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Green Sustainable Entrepreneurship Based on Blockchain Financial Practices

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

Today, the state-of-the-art research in entrepreneurship involves the application of both the disrupting distributed ledger technology and the innovative Blockchain data structure to finance, economy and management disciplines (i.e. corporate finance, peer-to-peer management, digital marketing, etc.). Despite the well known recognition of the importance and the role of the peer-to-peer computing in the development of entrepreneurial financial strategies, as well as distributed firms and decentralised companies, there have been just a few attempts to apply distributed Blockchain methodology to financial practices and a number of hot-red issues have arisen in this field. The purpose of this article is to indicate opportunities for useful applications in the developing field of green sustainable entrepreneurship research. Hence, this article introduces, describes, evaluates, and documents new sustainable Blockchain functionalities and corporate finance practices for green entrepreneurship.

Keywords: Entrepreneurship; DLT technology; Blockchain data structure; corporate finance.

1. INTRODUCTION

Don Tapscott -a Canadian businessman, engineer, executive, author, consultant and speaker, specialised in the technology and business domain (Finance & Technology; FinTech)- introduced the phrase, "*the digital economy*" within his famous book about digital

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thinking in 1994 [1]. Actually, in this book, he discussed how the World Wide Web (Web) and the *Internet of Information* should bring important changes in business, economy, and society. Obviously, today, the *Internet of Value* (i.e. synchronised applications based on the Distributed Ledger Technology (DLT); and the Blockchain data structure) creates new opportunities and new functionalities in financial practices. In 2017, Don and Alex Tapscott launched the "Blockchain Research Institute" (BRI) to document and to help the people realise the new promise of the so-called "*digital economy*". Actually, in BRI they research the functionalities and the strategic implications of DLT/Blockchain technology and produce practical insights to contribute global DLT knowledge and help BRI members share and explore this revolution [2]. The findings, test results, feed-backs, conclusions, and recommendations are all initially proprietary to BRI members and ultimately released to the public in support of a mission (www.blockchainresearchinstitute.org) [1,2].

Tom Baumann, in his book entitled: "*Blockchain for Planetary Stewardship: Using the Disruptive Force of Distributed Ledger Technology to Fight Climate Disruption*" and foreword by Don Tapscott (BRI) on January 30th 2018, develops a new technology and innovative business models dealing with environmental consequences of the hot-red ICT technologies (i.e. DLT/Blockchain) on the planet Earth [3]. Following are some key-points introduced and discussed in this excellent book:

- It is really very important to know that, the Earth's surface temperature (in average) has risen about 1.1°C since the end of the 1st Industrial Revolution (in the early to mid of 1800s), which introduced the use of: (a) materials (such as iron and steel); (b) energy sources (such as coal); (c) machines (such as the power loom); (d) factories as a means of organising labor; (e) steam locomotives as transportation; and (f) the release of human-generated CO_2 [4,5].
- The upper levels (layers) of Earth oceans are really taking a hit. Their acidity has increased approximately 30 percent since the 1st Industrial Revolution. As a result, the amount of CO_2 they absorb is increasing by some two billion tons per year [6,7,8].
- The DLT technologies / Blockchain data structures [9,10,11,12,13].
- A number of sustainable financial good practices [14,15,16,17,18,19,20,21].
- In the Northern Hemisphere, snow is melting a bit earlier, and spring snow cover has dramatically decreased over the last fifty years. From Africa to Alaska, glaciers are shrinking—in the Andean mountains, the Alps (an extensive mountain range system in Europe), the Himalayas, and the Rockies as well [22,23].
- In the last century, the global sea level has risen by 24 centimeters. Also, in the last twenty years, the rate of change has nearly doubled [24].
- The mass of Antarctic and Greenlandic ice sheets has decreased at a minimum rate of 36 cubic miles per year. Also, the mass of the Arctic sea ice has declined rapidly and dramatically [25].
- Since 1950, the number of record high temperatures and intense rainfall events has been increasing in the United States by 23%, whereas the number of record low temperature events has been decreasing by 17% [26].

The BRI research project (Tom Baumann) explains what the community is doing to improve this situation, such as for instance the developing of less computationally demanding algorithms and applications, encouraging of digital outputs, promoting distance learning and home-working, etc. According to recent estimations DLT/Blockchain applications should require more energy in 2020 than is currently available [25,26]. Jonathan Koomey, an expert in studying the energy usage of ICT (Information and Communication Technologies), told CNBC that the Blockchain data structure "*is a tiny, tiny part of all data center electricity use*". MIT's professor and top researcher Christian Catalini questioned whether anybody could "*make a credible claim without actually having data from the miners*". Also, Mr. Catalini told to "The Independent" newspaper that "*different miners will have different cost structures depending on how advanced their hardware is*" and where they are located [27].

Obviously, apart from this sizeable, quantity and quality problem, technological state-of-the-art innovation can help to guide stakeholders at a larger scale to address global crises. In this domain, obviously, there is a need first to understand the sign, the size, and the magnitude

of the challenge and then to approach and addressing it. This article outlays the principal goals, key functionalities and main difficulties of using DLT/Blockchain to address climate change on building sustainable financial practices (i.e. a Blockchain green Entrepreneurship) [27]. In this way a number of start-ups should support the issue for deploying DLT/Blockchain functionalities; firstly to approach and control this experiential and empirical threat; and following to improve the financial markets integrity (i.e. smart money, digital money, e-economy, crypto-currency, Initial Public Offers (IPOs), securities/ equities, stock and commodities markets, etc.); as well as to mobilise, describe, document and monitor the huge resources required to preserve the planet Earth (climate change) [28-33].

2. BLOCKCHAIN SUSTAINABILITY

People in general, on talking about "sustainability" they are usually mean "environmental sustainability" only. However, sustainability researchers, academicians and activists have a much broader definition: sustainability is simply defined as "*meeting the needs of the present without compromising the ability of future generations to meet their needs*". This is a appealing definition and therefore the "devil" is in the details. For instance it is rather hard to know the needs of the future generations, as we often battle to understand even our own today's needs. What is quite clear by now is that such an approach, aiming at a good livelihood for all, has to consider both, the natural as well as the human systems; and then to think them together. Today we still attempt to meet even the basic needs and hopes of many people of our current generations. To help tackle this global challenges the United Nations (UN) have defined the seventeen (17) Sustainable Development Goals (SDGs) with the objective to produce a set of universal targets that meet the critical environmental, political, social, and economic challenges and opportunities facing our world [34-37].

These goals are broadly defined, very often interdependent, and include 169 sub-targets. The SDGs cover environmental, social and economic development issues including poverty, health, education, global warming, hunger, gender equality, water, urbanisation, sanitation, energy, nature conservation protection environment and social justice. The SDGs provide a common and agreed framework to address our most pressing sustainability issues. To reach these goals it will not only be necessary to work together across sectors, industries, countries and communities but also to find new alternative ways of how to educate our societies and organise their economies. For this "global transformation" towards sustainability DLT/Blockchain based applications could be an important enabling technology. The current article, in following Sections 3 and 4, will demonstrate Blockchains potential to contribute to the SDGs targets [34,35,37].

2.1 Blockchain Functionalities for a Sustainable World

DLT/Blockchain based applications for financial practices could provide many opportunities to help scientists to develop a more sustainable world. These applications should provide more transparency about individual and collective action, as well as reliable provenance within global supply chains; strengthen accountability loops and reduce bureaucracy and power asymmetries enabling new types of applications; and incentivise environmental friendly behaviour with purpose driven tokens (i.e. programming a sustainable world tokens).

But isn't Blockchain un-sustainable in financial practices? Widespread media coverage about mining aspects of cryptocurrency-industry used as a global means of payment (Bitcoin, Ethereum, Litecoin, etc.) and other Blockchains applications and digital assets, very often focus on the energy inefficiency of this technology. While this peer-to-peer (P2P) technology is in fact an energy intense one open source software project, most media coverage fails to compare the CO_2 footprint of P2P transactions with the CO_2 footprint of state-of-the-art non-Blockchain solutions (like for instance traditional "bank transactions"); and also forget to mention that the crypto community is fact working on solutions to this problem based on open source protocols and spinoffs [35, 36].

2.2 Blockchain & Transparency

Obviously, today, the lack of transparency along the global supply chains, create many opportunities and challenges for fraud, black-market functionalities, pollution, human rights abuses and other inefficiencies. Therefore, any sustainable behaviour of individuals and firms is therefore currently hard to track and usually it is

not rewarded. In this context Blockchain has the potential to provide conflict-free unmatched and unrivalled levels of transparency, with a shared, synchronised and decentralised database, where fixed, unchangeable and encrypted copies of the information stored on every computer (node) in the P2P network as blocks connected with pointers (i.e. in a block-chain order). This enables otherwise trust-less parties, such as individuals and companies that do not know each other, to engage in near friction free P2P transactions.

Blockchains can therefore serve as a transparent ledger (register) that everyone can inspect (i.e. referred to as public/permission-less Blockchains) or a limited group of people can inspect (i.e. private federated Blockchains, also known as DLT). This type of transparency has many excellent applications along the supply chain of services and technology and in institutional settings for less corruption and more accountability in financial practices worldwide [35, 37].

3. BUILDING SUSTAINABLE FINANCIAL PRACTICES

3.1 Blockchain Entrepreneurship - Application Case I (Supply Chains)

In corporate finance supply chains represent a complex network of distant, separate entities that exchange goods, services, documents, payments, data, and information across a dynamic business landscape. Obviously the sustainability of this architecture is strictly related to the underlying data structure and therefore a state-of-the-art supply chain network should be use the Blockchain data structure. Therefore Blockchain based solutions could help managers to trace the provenance of foods, goods and services along the supply chain, to unambiguously identify a product's input materials, including the material's quantity, quality and origin. The Blockchain protocol, as a decentralised network with distributed and transparent data structures, allows a disparate group of network actors to exchange data relatively seamlessly from anywhere in the world, replacing traditional centralised data structures (client server architecture, multiple document copies, data inconsistencies, or in many cases still paper copies) with a distributed ledger, in almost real time, so that auditing can be automated [36, 37].

3.1.1 Origin of Food and Services

When foods, for instance, reach their final destinations, most buyers and sellers do not know the true origins of the manufactured products including the ingredients. Transparent Blockchain-based supply chain approaches have the potential to provide consumers and other supply-chain participants with higher standards of responsibility and sustainability in sourcing and production. These standards include transparency of environmental impact (such as, for instance, diesel pollution of trucks at shipping ports); food origins and derivation; goods production type and ingredients; plants growing environment; animals treated conditions; fishing utilities (e.g. false fishing equipment leaving seal life trapped or illegal fishing equipment causing a decrease in a population of a species) [37].

3.1.2 Price Transparency & Inefficient Document Handling Systems

Lack of transparency, as well as costs imposed by some unscrupulous intermediaries, prevents many end users from knowing who earns what along the supply chain of goods and services they consume or what the working conditions along the supply chain are. Blockchain base solutions have the potential to provide us with greater accountability and responsibility around human rights, eg. monitoring factory working conditions for modern day slavery, child labour, employees being exposed to toxins, or revealing if farmers receive fair prices for the value they created. Such solutions would however include a combination of Blockchain, Artificial Intelligence (AI) and Internet of Things (IoT), to provide full transparency over what happens along the global supply chain [37]. Inefficient document handling systems along the supply chain provide a toll on company profits. Maintaining bureaucratic paper trails required to manage modern supply chains are costly and inefficient. Supply chain startups and established industry players are beginning to utilise Blockchain to optimise their value chains, improve inefficiencies and free up working capital, and make goods and services more accessible [35,36,37].

3.2 Blockchain Entrepreneurship - Application Case II (Institutional Weakness)

Blockchain and similar distributed ledger technologies have the potential to mitigate

institutional weaknesses though transparency of processes, restricting deception, corruption and uncertainties [36,37].

3.2.1 Traceability of Donations & State Corruption

Blockchain provide near real time transparency of what happened to the money that has been donated to charity organisations, supporting civil society accountability by tracking funds and ensuring they support the cause of the donation, tackling bureaucracy and corruption, and releasing funds where needed without sophisticated banking infrastructure. Examples: Giveth (a community of developers; building the future of "Giving" -#blockchainforgood. https://giveth.io/), Alice (an innovative Blockchain based distributed programming environment that makes it easy to create animations), and Aidcoin (it is actually a "token" for charitable giving. It has been built on the Ethereum Blockchain and is empowered by CharityStars). Blockchains can provide near real time transparency of what happened to tax-payers money and international loans, and how the funds have been reallocated, preventing corruption and tackling public mismanagement. By providing an unprecedented level of security of the information and the integrity of records it manages, guaranteeing their authenticity Blockchain based applications can eliminate opportunities for falsification and the risks associated with having a single point of failure in the management of data and funds. It can also help overcome data silos in traditional bureaucracies in which public entities are reluctant to share information among them-selves. Blockchain is particularly suited to fight corruption in the registry of assets and the tracking of transactions such as procurement processes. It eliminates the need for intermediaries, cutting red-tape and reducing discretionality and strengthen public integrity.

3.2.2 Reduction of Bureaucracy & Transaction Costs

Blockchain based machine consensus and smart contracts have the potential to reduce transaction costs and bureaucracy in many industries and across jurisdictional borders, introducing many new use cases in governance, government and impact assessment especially across jurisdictional boundaries; in inclusion of the underbanked and undocumented of the world; and in disintermediation (making some clearing institutions or governmental institutions obsolete thereby reducing power asymmetries).

3.2.3 Case Study 1: Governance, Government & Impact Assessment

Blockchain based applications can provide solutions that contribute to (a) CO_2 emission reduction, lean & transparent government, (b) impact assessment & governance tool.

(a) CO_2 Emission Reduction – Lean & Transparent Government

CO_2 emission reduction could be achieved as a result of DLT/Blockchain based state-of-the-art e-government solutions. This would reduce the necessity of physical commute to a government office (i.e.: to pick up a new driver's license, apply for tax number, register a car, etc.) and therefore reduce the fuel emission. DLT technology and Blockchain data structures reduce cost of bureaucracy through more efficient e-government tools saving in this way tax-payers money.

(b) Impact Assessment & global Governance Tool

Blockchain are especially useful for cross jurisdictional governance where cost effective, transparent and auditing measures can be implemented into the protocol, making monitoring and enforcement of all sustainability goals easier. All our daily transaction leave a carbon footprint—whether it is obvious, such as filling up our cars with petrol or booking a long-haul flight, or subtle, like when we buy a coffee or a new pair of shoes, or increase our cloud storage plan. Unfortunately, until now, monitoring and reducing our impact on the planet has been difficult, mostly because access to data is limited. Combining DLT/Blockchain with Artificial Intelligence (AI) and Internet of Things (IOT) will allow us to draw better data for impact assessment and evaluation and make collective sustainability behaviour across groups and geographic boundaries more transparent. In combination with AI (software oracles) and IoT (hardware oracles) the fulfillment monitoring of sustainable action could be verified in an objective and decentralised manner. Blockchain based solutions could, for example, provide more transparency regarding the actions of governments (countries, cities or regions) do to reduce overall emissions.

Recording these actions on Blockchain would make international treaties much more stringent, at lower transaction costs than today. Impact assessment would be easier to track leading to quicker results and feedback loops. Possible Solutions: Ocean Protocol, IXO. In a world where carbon emissions and credits can be tracked transparently and reliably at low costs, at the point of sale, retailers will be able to sell a product and take into account the carbon impact it creates at the same time. Governments will be able to measure, track and trade emissions transparently, consumers will be able to understand the environmental impact of the products they are buying, both positive and negative, and will be able to mitigate this in an instant, with millions of micro-transactions scaling up to make a huge collective impact.

3.2.4 Case Study 2: Inclusion of Undocumented & Underbanked Population

Depending on the type of estimation, more than one to two billion people worldwide are unable to prove their identity to the satisfaction of authorities and other organisations often excluding them from property ownership, free movement, and social protection as a result. Additionally, any Lack of identity prevents credits, loans and thus prevents entrepreneurship.

3.2.5 Lack of Identification and Documentation – Banking Services

Millions of refugees trying to relocate around the world can't be identified, a disproportionate amount of them being women and girls, who struggle to obtain IDs, often the result of barriers related to freedom of travel, distance, financial costs, time constraints, illiteracy, lack of information and awareness, and lack of support from family members. Blockchain can allow for complementary decentralised and self sovereign identity solutions. While the number of unbanked individuals is decreasing, there are still 2.3 billion people on the planet without access to traditional banking services. These under-banked people have to rely on alternative financial services like payday loans, pawnbrokers, and loan sharks, that are often highly unregulated and can be exploitative and even downright criminal. Blockchain with its P2P nature removes the need for verification from costly intermediaries such as banks or other institutions. The World Food Programme (WFP) is trialing Blockchain as a means of making cash transfers to the under-banked more efficient, transparent and secure, through vouchers or pre-paid debit cards, allow people to purchase their own food locally and are an effective way to empower them to make their own purchasing decisions to relieve hunger. Cash transfers are an increasingly important means of providing assistance for example to refugee camps. The WFP therefore aims to reduce payment costs associated with cash transfers, better protect beneficiary data, control financial risks, and set up assistance operations more rapidly in the wake of emergencies [33,34,37].

3.3 Blockchain Entrepreneurship - Application Case III (Disintermediation & Power Asymmetries)

Blockchain-based applications are also seen as a development vehicle which can help to empower people directly and mitigate power and information asymmetries, replacing certain aspects of clearing institutions or governmental institutions with smart contracts. One example could be applied in the renewable energy sector: Once on the grid, renewable electricity is indistinguishable from electricity from conventional sources. Existing mechanisms, such as renewables certificates and e-documents that are traded between parties, needlessly take up time, energy and resources. These certificates could be replaced by a system that monitors renewable electricity generated onsite, feeding data into a Blockchain. This would result in the automatic creation and distribution of certificates. Furthermore, the prevalence of smart meters and other IoT devices, could enable P2P energy trading, where owners of distributed grids efficiently and legitimately sell excess power to anyone within an open market [32,37].

4. BLOCKCHAIN ENTREPRENEURSHIP

It's become impossible to ignore cryptocurrency and Blockchain -- it's everywhere, and there is no sign of slowing down. As a result, Blockchain-based exchanges of information and tokens are releasing a wave of new possibilities for entrepreneurs. The rush to create innovative business solutions that are faster, more secure and more transparent is on. Blockchain is already contributing to real-world improvements in the world of entrepreneurship. In following sub-Sections six (6) good-practice examples are presented.

4.1 Increasing Access to Entrepreneurship Education

People of all ages and from all walks of life are becoming increasingly interested in entrepreneurship, and many simply don't have the time or resources to seek further education from formal institutions. Someone with a “10-to-6” job trying to launch his or her own business likely doesn't have time to enroll in an MBA program. While formal education isn't a requirement, many new entrepreneurs seek flexible, reliable and affordable educational options to help them develop the skills needed to launch their businesses. The “Success Life” company is using Blockchain tokens to offer video content, digital courses and personal coaching to aspiring entrepreneurs, covering topics such as management and investment techniques. The token's immutable ledger and automatic smart contracts render the transactions that provide these educational opportunities reliable and cost-effective. Entrepreneurs only need an internet connection to access the educational content [34,37].

4.2 Unlocking Crowd Funding Opportunities

One of Blockchain's most newsworthy contributions to entrepreneurship is its effect on crowdfunding campaigns. In fact, Blockchain startups raised $7.2 billion in funds in 2017-2018, mostly driven by community campaigns. This Blockchain-based fundraising model has proven so successful that it's attracting plenty of mainstream investment. Despite the success of Blockchain-centric crowd funding campaigns, the traditional crowd funding market is still extremely inefficient. Only 1.9 percent of campaign funds go to developing countries and 81 percent of campaigns fail to reach their targets. The lack of accessibility has led some innovative companies to combine Blockchain with traditional crowd funding to give power back to entrepreneurs around the globe. “Acorn Collective” is a company providing a second-generation open marketplace for new ventures seeking crowd funding. Any legal new project whose founder passes primary screening can make a pitch on the Acorn platform. Blockchain makes the process transparent, safe and accessible from any region. On the platform, a crowd funding engine helps entrepreneurs drum up marketing support, maximising the chance of a successful project [33,37].

4.3 Providing User-Friendly Financial Tools

More new ventures are using crypto-currencies in addition to fiat currencies in order to manage their financing, whether that takes the shape of a token sale or an entrepreneur raising funds through adroit trading on crypto exchanges. Managing multiple fiat and crypto accounts, however, has always been a complicated task. “Zerta” is a next-generation trading platform built by a leading team of exchange technologists and entrepreneurs. The platform connects an exchange, a crypto and fiat wallet, and a bank in a single ecosystem. "*We are taking the crypto-trading market up to the level of traditional markets and stock exchanges*" says Paruyr Shahbazyan, co-founder of Zerta. As this crypto adoption becomes more prevalent, it is important to focus on education and ease of use, especially within financial services. For Zerta, this means personalisation and customisable interfaces to help users of all experience levels trade, send and receive payments and engage with a community of like-minded people. User-friendliness is the focus [31,37].

4.4 Cultivating New Investment Opportunities

Entrepreneurs across every industry are constantly looking for new ways to diversify their investments, and the introduction of coin-based transactions is opening up new possibilities. For example, “Muir-field” has decades of experience facilitating private equity investment opportunities. Now, as Blockchain becomes increasingly common across industries, Muir-field IP is rumored to be launching its own Tokenized Asset Offering (TAO) in 2018. Not only do token-based opportunities open up the doors for new entrepreneurs to purchase assets, facilitating a TAO also ensures that the laws and regulations regarding security tokens are strictly followed [30,37].

4.5 Developing Customer-Loyalty Platforms

Customer loyalty is essential for all businesses. To nurture business-customer relationships, many entrepreneurs try to create customer-loyalty problems. Such programs, however, can require more technological headaches and bookkeeping hurdles, creating one more data field for entrepreneurs to track and manage.

Blockchain is an ideal tool for helping entrepreneurs rewarding repeat customers with special incentives; develop low-stress customer-loyalty programmes; and fostering synchronisation and close relationships. Blockchain's automatable transaction ledger can keep track of customer interactions and adjust customers' loyalty status appropriately. “Block-point”, for example, allows users to quickly set up Blockchain-based loyalty programs to integrate with their existing businesses [30,37].

4.6 Creating Reliable Agreements

Entrepreneurs thrive in a network of mutually supportive relationships that allow them to launch their ventures. Many of these relationships (such as between investors and founders), take the form of official or unofficial contractual agreements. When these agreements fall through, entrepreneurs struggle. A product launch, for example, could be ruined if a deal with a manufacturer collapses. Blockchain signatures and smart contracts provide effective, affordable options for entrepreneurs seeking reliable legal contracts. Companies such as “DocTailor” offer tools for users to build and customise legal agreements and smart contracts on the Blockchain. Tennessee recently made smart contracts legally binding in the state, and other locales seeking to nurture tech innovation are likely to soon follow their lead [29,31,36,37].

5. RESULTS AND DISCUSSION

Bitcoin and the token governance rules specified in the Bitcoin Blockchain protocol have introduced a new form of value creation, where a network of actors agree on a specific goal (in the case of Bitcoin it is fault tolerant P2P money remittance without banks), and value is created when someone proves that they have contributed to a previously defined collective goal (in the case of Bitcoin this would be “proof of work” and the subsequent block reward, also called Bitcoin mining). Bitcoin has inadvertently introduced a new form of collective value creation without traditional intermediaries, that provides an alternative to conventional economic system, that only incentivised individual value creation, allowing private actors to extract raw materials from nature, transforms these into products, and in the end, disposes these products in nature, externalising costs to society, while internalising (and maximising) private profits. Cryptographic tokens issued by a smart contracts on the Ethereum Blockchain (or other similar Blockchains) can now be used to incentivise individuals and corporations to act in a sustainable manner. Such incentives motivate behaviour and can be a key to reaching a sustainable future and tokens can be used as a representation of the rewards collected [37].

Rewards can be fungible (tradeable for other cryptocurrencies) or non fungible (identity based reputation tokens). In some cases fungibility can be limited, representing a value that can only be exchanged for products and services within the community, therefore never leaving the internal system and being exchanged for fiat money, but being useful in the internal community. The “monetary policy” and other token governance rules can be simply embedded thus regulated by a smart contract on the Ethereum or similar Blockchains to fulfill the goals of the community and to incentivise and encourage behaviour with purpose-driven tokens.

Example of such purpose-driven tokens include:

- Proof of sustainable holidays staying in environmental friendly hotels using blockchain based solutions to track sustainability of holiday service provider.
- Proof of CO_2 emission reduction by riding a bike, walking, public transportation instead of using a car (examples currently include solar coin, recycle-to-coin, electric chain, sun exchange).
- Proof of energy consumption reduction. Blockchain-based rewards system incentivising users with a with token every time they prove that they have used less energy by using energy efficient devices, turning the lights off, etc. Users basically earn money for reducing their carbon footprint (examples: energi mine, eco coin, electron).
- Proof of tree planted, recycling, etc. Proof of undertaking actions to help natural resources like for example planting trees, cleaning a beach, reduction of food waste, recycling of goods (examples: plastic bank, earth dollar, earth token, bit seeds, etc.).

6. SUMMARY ISSUES AND RECOMMENDATIONS

Reversing Climate Change is really a Mars Shot: Solving the climate challenge is akin to collaborating globally to put people on Mars, and the underlying tools (e.g., MRV standards) to

support the new climate governance system being developed are a fragmented foundation and insufficient for the needs of investors and markets, as well as the needs of the fast-moving digital innovations.

Implementation & Coordination at all levels is needed: The Paris Agreement was a major milestone for international cooperation. Since then, the parties (i.e. nation states) have been busy developing the "Paris Rulebook" to be ready for COP24 in December 2018, which elaborates on general implementation modalities and procedures. Sub-national actors (e.g., cities, provinces, corporations, and finance) need to adopt this rulebook and do their part. In principle, the distributed nature of Blockchain technologies pairs well with this bottom- up approach to implementation supported by the Paris Agreement.

Interoperability is a "key" Issue: Blockchain innovation for climate is flowering in a variety of ways (also refer to the accompanying landscape report), and trends appear to be toward more robust applications in terms of technology systems, business strategies, and partner ecosystems. However, coordination among applications is low. Interoperability among Blockchain applications is essential.

Finally, some state-of-the-art issues raised in DLT/Blockchain Entrepreneurship Research include:

- Can DLT/Blockchain make our food system more sustainable?
- How can Blockchain serve society?
- This new carbon currency could make us more climate friendly
- Should DLT/Blockchain be the key to a Sustainable Energy Future?
- Even though Bitcoin wastes power, can Blockchain be sustainable?
- How the DLT/Blockchain could transform sustainability reporting?
- Can DLT/Blockchain help us to solve climate change?

7. CONCLUSION

DLT, Blockchains and token inventive mechanisms have a great potential to facilitate a more sustainable world. However, change does not happen by itself. Technology is just a tool, not a silver bullet. It will not magically protect forests, reduce CO_2 emission or restore ocean health. Applied correctly, it can facilitate smart choices by producers and consumers, governments and corporations. However, the technology is still in its early stages, with many technological, legal and network effect challenges ahead. Furthermore, token engineering (the design of token governance rules) is a new domain. Most tokens today do not incentivise behaviour but represent assets. There is still little experience, expertise and tools for token design, we are in a state of trial and error, with very few best practices we can learn from. Tokenized initiatives need to be translated into everyday applicability for the improvement of local livelihoods. Incentive-structures need to take a range of different agents into account. Blockchain-based solutions also need to take ground-truths into account, including existing physical and social infrastructure.

Regarding the scope of the Blockchain initiatives assessed, the findings suggest about half are focused on multi-issue opportunities for sustainability. Just over a quarter are focused on clean energy, and the remainder focuses primarily on climate. Blockchain initiatives were identified as either networks (e.g. climate ledger initiative, recycle-to-coin, electric chain, sun exchange), representing about a quarter, or applications (e.g. climate coin, energi mine, eco coin, electron), representing about three-quarters. To date, few Blockchain applications are able to present compelling evidence of successful proofs of concept of the technology and business case. Although there continues to be very high levels of hype, and concerns about "fast buck" Blockchain applications that could lead to a crisis of confidence, the trend for new Blockchain applications shows greater sophistication in the design of the Blockchain business plans and more advanced partner ecosystems supporting ICOs. The expectation for 2019 is to see more applications emerge, with larger implementations, and even larger ICO funding. Furthermore, the growth of Blockchain networks to support a good foundation will enhance the chances of success of the Blockchain applications. In the case of climate and sustainability opportunities, as described in previous sections of this article, the uncertainty and complexity of policies and rules represent a major challenge. In most cases, there are limited links between Blockchain applications and GSNs to support the scalability and credibility of the Blockchain application within its market. This lack of sufficient coordination with governance systems to support Blockchain applications,

considered as a non-technical challenge, is a greater risk to success than are the technical challenges.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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