

## Microsoft Azure and ConsenSys Quorum Blockchain Service : Using blockchain to enable companies to apply the SDGs

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〔研究論文〕

## Microsoft Azure and ConsenSys Quorum Blockchain

**Service:** Using blockchain to enable companies to apply the SDGs

マイクロソフトのアジュールとコンセンシスの Quorum ブロック  
チェーンサービス：企業の SDGs 実践におけるブロックチェーン活用

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### 1. Introduction

As we continue to witness the rapid advancement of technology in parallel with the swift increase of environmental and humanitarian issues, the natural response is to consider how modern technology can rectify these concerns. The Sustainable Development Goals (SDGs) have had a meaningful impact worldwide, with their implementation encouraged at the individual, small to midsize business, corporate, and governmental levels. As these various entities strive to incorporate the SDGs into their daily practices, they must make decisions as to what degree, and in what way, the SDGs can be incorporated for it to be practical and beneficial for themselves. From an organizational level, decisions made for the company with regards to the SDGs are not only considered from an ethical perspective, but from other business perspectives as well such as financial, marketing, or other viewpoints.

This paper seeks to take a preliminary look as to what extent blockchain may be a beneficial tool for businesses to utilize to meet their sustainability goals. First, we will take a closer look at what the SDGs are and how it is advised for them to be adopted by businesses. Then we will take a closer look at what blockchain is and how it might be incorporated to meet an organization's sustainability goals; with a discussion for and against its use. Finally, we will take a look at how Microsoft has partnered with ConsenSys to adopt blockchain in their suite of software solutions, and how a business might benefit from utilizing blockchain as a service through Microsoft.

## 2. A closer look at the SDGs

In July 2015, Heads of State and Government and High Representatives met in Ethiopia ahead of an anticipated UN meeting that was conducted in September 2015, to discuss the need for a set of guidelines and expectations for nations to follow (United Nations, 2015a). This set of guidelines and expectations includes key items to address the growing concerns over various economic, climate, and humanitarian issues. They include a preliminary list of how the world's needs might be met (United Nations, 2015a):

- Through reliance on all participating countries' policies, programs, and practices
- With the participation of all stakeholders: governments, civil sector, the private sector, etc.
- Through revitalized global partnership at the global level and multi-stakeholder partnerships

In summary, this meeting established the need to address worldwide environmental, economic, and social concerns, as well as set the framework for how the needs were to be met; a framework which ultimately became the Addis Ababa Action Agenda (United Nations, 2015a).

With this agenda in hand the United Nations, an international organization consisting of 193 member states, gathered in September 2015 well-prepared to discuss and formulate concrete guidelines for specific and attainable goals and targets pertaining to climate, economic, and social issues. These guidelines became the 2030 Agenda for Sustainable Development (United Nations, 2015b; United Nations, 2022b). Sustainable development, as defined by the United Nations, is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" and calls for "concerted efforts towards building an inclusive, sustainable and resilient future for people and planet" (United Nations, 2022b). Sustainable development focuses on three elements: economic growth, social inclusion and environmental protection. It was during this September 2015 meeting that they formally established the SDGs. There are seventeen goals in total with 169 targets, varying from climate related issues to human rights issues and encapsulating the overall needs and issues that our world faces. All of the goals include at least one of the aforementioned elements connected with sustainable development. The SDGs are as follows (United Nations, 2015b):

*Goal 1: No Poverty; End poverty in all its forms everywhere*

*Goal 2: Zero Hunger*

*Goal 3: Good Health and Well-Being*

*Goal 4: Quality Education*

*Goal 5: Gender Equality*

*Goal 6: Clean Water and Sanitation*

*Goal 7: Affordable and Clean Energy*

*Goal 8: Decent Work and Economic Growth*

*Goal 9: Industry, Innovation and Infrastructure*

*Goal 10: Reduced Inequalities*

*Goal 11: Sustainable Cities and Communities*

*Goal 12: Responsible Consumption and Production*

*Goal 13: Climate Action*

*Goal 14: Life Below Water*

*Goal 15: Life on Land*

*Goal 16: Peace, Justice, and Strong Institutions*

*Goal 17: Partnerships for the Goals*

From a business perspective, Mubtaker (2020) encourages the implementation of four key steps in order for an enterprise to become a sustainable company that aligns with the SDGs:

*Step 1: Understand the 10 principles of the UN Global Impact, the SDGs, and Circular Economy principles*

*Step 2: Define Priorities*

*Step 3: Set Goals*

*Step 4: SDGs Integration with the Business*

Although this paper seeks to address how blockchain may be utilized in a business that takes measures to become more sustainable (see step 4 above), it is important to take a brief look at the other steps needed for a business to follow the SDGs. The first step aims to encourage a business to educate themselves on the SDGs and the various principles that provide a foundational knowledge as to the benefit of implementing the goals. Step two provides guidance for performing an analysis of the value chain of a company to determine areas of operations that would benefit from implementing more sustainable practices. Step three then guides the organization in setting practical and attainable sustainability goals. Finally, step four is the actual implementation of those goals, with encouragement for top executives to drive the execution of the changes (Mubtaker, 2020). Every day businesses around the world are imagining new ways to be innovative in their application of the SDGs, with one of those ways potentially being blockchain technology.

## 2.1 Why the SDGs are important for business

According to Mubtaker (2020), the SDGs can be considered an integral part of a company's business model should they apply the four key steps towards implementation. Some of the benefits to incorporating these key steps, as described by Mubtaker (2020), include: creating new business opportunities, creating value, and reducing risks.

### 2.1.1 New business opportunities

As explained by the Business & Sustainable Development Commission (2017), fulfilling the SDGs creates the opportunity for what they refer to as an “economic prize” (p.22). This “prize” has the potential to exceed 12 trillion USD by 2030, of which half will come from developing countries, and half will come from key “hot spot” markets including food and agriculture, cities, energy and materials, and health and well-being. The Business & Sustainable Development Commission (2017) additionally reports that the implementation of the goals could create 380 million new jobs by 2030, with 90% coming from developing countries and affordable housing accounting for nearly 70 million of these jobs. This rapid growth of employment rates is due in part to companies recognizing that, simply, sustainability is good for business. In fact, a growing body of research is showing that more sustainability practices in a company leads to better financial performance, as evidenced in particular by a review of 200 studies on sustainability and corporate performance conducted by Oxford University and investment management firm Arabesque Partners (Business & Sustainable Development Commission, 2017). In this review, it was determined that a majority of companies saw a reduction of capital costs when they implemented high environmental, social, and governance (ESG) standards, and a connection between the companies’ stock market performances and their sustainability practices (Arabesque Partners, 2015).

### 2.1.2 Creating value

Implementing the SDGs also creates value for a business. Mubtaker (2020) explains how implementing the SDGs in a business can create value from multiple aspects. Implementing the SDGs envisions that by “empowering people, protecting the environment, businesses can build trust, improve their reputation, and connect with new stakeholders” (Mubtaker, 2020, p. 4). The opportunities for growth are not simply financial when using the SDGs, but can be impacted by other elements such as environmental, social, and intellectual (IR, 2017). For it not only “sends a positive signal” when companies align their business strategy with the SDGs, but it also opens more opportunities for partnerships (Mubtaker, 2020, p. 4).

### 2.1.3 Reducing risks

There is finally a reduction of certain risks, as a result of turning “global challenges and threats into business opportunities by aligning their business strategy with the SDGs” (Mubtaker, 2020, p. 4). Increasing pressure from society through various sources such as social networks, customers, the media, the company’s stakeholders, and even their own employees is causing companies to be held accountable for their actions (PwC, 2015). These actions include how the employees are treated, how materials are sourced, and other areas related to corporate culture (PwC, 2015). Examples of such treatment of workers and corporate culture might be gender equality, diversity and inclusion measures,

liveable wages, and appropriate work conditions. Sourcing and quality of their products naturally relates to using sustainably sourced materials. “Uncertain energy costs, looming regulation on carbon emissions, concerns about access to raw materials and the availability of natural resources like water” causes companies to be forced to take environmental sustainability into consideration (Mubtaker, 2020, p. 4). In short, finding tools and methods to sustainably integrate the SDGs will ultimately mitigate risk and benefit the company in multiple ways.

### 3. A closer look at Blockchain

Blockchain, also known as distributed ledger technologies (DLT), is a decentralized platform that allows for users to record and track data. As in its name, a blockchain is a set of digital blocks connected chronologically and in a linear fashion. In order for a block to be added to the blockchain, a cryptographic puzzle must be solved which is then shared to all other computers in the network. Once verified by the network, the new block is added to the blockchain (Daley, 2022b). Any information may be added to this block, but cannot be altered once added to the blockchain. Most commonly known for its use of storing cryptocurrencies such as Bitcoin, the use of blockchain for creation of digital assets was primarily the response to the rejection of fiat currency and bank-controlled financial activities as all activities on the blockchain (at the time of its initial use) were unregulated and decentralized.

To better understand how blockchain works, it can be most easily compared to how Google Docs documents work (Kleb, 2017). Google Docs is an example of a decentralized distribution chain as it allows those with access to the document to watch any modifications occur in real-time. Those with access are not locked out of the document while it is being modified. In this respect, blockchain works similarly as there is transparency as to the data being stored in real-time. One major difference to note, however, is that unlike in Google Docs, once data/content has been added to the blockchain, it cannot be altered. This creates an increased level of security, which in addition to the transparency, makes it a valuable platform for use by certain industries (Kleb, 2017).

Although blockchain is most commonly associated with cryptocurrencies, there are many other uses. Financial transactions, medical records, and supply chain data, are some of the potential data that can be added to the blockchain (Zebpay, 2021). Indeed, there has been a significant increase in companies that are utilizing blockchain technologies, and using said technology for multiple purposes, as the platform has reportedly saved money, time, and valuable resources (Daley, 2022c).

#### 3.1 Proof-of-Stake vs Proof-of-Work

As previously mentioned, the process of adding a block to the blockchain includes solving a cryptographic puzzle which is then shared and verified by the network. This process is called proof-

of-work (PoW or mining). It is the miners who create new coins through completing complex puzzles that validate transactions. PoW is a vital element to adding blocks to the blockchain as it is a process to validate the existence of the blocks, thus adding value.

Proof-of-stake (PoS or staking) is considered to be the next big business as it is the greener alternative to proof-of-work (PoW or mining)(Locke, 2022). Although PoW and PoS are often linked as similar processes, there are distinct differences between the two. In PoS, users contribute (or stake) their own coins to validate transactions (Buterin, 2016). PoW is the process originally used for key cryptocurrencies, such as Bitcoin. However, in response to the increased skepticism of using PoW to validate transactions due to the high use of energy in mining, PoS has been increasing in popularity (Locke, 2022).

#### 4. SDGs and Blockchain in use

As previously defined, the SDGs are a collection of goals focused on addressing climate action, meeting humanitarian needs, and establishing social equity worldwide. As the 193 member states of the UN have accepted the mission to enact the SDGs at multiple levels, including on a governmental, organizational, and individual scale, the real task is to create practical and sustainable practices to implement these SDGs. One tool that has emerged to aid in the implementation of the SDGs is in itself a tool with sustainability in mind: blockchain. Although discussion surrounding the UN's opinions concerning the SDGs and blockchain has been minimal, with zero mention in their 2022 Sustainable Goals Report (United Nations, 2022c), and infrequent articles and posts on their website (United Nations, 2022a), it is a rapidly growing industry and deserves attention. As an increase in the discussions surrounding adopting the use of blockchain technology for sustainability may be anticipated, the following sections will examine the pros and cons.

##### 4.1 Discussion for

There have been quite a number of arguments made in favor of using blockchain as a data ledger solution for many industries (UNDP, 2022). Some of the benefits include transparency, security, accountability, cost effectiveness, and allowing for streamlining operations. The following will briefly describe how some of these benefits can contribute to companies meeting their sustainability goals.

##### 4.1.1 Transparency and streamlined solutions

In connection with the 9th SDG to *Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation* (United Nations, 2015b), blockchain is the solution for many of the goal's targets. One illustration of this is the volatility seen in coordinating the global supplies changes, particularly in light of certain recent key events (e.g. the Ukrainian-Russian war and

COVID-19). All levels of the supply chain can be recorded on the blockchain, thus allowing a more streamlined solution for tracing products and coordinating deliveries more efficiently (Deschmukh, 2020). Additionally, as some of the targets of this goal are to provide a reliable technology system for all countries to build better communication (United Nations, 2015b), blockchain is a sustainable option that offers endless possibilities of uses for both developed and developing countries.

#### 4.1.2 Accountability and security

In accordance with the 12th SDG to *Ensure sustainable consumption and production patterns*, and the 16th SDG to *Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels* (United Nations, 2015b), the adoption of blockchain instills a transparency in the supply chain which brings light to the process and has the potential to reduce corruption and increase the accountability of how materials are acquired and transported. As an example, Deschmukh (2020) explains that public procurement is a major source of governmental corruption, and is described by the OECD (2022) as being where the majority of taxpayers' money is used, thus requiring an efficient system with high standards. The incorporation of blockchain as a tool has the potential to allow those high standards to be met and force governmental agencies and other partnered stakeholders to be held accountable (Deschmukh, 2020).

#### 4.2 Discussion against (including counterarguments)

As there have been many discussions favoring the adoption of blockchain as a digital ledger solution, so there has also been widespread argument against adopting the technology (Obafemi, 2022). With every discussion there is a potential for a rebuttal, however, and this section will include both the arguments against the use of blockchain technology and a refuting of the claims.

##### 4.2.1 An energy drain

One of the main arguments used against blockchain is the amount of energy consumed in using it. Indeed, it is said that mining bitcoin accounts for 0.41 percent of global energy consumption, reportedly more than the annual energy consumption of Belgium and the Philippines (Cambridge Centre for Alternative Finance (CCAF), 2022). Many even question the purpose of using such a tremendous amount of energy for storing and sharing information that could otherwise be stored with less energy-consuming methods. However, it can be assumed that as technology develops, there are plans in place to utilize renewable energy in mining and in using blockchain. Ultimately, the future of how organizations function will probably be on the blockchain.



It is interesting to note that the concern regarding the massive use of energy in mining to obtain blocks on the blockchain is an old argument. PoS, as defined above, became a central talking point in November 2020, with it becoming live in December 2020 (Dillet, 2022). As of this date, PoS is rapidly becoming a commonly used form of validating transactions, potentially seeing the phasing out of the PoW method. Although some blockchain technology still operates using PoW, PoS is becoming a more popular method for obtaining and verifying blockchain as it has a smaller carbon footprint.

#### 4.2.2 Risky crypto

Another point against adopting blockchain is that overall, there has been a level of distrust in the blockchain ecosystem that produces reluctant potential users. Many companies are reluctant to adopt the use of a platform that is new and rapidly developing. As the reputation of blockchain is so often connected with that of cryptocurrency, which shows signs of volatility, it may cause an additional reluctance to adopt the platform. With regards to the volatility element, there have been multiple instances in which cryptocurrency has experienced a rapid crash in the market. This year, for example, the crypto winter has persisted in which there was a rapid and drastic decline in the value of cryptocurrencies (Dovbnaya, 2022). It is important to note though that despite the crypto winter, there is still growth occurring in the crypto ecosystem as well as optimism from the experts, who report that this winter will only bring stronger digital assets (Morris, 2022).

As the perception of blockchain is most linked with crypto, the perception of blockchain for other purposes aside from crypto tends to be connected, thus reducing the adoption rate. What many individuals and organizations will come to realize; however, is that it is the value of cryptocurrency that is volatile, not blockchain technology itself. Rather, the blockchain ecosystem can be trusted as a secure and reliable platform for storing sensitive data (Buterin, 2016; Daley, 2022b). Obefemi (2022) best describes the differences between blockchain and cryptocurrency as electricity to a light bulb: blockchain is the electricity thanks to which cryptocurrency, the light bulb, can function. However, electricity, the blockchain, can be used for purposes other than lighting a light bulb.

In addition to the reluctance to adopt due to issues such as volatility of the value of crypto, governments are slow to enact regulation around blockchain (Morris, 2022). As blockchain is inherently decentralized, there has been wide discussion regarding to what extent governments are able to establish regulation in the blockchain ecosystem. Worldwide, every country's governing body has responded differently towards how they regulate activity in the blockchain ecosystem. As there are no clear regulations worldwide, companies must be careful in where they choose to operate using the system (Obafemi, 2022).

### 4.3 Looking ahead

Much growth will still need to occur before the world sees a majority adopting the use of blockchain in their businesses' practices, with or without consideration of sustainability. It certainly is not a current talking point amongst the United Nations, as they did not include any discussions regarding blockchain in their Sustainable Development Report 2022 (United Nations, 2022c). Furthermore, although a quick search of the United Nations website does show that they have posted articles pertaining to blockchain and sustainability, the majority of the articles are dated 2020 or older (United Nations, 2022a). Given that the more energy-saving method of PoS (as opposed to PoW) has become more widely adopted since becoming live in December 2020, perhaps blockchain will be given more attention as a solution for a business's sustainability practices.

## 5. A case study

Microsoft is an excellent example of a company that is embracing blockchain for sustainability through the various software systems that they offer. By partnering with Consensus, a blockchain platform, Microsoft is enabling their clients to reach their sustainability goals through the use of blockchain. The following will explore what services they provide and how they are shaping the future of sustainability solutions through blockchain.

### 5.1 Microsoft

Founded in 1975, Microsoft has been a leading technology company for nearly fifty years, offering a wide range of technology products and services (Microsoft, 2022a). Their offerings range from a selection of computers and other devices, software solutions, and other support services. As the company's core value is to "empower every person and every organization on the planet to achieve more" (Microsoft 2022d), it comes as no surprise that the services offered often come with an underlying intention to benefit not only the individual and organization but to additionally benefit the world.

Microsoft's offerings for providing cloud services that incorporate sustainability include its Azure platform and Sustainability Manager - a Microsoft Cloud for Sustainability solution. Some of the benefits of adopting these cloud services as a business include "unifying data intelligence, building a sustainable IT infrastructure, reducing the environmental impact of operations, and creating sustainable value chains" (Microsoft, 2022c). Some of the ways that Microsoft assists businesses is through the use of the Internet of Things (IoT). Put simply, IoT is the technology that enables devices to communicate with one another (Daley, 2022a) and is a tool for collecting massive amounts of data. The possibilities for the types of data that businesses can collect are endless, including recording the

data derived from sensors for any devices. Any devices used for areas such as tracking energy consumption, medical uses, security purposes, and manufacturing practices can produce valuable data that can be collected (Bigelow, 2022). This data that is collected can then be categorized and analyzed to inform the IoT user of their business practices, thus providing the user with the most up-to-date information as they make business decisions.

As Bittner (2021) explains, Microsoft's Azure service offers a platform from which businesses can make informed decisions regarding their business practices through the use of tools such as IoT. These informed decisions have the potential to greatly benefit the business from not only an ethical standpoint as it allows them to comply better with the SDGs, but also from a cost effectiveness standpoint. For example, Bittner (2021) provides an example of one of their clients, a leading strawberry provider in the United States that uses sensors to monitor the watering and growth of their produce. Through the use of IoT in collecting, categorizing, and analyzing data derived from these sensors, this strawberry producer is able to reduce the amount of water used to grow the strawberries, determine the best time to pick the strawberries for consumption, and reduce waste of the strawberries. This process of assessing water usage and monitoring ripeness of the fruit occurs in a fraction of the time that it would take the human eye to make those determinations (Bittner, 2021). As it is the Azure software service using IoT enabling this strawberry producer to meet its sustainability goals, the incorporation of blockchain technology can take the sustainability practices a step further. As Daley (2022a) describes, incorporating blockchain with IoT can increase the speed in which certain processes are completed and further streamline those processes, thus saving time, money, and resources.

## 5.2 ConsenSys

Microsoft's original blockchain service offering was the Azure Blockchain Services, which was retired in September 2021. Microsoft explained that the service was withdrawn for multiple reasons including a shift in the blockchain industry and a decreased interest in the service (Azure, 2021). Although this service was retired, Microsoft announced measures for existing customers to be able to migrate the service to their partner ConsenSys (Azure, 2021).

ConsenSys offers the Quorum Blockchain Service for Microsoft's Azure customers. As this company uses Ethereum for its platform, the blockchain utilizes PoS for validating transactions. This is a result of Ethereum officially completing the merge for its platform to be fully PoS as its consensus mechanism in mid-September 2022 (Dillet, 2022). As mentioned previously, PoS is the greener solution to validating transactions. An additional benefit to using the Quorum Blockchain Service with Microsoft's Azure software is the increased measure of security. One element of worry, according to

Daley (2022a), is the issue of cybersecurity in IoT. Daley (2022a) mentions that as IoT expands, cybersecurity becomes compromised. The decentralized, completely encrypted nature of blockchain is a productive solution to IoT's cybersecurity problem.

## 6. Conclusion

From the above discussion, it can be inferred that the future is in the blockchain, and as major companies such as Microsoft begin to adopt its use, other companies are sure to follow. There are certainly numerous advantages to adopting the use of blockchain in many industries, and most of the disadvantages that have been put forward as objections have been refuted. The only disadvantage that needs more work to resolve it is the evaluation of countries that regulate the use of blockchain technology. That will be an issue for future research to explore. Aside from blockchain regulation, it is still recommended that companies should consider whether incorporating blockchain as a data ledger solution would benefit their operations. Even if a company is not yet prepared to adopt such a solution, they can anticipate that in the future it may be a more viable option as it becomes a more widely used platform. As blockchain is becoming more accepted and adopted by leading corporations, it can be anticipated that many more organizations will follow. With the ultimate goal being to encourage the use of a platform that contains transparent, cost effective, sustainable solutions, this paper has illustrated how blockchain can be that tool. Furthermore, Microsoft has been the leader in the technology industry for nearly fifty years and has embedded in its values to provide software that allows for the application of sustainability. In addition to its development of blockchain technology through their partnership with ConsenSys, I would suggest that they are the company to follow when seeking experts in sustainability through blockchain technology.

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