and country of origin. It then creates a digital asset on the blockchain by posting the registration document to the *Tracr* blockchain.
- Next, the diamond is purchased by a manufacturer where it is cut, polished and graded for carat, color, clarity and cut, and is then "certified" – in the U.S. by the GIA (Gemological Institute of America). The certification documents, including, 3D scans and images, are added to the blockchain.
- Next, the diamond goes to a retailer where it is made into a piece of jewelry, documented, market-valued and purchased by a consumer. The retailer proves the authenticity of the diamond to the consumer based on its provenance as documented on the blockchain.

Business blockchains become a valuable part of an entity's business information ecosystem, driven in large part by its members' accounting information systems.

A Real-Life Example of the Process

Each participant is an invited entity on the blockchain, each interacts with the blockchain using a simple app, and each has an inherent interest in the authenticity and accuracy of the transactions it submits to the blockchain. Each entity also has its own proprietary information systems to support its internal operations. If fully implemented, each participant's blockchain app would be designed to submit data from an internal information system as a transaction on the blockchain. For example, when a manufacturer certifies a diamond, the documentation is entered in its proprietary information system, along with a value in a fiat currency, and the diamond becomes part of the manufacturer's inventory. Using its blockchain app, the manufacturer would interface with its internal asset management information system and use it as the data source to submit the agreed upon data to the *Tracr* blockchain. No matter what form the manufacturer stores its internal data in, it would be converted to *JSON* format and submitted as a transaction to the blockchain. All authorized participants would then have access to it.

This example is meant to illustrate the basics of how a blockchain in business can interface with an individual entity's internal accounting and other information systems. The business blockchain becomes an integral part of an entity's information system ecosystem, adding significant value to the entity and all of its blockchain partners. Depending on how both the blockchain and an entity's internal information systems are configured, there are multiple opportunities for interaction.

In the case of *Trackr*, the mining operation would have internal AISs to record the labor and other related expenses involved in mining the raw material and pricing the extracted raw diamonds in inventory. It would have other internal information systems to create, process and store the diamond registration data. The mining business would use a blockchain app to interface these internal information systems with the blockchain that would allow them to automatically submit the registration documentation and selected price data as transactions to the blockchain. The diamond manufacturer would have similar internal systems to record costs and track inventory, record certification data and create images. Each of these internal systems would be interfaced with the *Tracr* blockchain to automatically submit transactions with the required data to the blockchain. The same applies to the retailer. In all cases, a business entity's internal information systems, including its AISs, would interface with the blockchain to submit transactions containing the agreed-upon data. The effect is cumulative – as each participating business entity submits its data to the blockchain, the asset's value is enhanced, benefitting each individual entity and the blockchain consortium as a whole.

A business blockchain is a collaborative platform created to meet business objectives.

The value realized by each individual business entity depends on its location on the blockchain. Based on due diligence, a mining company is invited to join the *Tracr* blockchain. Each diamond that the company registers on the blockchain becomes an ethically-sourced diamond from a trusted mining operation. Such diamonds are more valuable and the company realizes the benefits of enhanced reputation and, potentially, higher sales volume and more profit. The manufacturer who purchases and then cuts and certifies the diamond is sure of its source and its authenticity. The diamond can be graded and priced accordingly, and the company potentially realizes reputational and profit benefits. Also, when the company needs to finance its inventory, it has documentation with which to back up its stated value, potentially gaining a lower interest rate. The retailer who purchases the diamond benefits from being able to document its authenticity and provenance and, thereby, prove its value to a customer. The retailer would also potentially realize reputational benefits and increased sales.

A business blockchain, such as *Trackr*, contains data submitted to it from its member's internal information systems, including their AISs. As such, the blockchain becomes a platform on which its members have access to shared data from the information systems of all of its members. All of the blockchain members collaborate to realize the otherwise difficult mutual benefits that accrue from being able to prove the provenance, traceability and authenticity of their natural diamonds. From this point of view, business blockchains become a valuable part of an entity's business information ecosystem, driven in large part by its members' accounting information systems.

A key point is that a blockchain can become a significant part of a business entity's information systems ecosystem. Though a blockchain is both conceptually and technically quite different from traditional business information systems, it can add significant value to an entity's information systems ecosystem. Each business blockchain is created to accomplish goals that are difficult to accomplish without the collaboration of others in a business entity's value chain. Based on these goals, agreed-upon data from traditional internal information systems is submitted in transactions to the business blockchain and shared with the members of the blockchain to help accomplish mutual goals and improve decision making. In addition, blockchains add other benefits not typically associated with traditional information systems, including transactions being verified based on an agreed-upon algorithm that is part of the blockchain transaction processing protocol and a diminished risk of loss of data because each trusted participant has their own copy of the blockchain.

Redefining an AIS

Traditional accounting information systems are characterized by transactions representing economic events related to an asset, valued in a fiat currency, with the corresponding data recorded in proprietary databases. If we expand the definition of a traditional AIS, the *Bitcoin* blockchain is an example of an enhanced, separate AIS because each transaction represents an economic event between two users on

the blockchain involving a change of ownership of the number of *bitcoins* recorded on a public ledger. In addition, each transaction is signed with a private digital signature, validated by an independent user running a computationally complex algorithm, and secured by being added to a block and chained to previous blocks, forming an immutable chain of blocks of transactions.

A business blockchain, such as *Trackr*, on the other hand, is a collaborative platform created to meet business objectives. It is an enhanced accounting information system from the perspective that each transaction affects the value of an asset, it is submitted by a trusted participant and the data comes from the participant's internal AIS or other information system. A blockchain, either a stand-alone transaction processor or a collaborative business platform, can become a valuable part of a business entity's redesigned information systems ecosystem. It simply requires thinking more broadly about how we define an AIS.