

USING BLOCKCHAIN-ENABLED SOLUTIONS AS SDG ACCELERATORS IN THE INTERNATIONAL DEVELOPMENT SPACE

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Abstract

As the world is striving to recover from the shockwaves triggered by the Covid-19 crisis, all hands are needed on deck to transition towards a green recovery and make peace with nature as prerequisites of a global sustainable development pathway. In this paper, we examine the blockchain hype and the gaps in data and tools to build promising use cases for blockchain technology to accelerate global efforts in the decade of action towards achieving the SDGs. We attempted to break the hype-cycle portraying blockchain's superiority by navigating a rational blockchain use case development approach. By prototyping an SDG Acceleration Scorecard to use blockchain-enabled solutions as SDG accelerators, we aim to provide useful insights towards developing an integrated approach that is fit-for-purpose to guide organizations and practitioners in their quest to make informed decisions to design and implement blockchain-backed solutions as SDG accelerators. Acknowledging the limitations in prototyping such tools, we believe these are minimally viable products and should be considered as living tools that can further evolve as the blockchain technology is getting mature, its pace of adoption increasing, and its lessons learned, good practices and standards widely shared and internalized by teams and organizations working on innovation for development.

Key Words: Blockchain, SDGs, Innovation, COVID-19, Green Recovery, Scorecard

JEL codes: O16, O19, O35, P16, Q01, Q56

1. Introduction

As we enter the decade of action to achieve the SDGs by 2030, the international community is facing unprecedented challenges to accelerate the pace towards meeting national sustainable development targets, at a time where the very development gains hardly won over the last decades continue to be reversed by the aftershocks of the Covid-19 crisis. Now, if new technologies are going to contribute to the necessary transformation, there have to be adequate tools, methodologies, and standards to navigate the blockchain hype-cycle and move from a generalized "let's blockchain it" approach towards a rational narrative that is evidence-based.

Despite blockchain's promising potential, the reality can be challenging, there are not enough data, blockchain-backed applications for social impact are under-studied, and claims that blockchain-backed solutions can yield superior results when compared to other alternatives are yet to be supported by evidence. While we can agree that blockchain has

a promising potential to trigger disruptive innovations, we can also agree that the technology is not mature yet and that there is still a gap in terms of approaches and tools to develop blockchain use cases, evaluate blockchain applications, monitor experiments, mitigate associated risks and manage organizational changes to galvanize innovation-readiness within organizations considering to adopt blockchain technology and run use cases' experiments. It is only by filling the existing gaps that we can make a stronger case for using blockchain as an SDG accelerator.

We can argue that the comparative advantage of blockchain can be explained by its ability to address the issue of trust within the world financial system in the aftermath of the 2008 global financial crisis (Jiang, 2018). Looking into the current practice among the key players in both worlds of public and permissioned blockchains, there is a costly race among early adopters towards becoming the standard and prototyping blockchain applications to do things other technologies cannot. Against this background, we can look at the blockchain as a package of technologies and approaches to open up new opportunities for users to manage transactions, exchange values, and maintain digital trust (Gartner, 2018).

In one forecast the business value of blockchain was predicted to climb up reaching \$176 billion by 2025 before skyrocketing to \$3.1 trillion by 2030 (Gartner, 2018). Nevertheless, blockchain is yet to deliver its promise to match the hype despite its potential. The maturity of blockchain technology is expected to facilitate its wider adoption, widen the scope for its utilization, and consequently foster blockchain's ability to stimulate successful disruptions. This goes in line with the need to stimulate business processes, enable regulatory frameworks, and trigger the necessary cultural shift and the underlying organizational structures.

In this paper, we examine how various blockchain solutions should be ideated, designed and applied and how their related implementation choices can be made in an attempt to define a structured approach to develop effective use cases for blockchain applications in the fields of sustainable development and green recovery. We then identify potential gaps in terms of monitoring and evaluation, risks, and ethical considerations to propose tools to assess the impact of blockchain-powered applications and manage the associated potential risks and ethical considerations. We also explore to what extent does the use of blockchain influences business processes and identify structured ways to manage transformational change within organizations. Individuals and organizations designing and experimenting blockchain-based solutions for sustainable development may benefit from the tools we have prototyped in this study. In this regard, we propose the SDG Acceleration Scorecard and the Integrated Approach to use blockchain-enabled solutions as SDG accelerators.

By doing so, we aim to stimulate a discourse that effectively harness the disruptive potential of blockchain as an SDG accelerator. This work will support development workers and organizations experimenting or willing to experiment blockchain-enabled applications to address various challenges related to the achievement of the sustainable development goals by providing a practical toolbox. Such a toolbox will (i) facilitate the deployment of structured approaches and meaningful tools to build promising use cases for blockchain applications, (ii) monitor and evaluate the results of blockchain-enabled development interventions, (iii) assess and mitigate the risks associated with the blockchain technology, (iv) manage organizational change and nurture a culture of change that will foster an early and rational adoption of disruptive innovations.

2. Methodology

To prototype an integrated approach for this research, we will go through several stages. First, we will define the minimum viable product for the integrated approach by examining the available literature using four thematic clusters: building blockchain use cases, monitoring and evaluation of blockchain-based applications, risks and ethical considerations associated with blockchain-powered experiments, and change management in organizations deploying blockchain-based solutions. Second, the integrated approach built on the initial findings from the literature review will be further improved based on our observations and the inputs shared by resource persons approached to conduct this research.

During the last stage, we will finally propose an Integrated Approach together with an SDG Acceleration Scorecard to assess the potential for SDG acceleration. While we recognize the limitations of this work and the need to conduct further field investigations to explore the proof of concept by reaching out to a larger number of respondents to gather and analyze critical data, we believe that the proposed package composed of the Integrated Approach and the SDG Acceleration Scorecard is a necessary first step. Such tools should be considered as “living tools” that can be further improved as blockchain technology is getting mature, based on the feedback from end-users as they domesticate and internalize these tools to develop meaningful blockchain solutions.

3. Thematic Clusters

In Table 1, we consider four thematic clusters according to which we will test the following research questions and assumptions in an attempt to verify their validity.

Table 1: The thematic clusters proposed to prototype the integrated approach

Thematic Cluster	Research questions & Assumptions
Building a use case	What can be solved and what cannot be solved by blockchain? Which structured approach should be followed to understand the potential of blockchain in a given context and design specific and promising use cases? We assume that the solution should not come before the problem. To make a meaningful use case for blockchain there are many boxes to tick-in.
Risks and ethical consideration	Are blockchain applications in sustainable development risk-free? What are the potential risks associated with the utilization of this technology and which ethical reflections should be taken into consideration? We assume that there is a need to explore ethical considerations around the use of blockchain to determine potential risks for development professionals to make informed decisions and come up with appropriate mitigation measures.
Monitoring and Evaluation	Which structured approach and tools can be used to M&E blockchain applications? Looking beyond pilots, can blockchain solutions deliver impacts at scale? How can we measure such impacts? We assume that while blockchain applications are

	<p>contributing to solve some of the challenges around the implementation of the SDGs, it has been mostly demonstrated and reported in the available literature through pilot applications that were not replicated at a larger scale. To better assess blockchain's impact on the SDGs, to examine whether or not a given result could be fully attributed to the blockchain, or if blockchain rather partially contributed to such a result, we assume that there is a need to develop adequate tools to support monitoring and evaluation of different blockchain experiments. Such tools should not only track progress but also provide a standardized platform to ensure comparability and assess criteria of relevance, effectiveness, efficiency, sustainability, and impact, in addition to gender equality.</p>
<p>Change management</p>	<p>What about change management in organizations adopting blockchain? How does embracing innovation, in the case of blockchain applications, affects the way development and humanitarian organizations do business? We assume that change management is a dynamic process that needs to be understood, to enable organizations to develop an evolutionary adaptation approach to navigate the transition, address resistance to change, and nurture innovation.</p>

3.1 Building a Use Case

Low experimentation costs of blockchain solutions driven by platforms made available via service providers known as Blockchain as a Service (BaaS) offerings (DeCleene, 2018), combined with the increasingly complex nature of delivering development and humanitarian interventions in a time where both developing and developed countries are pursuing their sustainable development targets, stimulated many investments to build use cases for blockchain solutions in a wide array of contexts. Here, we are looking, beyond the hype, at the fundamental question of what can be, and what cannot be solved by blockchain? We can also agree that given the scarcity of development finance, the increasing demand, and challenges faced by organizations and practitioners in today's world to deliver effective yet lasting results, the return on investment of innovation experiments including blockchain should not be limited to the proof of concept but also consider impact at scale.

While blockchain can be the appropriate choice in some cases, other conventional technologies might be more appropriate in other situations (Sin Kuang, Xiwei, Yin Kia, & Qinghua, 2017). Giving the blockchain hype, we consider that the critical starting point to make a use case for a given blockchain application is to avoid at all cost developing a blockchain solution when there is no problem to be solved with it. The specific problems that need to be fixed and the feasibility of the blockchain solution should be rigorously examined while building a promising use case for blockchain (Mckinsey, 2018). Other criteria to consider could include the realities on the ground in line with the specific development or humanitarian contexts for which a blockchain solution is sought, the

capabilities of the staff involved in the blockchain experiment, the flexibility of the applicable business processes and the underlying managerial structures.

Another vital factor is the coordination among stakeholders involved in the design and implementation of a given blockchain solution. To design viable blockchain solutions, due consideration should also be given to the ability to manage technology constraints through trade-offs, to convince various stakeholders of the relevance of the blockchain use case, to cooperate with other players, and to comply with the applicable regulations and standards on a case-by-case basis.

For this research, we have adapted the stages defined in the blockchain use case development method (BUD) proposed by (Fridgen, Lockl, Radszuwill, Schweizer, & Urbach, 2018) using a design thinking process (Dam & Siang, 2019). We argue that these stages will evolve to reflect the latest developments in blockchain as the technology is getting mature and reaching a stage of producing impact at scale.

Step 1 - Understand blockchain

We assume that the focus here should not be on understating the technology itself, but on what can be done with it. This also takes into consideration the capabilities organizations should have to design and implement blockchain solutions.

Step 2 - Define the problem you are trying to solve with blockchain

Here we need to clearly define the challenge that we are trying to overcome with blockchain. Individuals and organizations need to consider the feasibility aspects, as well as various organizational implications with regard to business processes and change management, should be also taken into consideration. Guiding questions can be provided as:

- What is the exact problem you are trying to solve?
- How does it affect your sustainable development context?
- Which capabilities do you need to develop a blockchain solution to address this problem?

Step 3 - Pitch your ideas

We assume that while teams can consider existing blockchain use cases in their fields of interest, they should only use such cases for inspiration and come up with their innovative ideas by brainstorming and working together in cross-functional teams. Guiding questions can be provided such as (Wachal, 2019):

- Are transparency and traceability important in your context?
- Do you need a centralized or decentralized solution?
- Which transactions require trusted partners or processes?
- Which intermediaries can be eliminated?
- Will you reduce transaction time for end-to-end processes with blockchain?
- Which costs can be reduced?
- Which data is most sensitive and which data will be stored?
- How much control do you need for stored data?

- Who are your potential end-users?
- Which transformational change can result from using blockchain in your organization?

Step 4 – Build Consensus

We assume that while consensus protocols make blockchain platforms immutable, achieving such consensus may require huge computational power and large amounts of energy, while design choices can have implications on how much time is needed for consensus and the degree of decentralization.

- To what extent are timing and decentralization critical factors in your context?
- How much computational power is needed to achieve consensus? Can it be reduced?
- Which consensus protocols can be used?

Step 5 - Prototype the solution

We assume that issues of efficiency, scalability, performance, and impact should be factored-in while defining the parameters for any given blockchain prototype. Guiding questions may include:

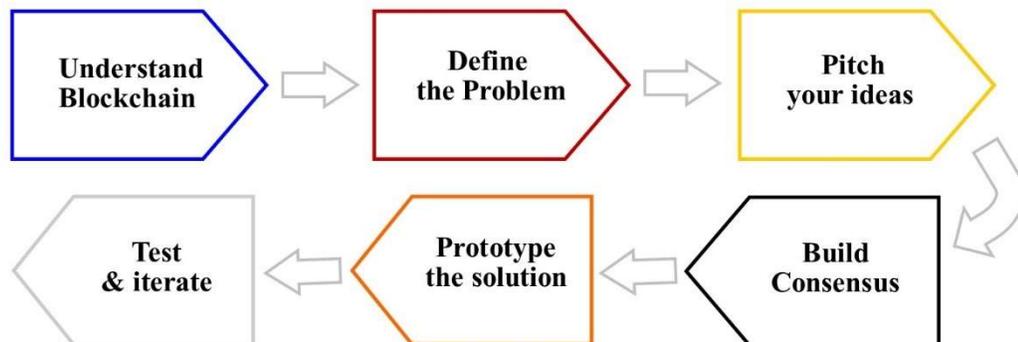
- What is the cost of developing this blockchain solution?
- What would be the return on investment?
- Which blockchain platform should be used in your case (Public, Private, Hybrid)?

Step 6 - Test & Iterate

We assume that blockchain solutions should be tested with potential end-users to identify residual issues which will be taken back to the prototyping phase through an iterative process.

Figure 1 summarizes the steps in the blockchain use case development method.

Figure 1: Presentation of the blockchain use case development method



Source: author based on (Fridgen, Lockl, Radszuwill, Schweizer, & Urbach, 2018)

3.2 Risks and ethical considerations

We can praise blockchain for its disruptive potential and all the benefits it can bring into a given use case. Nevertheless, we can also agree that there is no return on investment without risks. Organizations and practitioners must avoid at all costs creating more problems than the ones a blockchain application is designed to solve. Given the complex nature of blockchain technology, it is not an easy task to assess the underlying risks especially in the absence of standards and regulations (Panetta, 2016). For this research, we have adapted the frameworks for risk analysis and management proposed by (S. Kaplan & Mikes, 2012), (Tasca, 2017) and (Thivaivos, 2018):

- Analyze (identify core risks and assess their potential impact and likelihood)
- Manage (develop proper management responses to mitigate risks)
- Anticipate (detect new risks that are arising from various ethical considerations)

3.2.1 Risk Analysis

At the design stage, there are no blockchain standards as the technology is not mature yet. Lessons learned and good practices should be coded into standards to minimize risks and pave the way towards enhanced cooperation. We assume that the inter-operability between blockchain platforms will remain a key issue and thus represents a key risk. Other technical risks may potentially stem-out from design-related choices for instance whether forking another version of the ledger is allowed or whether automated actions are built-in on a blockchain infrastructure.

Implementation comes with its own set of risks. Consensus building algorithms can cause serious delays giving the nature of participatory processes. High maintenance costs can cause projects to fail and scalability might not be done through economies of scale. Cybersecurity risks and frauds are a key challenge for shared technological infrastructures that can originate from the outside or from within. While the likelihood of outside attacks appears to be minimalistic, risks stem-out from the irreversible nature of internally produced mistakes such as sharing an erroneous code across the network or building consensus on a false entry. Updates and maintenance managed by third parties may qualify as potential risks as well, especially if the skills required and the availability of service providers are in low supply.

Other risks in general terms are linked to the constantly evolving blockchain regulations in various jurisdictions, the cost of technology updates, competition from other disruptive innovations, and the ecological footprint of blockchain giving its energy consumption. In general terms, the more we understand blockchain, and the more we understand the problem we are trying to solve with blockchain, the highest is our chance to come up with the most appropriate risk mitigation measures.

3.2.2 Risk management

We consider three risk categories that can be analyzed at different stages before, during, and after the implementation of the blockchain-backed solution.

Preventable risks

Here we are looking at internal and avoidable risks arising from within organizations and teams. With blockchain, the need for human interventions can be reduced when using automated processes and smart contracts, which in return can decrease the likelihood of alteration of records or corruption of people involved. However, risks may stem-out from the irreversible nature of internally produced mistakes such as sharing an erroneous code across the network or building consensus on a false entry. We assume that active prevention through a rules-based control model is the most suitable risk management response to risks listed under this category, it could be achieved by monitoring business processes and by guiding human-made decisions related to blockchain applications.

Strategic risks

These are risks organizations and teams are willing to take to achieve high targets. Here the managerial response is rather towards reducing the likelihood for risks to occur and containing such risks in the case they materialize. While blockchain can minimize risks related to compliance and litigations, early investors driven by an appetite for innovation to pioneer their field of practice can see their projects seriously delayed by consensus building algorithms giving the nature of the participatory processes, or even fail due to poor buy-in from their stakeholders, high maintenance and scalability costs which might not be done through economies of scale.

External risks

These are consequences of events happening in the outside world that cannot be accurately forecasted, and over which organizations and individuals have no control whatsoever. Proper mechanisms should be set in place to track such risks and mitigate their impacts to the extent possible using appropriate managerial responses. Although the likelihood of outside attacks appears to be minimalistic, cybersecurity risks are a key challenge for shared technological infrastructures. Updates and maintenance managed by third parties may qualify as potential risks as well, especially if the skills required and the availability of service providers are in low supply. Other risks in general terms are linked to the legal-technology mismatch due to the constantly evolving blockchain regulations in various jurisdictions, in addition to the cost of technology updates and competition from other disruptive innovations.

3.2.4 Ethical considerations

We can argue that ethics made a late appearance in the blockchain sphere because it is seemingly complicated to understand how the technology works. Several ethical considerations need to be addressed. Due to massive energy consumption, public blockchains based on mining can potentially have a significant impact on the environment. The annualized total electricity consumption of bitcoin assuming constant power usage over one year is estimated at 77.38 TWH (CBECEI, 2019). This number should be understood as an educated guestimate to have an idea giving that it is not possible to accurately calculate the electricity consumption of bitcoin.

The hyper-efficiency which is indeed a valuable comparative advantage of blockchain applications can disrupt the jobs of many people involved for example in data maintenance (Houlding, 2019). Also, blockchain can over-promise and fail to meet the expectations, or

inadvertently facilitate crime-related transactions and oppressive conduct (Longstaff, 2019). Blockchain can be used for money-laundering, in illicit business activities such as weapons and drugs or other related transactions (Smith, 2019).

Equally important is the way we design blockchain applications based on trade-offs which can have far-reaching consequences (Apoinde & Fishbane, 2018). It can codify biases and exacerbate social dynamics within a given community, the transparent nature of blockchain information can put persons at risk because of their ethnicity, religious background, or sexual orientations (Apoinde & Fishbane, 2018). The same applies to the immutability of digital identity records in case a person is threatened and would need anonymity or a new identity, or if erroneous data is recorded. If there are no ways of retrieving a lost private key it might simply mean that a person lost control over his digitally recorded assets. When the encryption algorithms used are outdated, sensitive information might be exposed, and transactions can be forged (Apoinde & Fishbane, 2018).

3.3 Monitoring and Evaluation (M&E)

3.3.1 Monitoring

We argue that the core ingredients to successfully monitor blockchain interventions would be for organizations to have clear monitoring policies in place, for individuals to have clearly defined roles and responsibilities in the monitoring process, and to have a first-hand understanding of the operational context in which a given blockchain-powered application is being deployed. Appropriate M&E frameworks should be developed to track specific project outputs, especially related to the annual targets that blockchain projects expect to achieve in line with their results' matrices. Monitoring actions should capture and analyze data to report on the progress towards outcomes, impeding factors, partners' role in achieving the expected results, and lessons learned to develop and disseminate knowledge products. While blockchain experiments for social good remain largely understudied, such knowledge products are undoubtedly needed by the global community giving the scarcity of data to identify good practices. Additionally, monitoring data and reports are key resources to inform decision making and future experiments.

For this research, we propose a three-step approach for monitoring blockchain projects, namely data gathering, analysis, and reporting:

- Collecting data through available tools. Data can be collected based on field investigations and through different reporting mechanisms, then triangulated for validation and discussed via participatory processes such as during coordination meetings with partners.
- Analyzing the data gathered to extract useful information, identify patterns, and detect bottlenecks. Data interpretation in terms of what needs to be done may be used to generate useful and user-friendly insights to guide decision-makers.
- Reporting to inform future decisions. Stakeholders and partners involved in blockchain projects can be guided to make informed decisions to ensure the project is on track to deliver their expected results.

3.3.2 Evaluation

Since their adoption in 1991 (OECD, 1991), the five OECD DAC criteria are the most referenced and used standard to evaluate international development interventions. For many years, evaluation professionals have considered relevance, effectiveness, efficiency, impact, and sustainability as the standard to assess development interventions. The main issue here seems to be how these criteria should be used, as one mainstream mistake is to start using such criteria in a mostly mechanical way by ticking-in-the-box instead of using them to support a non-linear critical analysis (Pasanen, 2018). There are ongoing discussions as to what extent the DAC criteria should be revised to capture the new paradigms of sustainable development. We can argue that not every evaluation should cover all the 5 criteria, and even if this is the case, not all the criteria are analyzed in the same depth, and most importantly, these criteria may not be entirely suitable for the needs of today (Pasanen, 2018). We are looking here into disruptive innovations and specifically blockchain-enabled applications for sustainable development to extract key guiding criteria, which evaluation professionals could consider when evaluating blockchain-backed projects.

One common critic of blockchain applications is the lack of evidence to support claims for disruptive results. This can be partially explained by the fact that the technology is not mature yet, or that lessons learned from blockchain experiments are poorly documented. As a result, we can argue that the hype was driven to some extent by a fear-of-missing-out bubble based on proof-of-concepts experiments to get the headlines (Jiang, 2018). This being said, there is a promising potential for blockchain use cases to have a transformative business impact by improving productivity and quality, increasing transparency, and reinventing products and processes (WEF, 2019). Hence the need to fill in the gap by developing proper M&E evaluation frameworks for blockchain applications in international development.

After developing a promising use case for blockchain, securing the support of various partners, and unlocking the necessary funding, and before kicking-off the implementation of a given blockchain-powered solution there is a need to set up robust M&E frameworks. Organizations might consider hiring full-time M&E practitioners or investing in diffuse M&E skills throughout their workforce assigned to design and implement blockchain-based applications. However, various considerations make it difficult to perform M&E functions for sustainable development interventions driven by innovative processes. For instance, the uncertainty associated with innovation-based solutions, the speculative nature of the results one should expect down the road, and the hard-to-measure nature of innovation-driven benefits such as stimulating an appetite for a diffuse business-as-unusual culture, are all vital aspects to consider while monitoring and evaluating blockchain-centered experiments.

Before implementation, certain criteria need to be considered for blockchain practitioners to come up with the right decisions (Vangala, 2018). In terms of governance, for instance, it is vital to identify who controls access to the blockchain application, who makes decisions and who enforces such decisions to alter the blockchain solution as the needs evolve in a given development or humanitarian context. One of the main preoccupations for developers of blockchain applications in sustainable development contexts is to minimize their power consumption and ecological footprint (Vangala, 2018). In this regard, choosing the right consensus scheme and offering the right incentives can enhance

the acceptability and thus the success of blockchain-enabled solutions. To decide on the right type of blockchain platform to deploy, organizations need to take into consideration whether the data is meant to be accessible publicly, in a restricted circle, or a combination of both.

For this research, we have adapted the evaluation framework which was developed by (Fridgen, et al., 2018) to evaluate the applicability of blockchain technology along with the public sector. We argue that this framework is not only suitable for the evaluation of blockchain use cases, but also for the provision of a set of evaluation criteria to consider while conducting mid-term or final evaluations of blockchain projects for sustainable development. Here we consider 3 sets of criteria namely technical, functional, and legal criteria:

Technical Criteria

In this set, we have included 4 criteria namely performance, scalability, security, and usability.

1. *Performance*

Due consideration should be given to how fast transactions can be operated within a blockchain network. Furthermore, duration and latency need to be verified using available metrics such as the number of blocks and the size of transactions.

2. *Scalability*

This is a key element giving that blockchain experiments are usually designed to be tested in small pilot cases. Once the candidate blockchain applications deliver the proof of concept and graduate from the experimentation phase, they are expected to be applicable on a larger scale to address international development. It is thus critical to factor-in scalability parameters such as the network size, number of possible nodes, and transactions needed down the road on a larger scale.

3. *Security*

We can assume that a fair number of development solutions were designed as blockchain applications given the enhanced security features of blockchain technology. This is to point out the need to carefully consider the security features provided by a given blockchain application and assess whether it answers specific contextual requirements related to the security of data and transactions.

4. *Usability*

User-friendly applications tend to be more accepted. The ease of use is a critical parameter to consider which comes down to ensuring that everyone can benefit from the blockchain solution and that no one is left behind. Important details to factor-in can range from internet traffic to the ability to fork new features, the available tools, and languages, and the number of possible users.

Functional criteria

This set includes criteria related to the costs of R&D to build a blockchain-backed solution, implement it, ensure its operationalization and maintenance, besides other criteria related to the flexibility and transparency of the process.

1. *Costs*

Some applications of blockchain may require heavy transactions and storage of data which implies high costs. This should be duly considered while budgeting to

include not only the prototyping and deployment of the blockchain application but also its operational and maintenance costs.

2. *Flexibility*

Another important feature in international development set-ups, is the adaptability of blockchain-powered pilots to be replicated or altered in a way to serve new needs or address new challenges. If a blockchain platform for instance is only meant to be deployed in a restricted area, such limitations are to be considered before any investments upfront.

3. *Transparency*

It is important to find out the right trade-offs between transparency and other outputs. Confidentiality can be increased by storing encrypted data but it will reduce transparency and performance. Transparency can be in tension with commercial confidentiality such as in cases where competitors exist (Sin Kuang, Xiwei, Yin Kia, & Qinghua, 2017).

Legal criteria

This set includes criteria related to data privacy, legal procurement frameworks, employee protection rights, and other legal regulations. Here we highlight various legal considerations applicable in the jurisdictions and to the entities involved in blockchain experiments. These include requirements for data privacy, contractual modalities specified in procurement laws, employment protection rights, and any other legal instruments that are potentially applicable to blockchain within a specific jurisdiction.

3.4 Change Management

We can argue that blockchain technology stimulates a progressive evolution in the ways business is conducted. Development organizations and practitioners running various innovation experiments and aspiring to harness the disruptive potential of blockchain are facing the challenge of managing the change towards a new normal. New avenues and meaningful ways are being explored to nurture a culture of innovation, keep risks at acceptable levels and address pockets of resistance for both organizations and individuals within to be able to follow a trajectory of evolutionary adaptation and achieve a transformational change in doing business (Gartner, 2018). Blockchain should not be considered as a technology option but understood in terms of its capabilities to address specific issues and deliver precise solutions. Organizations and individuals should also consider experiments where they can explore decentralized business processes and allocate staff having both technological but also technical capabilities (Gartner, 2018).

We also argue that organizations and individuals embracing the disruption wave brought by the blockchain technology need to be change-adept. When an organization invests in a blockchain application, it has already identified a problem and came up with a use case for blockchain as a solution. In this respect, managers will need to set-up innovation-prone environments to ensure effectiveness and efficiency, reinforce collaboration, address siloed-behaviors, provide leadership and coaching, and avail resources needed for the blockchain-enabled solution to deliver its promises. Here, the focus is on the capability of the organizations to implement a blockchain-backed solution. In fact, without a structured approach for implementation, an innovative solution is likely

to fail. We assume that change management is a dynamic process that needs to be understood, to enable organizations to develop an evolutionary adaptation approach to navigate the transition, address resistance to change, and nurture innovation.

For this research, we will focus on change at the individual level as the cornerstone for change to happen at the organizational level. The following change management approach was inspired by the ADKAR (Prosci, 2019) and Kurt Lewin's (Talib Hussain, et al., 2016) change management models:

1. *Unfreeze*

At this initial stage the focus should be on raising awareness beyond the hype to visualize potential opportunities of adopting blockchain-based solutions and seize the most promising ones.

2. *Change*

This is an intermediary stage where the spotlight is on motivating individuals and teams to design blockchain-powered solutions. This includes coaching, managing resistance, fostering readiness to become a change agent, as well as investing in core capabilities through learning and practice for individuals and teams to acquire a wide spectrum of skills deemed necessary to implement blockchain projects.

3. *Refreeze the change*

This is the final stage where the focus is on re-calibration through corrective actions whenever applicable, but also on measuring achievements and celebrating success.

4. SDG Acceleration Scorecard

Giving the current hype, one can argue that in general terms developments practitioners and organizations tend to act prematurely to address a given problem without necessarily being aware of the alternatives and without running proper assessments that would or would not prioritize "let's blockchain it!" as the best way forward. Now, even after an assessment indicates that a blockchain solution is the number one option, one can still do more to harness not only the direct benefits to address the initial problem for which a blockchain solution is needed, but equally important are the wider sustainable development co-benefits to which such blockchain solutions can contribute. Giving the interlinked nature of the SDGs, one blockchain-backed solution can contribute to more than just one SDG at a time. In other terms, one should think beyond the simple issue to be solved by a blockchain application. While such an application can solve a specific problem, it can also contribute to achieving other development targets if properly designed and implemented, hence the SDG acceleration effect. That is why we truly believe that for blockchain-powered applications to deliver wider development co-benefits, it is critical to assess their SDG acceleration potential by taking into consideration an initial set of criteria and indicators related to use case development, monitoring and evaluation, risks and ethical considerations and the change management. We refer to Table 2 that showcases examples through which dimensions SDG targets can be accelerated.

Table 2: SDG acceleration matrix

Acceleration area	Multiplier effect (# of SDG targets)	Balance across the 3 dimensions			Score
		Social	Economic	Environmental	
Ex: women empowerment	15	Yes	Yes	Yes	15 3
Ex: impact investing	10	Yes	Yes	Yes	10 3
Ex: Health records	8	Yes	Yes	No	8 2

Source: adapted from the SDG Accelerator and Bottleneck Assessment Tool (UNDP, 2017), the acceleration areas, multipliers, balances, and scores are examples for illustration and will depend on the specific context applicable to a given development intervention

Our attempt here is to provide a simplified scorecard that will help development practitioners and organizations running blockchain experiments understand the bigger picture, pilot their interventions in a way to accelerate the achievement of the SDGs, and fulfill the sustainable development aspirations of individuals, communities, cities, regions, and governments worldwide. Inspired by the use of scorecards in the development practice, one of the experimental tools we have proposed in this work is the SDG Acceleration Scorecard (SAS). We argue that scorecards can be extremely useful in helping development practitioners monitor progress and measure results. To monitor capacity development, scorecards can be used as tools to quantify qualitative processes and measure the change in capacities using a set of relevant indicators to which specific ratings are assigned.

This was, for example, the case with the Capacity Development Scorecard developed to monitor the progress made towards achieving global environmental benefits for projects funded by the Global Environment Facility (Bellamy & Hill, 2010). This scorecard was adapted to measure increases in capacity in the case of the implementation of the Access and Benefit Sharing (ABS) mechanism of the Nagoya Protocol which governs the utilization of genetic resources and their associated traditional knowledge (CBD, 2018). Simplified scorecard systems were also used to gather general information and conduct assessments. The WWF-World Bank MPA Scorecard for instance was designed for marine protected areas. It mainly relies on the available literature in addition to the opinions of sites' managers and independent assessors (Leverington, Hockings, Lemos, Courrau, & Pavese, 2008). Such a scorecard can be rapidly deployed, is less costly to implement, and broadly covers the relevant issues. Nevertheless, the depth of analysis provided by such tools remains low (Staub & Hatzios, 2004).

In our attempt to develop a scorecard to assess the SDG acceleration potential of blockchain-enabled solutions, we have applied the core criteria defined in the thematic clusters to propose acceleration areas, and we tried to identify possible drivers of acceleration by asking specific questions to generate useful information that can be used for two main objectives. Under the first scenario, the scorecard can be used to assess the multiplier effect of a given blockchain-enabled solution in terms of how many SDGs are expected to benefit from such an intervention. The information generated by the scorecard can also be used to run a quick assessment to check whether or not the gaps in design and implementation have been properly addressed. In the second scenario, gathering data

using the scorecard can enable the comparison between different blockchain-backed candidate solutions, in terms of their rational, risk category, the existence of proper mechanisms to generate data, track the progress, assess outcomes, manage the change, and their overall ability to deliver tangible and holistic development outcomes.

The proposed SDG Acceleration Scorecard consists of acceleration areas, drivers, and a scoring system. To characterize the acceleration effect of a given blockchain-enabled solution, the scorecard provides descriptive sentences for each driver in the acceleration areas, each corresponding to a numerical rating from zero (0) to three (3) based on a 33-point scoring system. In the following paragraphs, we provide practical explanations related to the acceleration areas, the drivers within each area, and how are the scores assigned using descriptive sentences to describe each driver.

A. Acceleration area 1: Use Case Development

When use cases of blockchain-enabled solutions are properly designed by taking into consideration the interlinked nature of the SDGs, they can have a multiplier effect on the development dividends expected down the road. This in return will boost the ongoing efforts to achieving the SDGs hence the acceleration effect.

Driver A1

It generates useful information to explain whether or not there is a strong justification for the design choice of a blockchain-backed solution. We propose asking the following or other alternative questions: why would you consider blockchain as a solution to the problem encountered in your case?

Scorecard rating: we have assigned a score of 0 to 3 to the responses provided

0--No Response/ Not sure

1--Blockchain is an emerging innovation in international development

2--Blockchain has the potential to solve some development challenges we face today

3--Blockchain is the best alternative to address the specific challenges we are facing

Driver A2

It generates useful information to explain whether or not a given blockchain-backed solution was compared to other alternatives. We propose asking the following or other alternative questions: did you compare blockchain to other alternative solutions in terms of efficiency, scalability, performance, impact, and cost-effectiveness?

Scorecard rating: we have assigned a score of 0 to 1 to the responses provided

0—No/ Not sure

1—Yes

Driver A3

It generates useful information to understand whether or not end-users were involved to test and iterate a given blockchain-backed solution during the design which is crucial to strengthen ownership and for consensus building. We propose asking the following or

other alternative questions: How many end-users were/will be approached during the design of your blockchain experiment?

Scorecard rating: we have assigned a score of 0 to 3 to the responses provided

- 0 – None/Not sure
- 1 – Less than 2
- 2 – 2 to 5
- 3 – More than 5

Driver A4

It generates useful information to assess the multiplier effect of a given blockchain-powered solution in terms of its ability to generate wider development co-benefits by contributing to multiple SDGs. We propose asking the following or other alternative questions: How many SDGs do you expect your blockchain project to contribute to?

Scorecard rating: we have assigned a score of 0 to 3 to the responses provided

- 0 – None/Not sure
- 1 – Only 1 SDG
- 2 – From 2 to 3 SDGs
- 3 – Multiplier effect across more than 3 SDGs

B. Acceleration area 2: Risks & Ethical Considerations

This part of the scorecard can generate risk-related information to reveal whether risks and ethical considerations related to blockchain technology are well understood and to ensure that a given blockchain experiment does not create more problems than the ones it was designed to solve.

Driver B1

It generates useful information to assess whether or not a risk analysis was undertaken for a given blockchain-powered solution. We propose asking the following or other alternative questions: Have you conducted a risk analysis to identify and assess the core risks associated with your blockchain experiment?

Scorecard rating: we have assigned a score of 0 to 1 to the responses provided

- 0—No/ Not sure
- 1—Yes

Driver B2

It generates useful information to assess the ability to identify and categorize risks in a structured way to enable a proper risk management response. As a follow-up to the question under B1, we propose asking the following or other alternative questions: what were the risks you have identified?

Scorecard rating: we have assigned a score of 0 to 3 to the responses provided

- 0--None/ Not sure

- 1--Mostly external risks (High risk)
- 2--Mostly strategic risks (Moderate risk)
- 3--Mostly preventable risks (Low risk)

Driver B3

It generates useful information about whether or not there is a risk management mechanism for a given blockchain-powered solution to mitigate different types of risks. We propose asking the following or other alternative questions: Did you come up with a proper management response to mitigate the risks identified?

Scorecard rating: we have assigned a score of 0 to 1 to the responses provided

- 0—No/ Not sure
- 1—Yes

Driver B4

It generates useful information whether or not there is a mechanism in place to update risk-logs and detect emerging risks as blockchain-backed solutions are being prototyped and deployed in a rapidly evolving legal, institutional and technological landscape. We propose asking the following or other alternative questions: Did you set up a mechanism in place to detect and anticipate new emerging risks and address ethical considerations?

Scorecard rating: we have assigned a score of 0 to 1 to the responses provided

- 0—No/ Not sure
- 1—Yes

C. Acceleration area 3: Monitoring & Evaluation

This part of the scorecard can generate M&E-related information to explain how activities will be monitored, how progress will be tracked, and which criteria will be used to evaluate the applicability but also the outcomes of blockchain experiments.

Driver C1

It generates useful information to assess the extent to which data is being collected for a given blockchain-powered solution. We propose asking the following or other alternative questions: Do you collect any type of data on your blockchain experiment?

Scorecard rating: we have assigned a score of 0 to 3 to the responses provided

- 0 -- There is essentially no data collection
- 1 -- There is some sort of data collection
- 2 – Data is collected and analyzed
- 3 – Data is systematically collected, analyzed and publicly shared to inform peers and decision making

Driver C2

It generates useful information to assess whether or not an M&E mechanism is in place for a given blockchain-powered solution. We propose asking the following or other alternative questions: Do you have an M&E mechanism in place to ensure proper monitoring of your blockchain experiment?

Scorecard rating: we have assigned a score of 0 to 3 to the responses provided

- 0 -- There is essentially no mechanism
- 1 -- There is some sort of mechanism
- 2 -- There is a relatively good mechanism
- 3 -- There is a well-functioning mechanism

Driver C3

It generates useful information to explain the set of criteria used in assessing the applicability of blockchain experiments and evaluate their outcomes. We propose asking the following or other alternative questions: Which of the following criteria would you consider in evaluating your blockchain project? Performance, Scalability, Usability, Security, Cost, Flexibility, Transparency, Legal regulations, Environmental footprint, Social impact, and SDG acceleration.

Scorecard rating: we have assigned a score of 0 to 3 to the responses provided

- 0--None/ Not sure
- 1--At least 1 criterion
- 2--At least 3 criteria
- 3--At least 5 criteria including the one on SDG acceleration

D. Acceleration area 4: Innovation Management

The last part of the scorecard can be used to generate information to better understand the change dynamics in a given development setup and trigger adequate change management responses towards nurturing a culture of innovation and addressing pockets of resistance.

Driver D1

It generates useful information to assess whether or not there is some sort of awareness about change management. We propose asking the following or other alternative questions: Would you conduct any awareness-raising activities within your organization or team to visualize the potential of blockchain-enabled applications and co-create promising use cases?

Scorecard rating: we have assigned a score of 0 to 1 to the responses provided

- 0—No/ Not sure
- 1—Yes

Driver D2

It generates useful information to assess the willingness of managers to understand the root causes of resistance to change, and more specifically to blockchain-driven innovations. We propose asking the following or other alternative questions: Are you planning to explore the reasons behind any resistance that blockchain-backed solutions may face within your organization or team?

Scorecard rating: we have assigned a score of 0 to 3 to the responses provided

0—No/ Not sure

1--Yes

Driver D3

It generates useful information to assess whether or not there are proper mechanisms in place to enable an innovation-centered environment. We propose asking the following or other alternative questions: Would you consider motivating your staff, partners, and end-users involved in your blockchain experiment?

Scorecard rating: we have assigned a score of 0 to 3 to the responses provided

0—No/ Not sure

1— Yes, by allocating appropriate time and resources for the team members to innovate and prototype promising solutions

2—Yes, by investing in core capabilities and skills to implement blockchain projects through learning and practice

3— Yes, through coaching for readiness to become a change agent

Driver D4

It generates useful information to assess whether or not there is some sort of policy or strategy to maintain an innovation-prone set up in a given context. We propose asking the following or other alternative questions: Do you have a strategy to maintain an innovation-friendly environment within your organization?

Scorecard rating: we have assigned a score of 0 to 3 to the responses provided

0—No/ Not sure

1— Yes, by recommending corrective actions for improvement

2— Yes, by measuring achievements

3— Yes, by celebrating successes

Table 3 presents the SDG acceleration scorecard. We emphasize that the scoring system proposed here is not exclusive and that the scores assigned to each descriptive sentence can be revised and weighted accordingly on a case-by-case basis to better reflect the context within which a blockchain-backed solution is deployed. The scorecard can be used as a benchmark at the beginning of the design phase, but also to generate useful insights as the implementation of blockchain experiments is moving forward, and stay on track towards reaching the established targets. The SDG Acceleration Scorecard is a flexible tool and can be adapted and further improved to reflect the differentiated contexts underpinning blockchain experiments.

We fully recognize the limitations of using an SDG Acceleration Scorecard in the context of blockchain experiments. While it was designed as a low-cost and rapidly deployable tool, it should not be seen as a replacement of academically proven methodologies. The concept of scoring can entail risks of distortions, which leave ample room to improve accuracy by weighting the scores (Staub & Hatzios, 2004). In this case, we assume that the weights assigned to each question in the SDG Acceleration Scorecard reflect some sort of rational which might not be necessarily the case. We have considered a simple scoring system while recognizing its limitations.

Again, while recognizing the limitation of the proposed acceleration scorecard as a minimum viable product, which should not replace academically tested methodologies, the scorecard can help individuals and organizations to generate useful insights to guide their efforts throughout the journey of co-creating blockchain-powered solutions in the field of international development, and more specifically to meet the 2030 deadline for achieving the SDGs.

Table 3: SDG Acceleration Scorecard

Acceleration areas	Drivers	Scorecard	Score
Use Case Development	Why would you consider blockchain as a solution to the problem encountered in your case?	0--No Response/ Not sure 1--Blockchain is an emerging innovation in international development 2--Blockchain has the potential to solve some development challenges we face today 3--Blockchain is the best alternative to address the specific challenges we are facing	
	Did you compare blockchain to other alternative solutions in terms of efficiency, scalability, performance, impact, and cost-effectiveness?	0—No/ Not sure 1--Yes	
	How many end-users were/will be approached during the design of your blockchain experiment?	0 – None/Not sure 1 – Less than 2 2 – 2 to 5 3 – More than 5	
	How many SDGs do you expect your	0 – None/Not sure 1 – Only 1 SDG 2 – From 2 to 3 SDGs	

	blockchain project to contribute to?	3 – Multiplier effect across more than 3 SDGs	
Risks & Ethical Considerations	Have you conducted a risk analysis to identify and assess the core risks associated with your blockchain experiment?	0—No/ Not sure 1--Yes	
	If yes, what were the risks you have identified?	0--None/ Not sure 1--Mostly external risks (High risk) 2--Mostly strategic risks (Moderate risk) 3--Mostly preventable risks (Low risk)	
	Did you come up with a proper management response to mitigate the risks identified?	0—No/ Not sure 1--Yes	
	Did you set up a mechanism in place to detect and anticipate new emerging risks and address ethical considerations?	0—No/ Not sure 1--Yes	
Monitoring & Evaluation	Do you collect any type of data on your blockchain experiment?	0 -- There is essentially no data collection 1 -- There is some sort of data collection 2 – Data is collected and analyzed 3 – Data is systematically collected, analyzed and publicly shared to inform peers and decision making	
	Do you have an M&E mechanism in place to ensure proper monitoring of your blockchain experiment?	0 -- There is essentially no mechanism 1 -- There is some sort of mechanism 2 -- There is a relatively good mechanism 3 -- There is a well-functioning mechanism	
	Which of the following criteria would you consider in evaluating your blockchain project? Performance,	0--None/ Not sure 1--At least 1 criterion 2--At least 3 criteria 3--At least 5 criteria including the one on SDG acceleration	

	Scalability, Usability, Security, Cost, Flexibility, Transparency, Legal regulations, Environmental footprint, Social impact and SDG acceleration		
Innovation Management	Would you conduct any awareness-raising activities within your organization or team to visualize the potential of blockchain-enabled applications and co-create promising ones?	0—No/ Not sure 1--Yes	
	Are you planning to explore the reasons behind any resistance that blockchain-backed solutions may face within your organization or team?	0—No/ Not sure 1--Yes	
	Would you consider motivating your staff, partners, and end-users involved in your blockchain experiment?	0—No/ Not sure 1— Yes, by allocating appropriate time and resources for the team members to innovate and prototype promising solutions 2—Yes, by investing in core capabilities and skills to implement blockchain projects through learning and practice 3— Yes, through coaching for readiness to become a change agent	
	Do you have a strategy to maintain an innovation-friendly environment within your organization?	0—No/ Not sure 1— Yes, by recommending corrective actions for improvement 2— Yes, by measuring achievements 3— Yes, by celebrating successes	

Source: Authors

5. Integrated approach

Intentional design is the recipe to develop promising blockchain applications. Unlike other technologies, it is not simple to fix flows, alter records, or change contracts because of the immutable and distributed nature of data. By intentional design here we mean an integrated approach that goes beyond identifying the problem faced and implementing an intervention to achieve expected outcomes, it is the extra mile of understanding risks, ethical considerations, and technology choices that will usually make the difference.

As can be observed from Figure 2, the prototype of the integrated approach proposed at this stage is a living tool that can be further improved as blockchain technology is getting mature over the years to come, based on feedback from end-users as they domesticate and internalize the tool in their quest to adopt the technology and run experiments of blockchain-backed solutions in the international development space.

Figure 2: Integrated Approach to use Blockchain-enabled solutions as SDG accelerators



Source: Authors

6. Discussion and conclusions

Can blockchain be a game-changer as an SDG accelerator? Or is it a hype that is driven by high expectations for its applications? We argue that the power of blockchain can be effectively harnessed to deliver significant progress towards achieving the SDGs. Nevertheless, we also argue that there are limitations to what can be done, hence the need to nuance that development professionals cannot solve all the issues around the SDGs with blockchain, and that implementation choices to design and implement blockchain-enabled solutions should be rigorously justified to demonstrate a tangible added-value compared to other alternative solutions which might be less costly and less technical.

While we recognize the limitations in developing the Blockchain SDG Acceleration Scorecard and the Integrated Approach to use blockchain enable solutions as SDG accelerators, these are meant to be minimally viable products and serve as living tools making room for further improvements and finetuning as the technology is getting mature and lessons learned from various experiments widely shared across the international development space.

“Don’t over-hype” and “don’t over-promise”, remains indeed a key message for individuals and organizations experimenting blockchain-powered solutions in international development. We believe this work offers good food for thought to further stimulate the discussions within the research community but also among innovation and development practitioners working at the frontlines to raise the double challenge of adapting to the new normal post-Covid19 and meeting the SDG targets by 2030.

References

- Apoinde, C., & Fishbane, L. (2018). *The blockchain ethical design framework*. Beeck Center for Social Impact +Innovation - Georgetown University. Retrieved from https://www.mitpressjournals.org/doi/pdf/10.1162/inov_a_00275
- Bellamy, J.-J., & Hill, K. (2010). *Monitoring Guidelines of Capacity Development in Global Environment Facility Projects*. Global Support Programme, Bureau for Development Policy, United Nations Development Programme. Retrieved from https://www.thegef.org/sites/default/files/publications/Monitoring_Guidelines_Report-final.pdf
- CBD. (2018). *Overview of Access and Benefit-sharing capacity-building tools and resources*. Convention on Biological Diversity. Retrieved from <https://www.cbd.int/doc/c/99fa/59d2/f895959bebd76275b1fbf283/abs-cbiac-2018-01-02-add2-en.pdf>
- CBECI. (2019). *Cambridge Bitcoin Electricity Consumption Index*. Retrieved October 3, 2019, from <https://www.cbeci.org/>
- Dam, R., & Siang, T. (2019). *5 Stages in the Design Thinking Process*. Retrieved from The Interaction Design Foundation: <https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process>
- DeCleene, J. (2018, 5 30). *How Blockchain-as-a-Service (Baas) Platforms are Speeding up Blockchain Adoption*. Retrieved from Data Driven Investor: <https://www.datadriveninvestor.com/2018/02/17/how-blockchain-as-a-service-baas-platforms-are-speeding-up-blockchain-adoption/#>
- Fridgen, G., Guggenmos, F., Lockl, J., Rieger, A., Schweizer, A., & Urbach, N. (2018). *Developing an Evaluation Framework for Blockchain in the Public Sector: The Example of the German Asylum Process*. Amsterdam: Proceedings of the 1st ERCIM Blockchain Workshop 2018, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591). Retrieved 5 30, 2020, from <https://www.fim-rc.de/Paperbibliothek/Veroeffentlich/756/wi-756.pdf>
- Fridgen, G., Lockl, J., Radszuwill, S., Schweizer, A., & Urbach, N. (2018). *A Solution in Search of a Problem: A Method for the Development of Blockchain Use*. 24th Americas Conference on Information Systems (AMCIS).
- Gartner. (2018). *Digital Disruption Profile: Blockchain's Radical Promise Spans Business and Society*. Retrieved 2 29, 2020, from <https://www.gartner.com/en/doc/3855708-digital-disruption-profile-blockchains-radical-promise-spans-business-and-society>
- Houlding, D. (2019, January 18). *Blockchain: 6 Key Ethical Considerations*. Retrieved from Lifeboat: <https://lifeboat.com/blog/2019/01/blockchain-6-key-ethical-considerations>
- Jiang, L. (2018). *Breaking Blockchain — A Framework to Evaluate Blockchain Use Cases*. *hackernoon.com*. Retrieved from *hackernoon.com*: <https://hackernoon.com/blockchain-a-framework-to-evaluate-blockchain-use-cases-9efbc30a3fa7>
- Jiang, L. (2018, December 13). *The Age of Trust — the problem blockchain solves that others cannot*. Retrieved September 24, 2019, from <https://medium.com/swlh/the-age-of-trust-the-problem-blockchain-solves-that-others-cannot-6024ebf47cad>
- Leverington, F., Hockings, M., Lemos, K., Courrau, J., & Pavese, H. (2008). *Management effectiveness evaluation in protected areas, a global study, overview of approaches and methodologies, Supplementary report no.1*. The University of Queensland, Gatton; TNC, WWF, IUCN-WCPA.
- Longstaff, S. (2019, March 16). *Blockchain: Some ethical considerations*. Retrieved from The Ethics Center: <https://ethics.org.au/blockchain-some-considerations/>
- Mckinsey. (2018, June). *Blockchain beyond the hype: What is the strategic business value?* Retrieved September 24, 2019, from <https://www.mckinsey.com/business->

- functions/digital-mckinsey/our-insights/blockchain-beyond-the-hype-what-is-the-strategic-business-value#
- OECD. (1991). *DAC principles for evaluation of development assistance*. Organisation for Economic Co-operation and Development. Retrieved from <https://www.oecd.org/dac/evaluation/2755284.pdf>
- Panetta, K. (2016, October 11). *Blockchain Combines Innovation with Risk*. Retrieved from Gartner: <https://www.gartner.com/smarterwithgartner/blockchain-combines-innovation-with-risk/>
- Pasanen, T. (2018). *2018: time to update the DAC evaluation criteria?* Retrieved October 4, 2019, from <https://www.odi.org/blogs/10594-2018-time-update-dac-evaluation-criteria>
- Prosci. (2019). *What is the ADKAR Model?* Retrieved October 3, 2019, from <https://www.prosci.com/adkar/adkar-model>
- S. Kaplan, R., & Mikes, A. (2012, June). *Managing Risks: A New Framework*. Retrieved from Harvard Business Review: <https://hbr.org/2012/06/managing-risks-a-new-framework>
- Sin Kuang, L., Xiwei, X., Yin Kia, C., & Qinghua, L. (2017). *Evaluating Suitability of Applying Blockchain*. 2017 International Conference on Engineering of Complex Computer Systems. doi:10.1109/ICECCS.2017.26
- Smith, J. (2019, February 4). *Beyond Crypto—Blockchain Ethics*. Retrieved from Hackernoon: <https://hackernoon.com/beyond-crypto-blockchain-ethics-eabd8df6faf5>
- Staub, F., & Hatzios, M. (2004). *Score Card to Assess Progress in Achieving Management Effectiveness Goals for Marine Protected Areas. Revised version*. The World Bank.
- Talib Hussain, S., Shen, L., Akram, T., Jamal Haider, M., Hadi Hussain, S., & Ali, M. (2016). Kurt Lewin's change model: A critical review of the role of leadership and employee involvement in organizational change. *Journal of Innovation & Knowledge*. Retrieved from Study.com: <https://study.com/academy/lesson/lewins-3-stage-model-of-change-unfreezing-changing-refreezing.html>
- Tasca, P. (2017, March 3). *Managing Risk under the Blockchain Paradigm*. Retrieved from LinkedIn: <https://www.linkedin.com/pulse/managing-risk-under-blockchain-paradigm-paolo-tasca>
- Thivaivos, P. (2018). *Managing the risks of blockchain*. Retrieved October 1, 2019, from <https://knect365.com/riskminds/article/c515ed63-da12-4d4e-874a-eb83eefb3e66/managing-the-risks-of-blockchain>
- UNDP. (2017). *SDG Accelerator and Bottleneck Assessment*. Retrieved March 29, 2020, from https://www.undp.org/content/dam/undp/library/SDGs/English/SDG_Accelerator_and_Bottleneck_Assessment_Tool.pdf
- Vangala, N. (2018, June 27). *Evaluation Criteria for Blockchain*. Retrieved September 23, 2019, from Medium: <https://medium.com/nhct-nanohealth-care-token/evaluation-criteria-for-blockchain-e33a54b477aa>
- Wachal, M. (2019). *Factors to evaluate when using blockchain technology*. Retrieved from <http://scrypt.media/2019/08/08/factors-to-evaluate-when-using-blockchain-technology/>
- WEF. (2019). *Building Value with Blockchain Technology: How to Evaluate Blockchain's Benefits*. World Economic Forum.