



Business Innovation Observatory



Blockchain applications & services

Case study 68

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Blockchain

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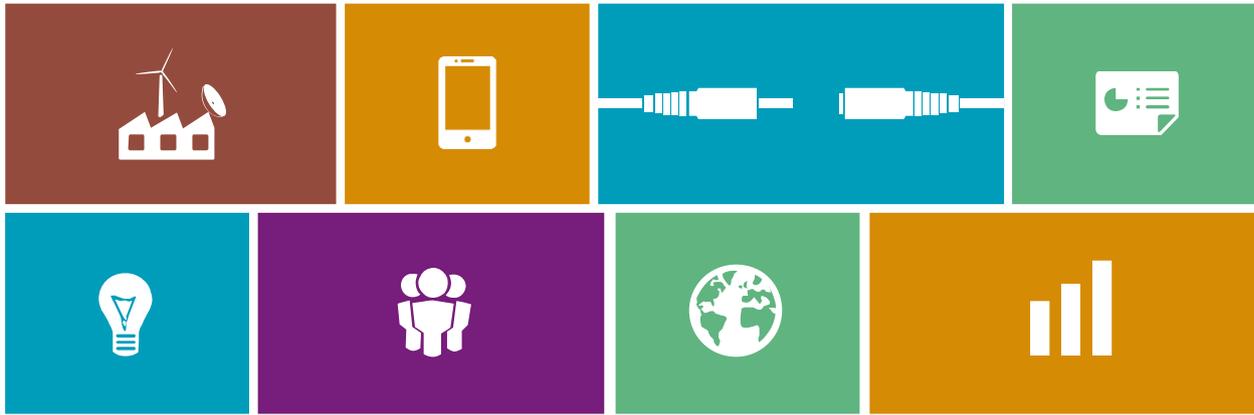
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1. Executive summary

The democratisation of high-speed internet access and the development of decentralised and distributed information exchanges and distributed models enabled the development of the blockchain technology.

The blockchain technology enables the maintenance of a permissionless distributed databases comprising a growing list of data records and preserves the **integrity, uniqueness, and validity of the stored information, without requiring any trusted third party** for verification purposes. These characteristics allow blockchain technology to transfer and store value in any intangible or tangible form in a rapid and secure manner limiting risks associated with fraud by reducing the role of trust in a transaction.

A blockchain is a public ledger (file for recording and totaling economic transactions) of all Bitcoin transactions ever executed. New blocks are added to it in a linear, chronological order. It enables the transfer of value in a digital form, without requiring a central authority or institution to verify and validate the transaction.

Over the last decade the Bitcoin public ledger became the most emblematic blockchain. Specific problems of cost and time efficiency in the financial industry and the recent interest and media hype boosted its development. Also the experience coming from nearly a decade of actual observation of advantages and disadvantages of Bitcoin public ledger helped in the development of blockchain applications, also in other sectors. New applications of the blockchain technology have been experimented and spread in domains such as health, insurance, accounting, or intellectual property management.

The industry of blockchain-based companies is still very young. Its future is currently being defined by R&D and

experimentation, partnerships between start-ups and large corporations, the development of standards, and advancements in regulatory frameworks. The main driver supporting the rise of blockchain applications is directly linked to cost and time efficiency, that in many industries are today far from being optimal.

Even though companies, customers, and governments slowly start to understand the potential benefits of this technology, its future is still not defined. Its development requires industry consolidation and community collaboration, which should lead to the establishment of standards and appropriate regulatory framework.

Moreover, development and commercialisation of blockchain applications poses difficulties for both developers and customers. On the demand side, business models associated to the transfer of benefits coming from goods and services have historically been the stronghold of the traditional banking institutions in the financial sector. Therefore lobbying pressures from established organisations may put the uptake process at risk, even though some institutions have recently started to gain interest and experiment with the technology. On the supply side, blockchain start-ups face uncertain regulation that limits their scope of action and imply a risk for their growth.

From a policy perspective, support for the development of the blockchain applications industry is important. Policy initiatives on a homogenous legislation across Member States can help ensure coordination and sustainability of the blockchain technological diffusion across different sectors of the EU economy. Moreover, support for community collaboration and networking could also be beneficial.



2. Blockchain applications and services

2.1. Trend presentation

Blockchain technology is based on cryptographic ledgers which are treated in a decentralised and distributed manner. These public and shared databases are maintained and verified amongst the actors participating in the system, ensuring digital transparency and confidence in the records of information blocks. In consequence, information exchanges made through blockchain based applications ensure, under some constraints (*e.g.* the information has to be 'licit' or compliant with norms and rules), **integrity and validity of the record, and do not require trusted third parties** for verification purposes.

This case study focuses on the potential applications of blockchain technology, in particular for the purpose of **implementing smart contracts**, by reflecting on current developments in the financial sector which is an early adopting industry. Blockchain technology applications across different verticals will help limit and/or redefine the role of intermediary stakeholders, and will provide **benefits to economic actors in the form of time optimisation and cost efficiency** in existing and/or new business models. **This technology has therefore has the potential to radically overhaul existing business models based on long chains of intermediaries** (*e.g.* platforms in the collaborative economy, middlemen in international trade, etc.).

Smart contracts are self-administered and enforced contracts built on the set of events and records fully detailed and stored in a blockchain ledger. They are defined as **sets of promises between contracting parties specified in a digital form**. Protocols and end-user applications formalise, store and secure the relationship between the parties over a public network.¹ Today, this definition translates into scripts embedded in distributed ledgers (the information contained in "blocks" are stored and seen by all actors within the system, meaning that no contracting party can deny or pull unilaterally from any promise made). The records stored in a distributed form allows mutually distrustful parties to transact safely². Agreements detailed in smart contracts are therefore verifiable reducing uncertainty and risk in automated transactions.

In consequence, when implemented through a distributed ledger, no central control is required to monitor these smart contracts since they reside within a validated and verified blockchain. Since smart contracts are deterministic, all possible outcomes of the contract need to be specified

beforehand, therefore reducing textual ambiguity and settlement costs.

As blockchain technology fulfils the function of enabling decentralised and verifiable exchanges, its rapid diffusion has been stimulated by its applications in the financial industry, specifically in the **identification and traceability of transactions** in cryptocurrency, which may be interpreted as a form of **complete digitisation** one of the simplest forms of contract: **value exchange**. As such, cryptocurrency trades are embedded in blockchains that contain a record of every transaction ever executed within the system, rendering information on the value exchanged and key identities involved verifiable and tamper-proof.

As the data exchange is decentralised and shared by all nodes within the network, the distributed approach to cryptographic validation of information blocks prevents duplicate exchanges (or transactions), and ensures ledger integrity. Given this specific decentralised, distributed and public validation approach, the implementation of a blockchain does not require a central authority or trusted third party to coordinate interactions between the actors within the system, regardless of the industry it is applied in.

Such **decentralised autonomous** business models are defined by self-governed programmes that may formalise multilateral interactions between parties through automated governance systems that facilitate collective decision-making. They will enable users to control the privacy inherent to their contracts through an encrypted and in a distributed approach rather than through a centralised or trusted third party. A shift in the digital paradigm is expected in to **redefine the role of cloud based computing** and business models transferring the identification, verification, and validation power from a hub towards an important number of nodes.

Today, due to the youth of this specific industry, it is mainly start-up businesses and in some cases business ventures between large financial institutions and SMEs who are redefining the roles of actors in the digital paradigm. Within the context of such a young industry, continuous work is currently carried out to develop and improve solutions to the validation issue raised by non-legal or non-compliant information with norms, regulations, and other conventions.

The applications of blockchain technology are far beyond virtual currency and the financial industry. This technology may disrupt exchanges in markets where centralised trusted third parties are needed to **prevent market failure and principal-agent problems by validating the existence**



of a trade, preventing duplicate transactions, settling disputes and acting as agents on behalf of individuals. The applications directly derived from this technology provide **solutions to reduce uncertainty and risk in situations**

where value and information need to be exchanged across space in a decentralised and autonomous manner, and where validation and verification in time are needed to record responsibilities and enforce liabilities of the parties involved in an exchange.

2.2. Overview of the companies

The present section provides an overview of innovative businesses who operate in the field of applications and solutions supported by blockchain technology. It is of vital importance for the comprehension of this case study to understand that **business applications of blockchain technology are currently limited to a handful of industries**. This observation is explained by the fact that we are at the genesis of successful business dynamics determining the diffusion process of the technology which

only started in the last 10 years. Applications in the financial industry at the forefront of the process; in consequence, **today, successful companies are mainly operating in the financial industry, compliance, and logistics**. In the short term, the diffusion of the blockchain technology will be transversal and suitable for a number of industries, such as health care and the internet of things, which have already begun adoption although successful businesses are currently rare or unwilling to communicate at their present stage.

Table 1: Overview of the company cases referred to in this case study

Company	Location	Business innovation	Signals of success
Blockchain.info	Luxembourg	Platform providing ease of access to information on transactions from the bitcoin blockchain	<ul style="list-style-type: none"> - Media coverage - Attraction of risk capital investments
ChainSmiths	Ireland	Consultancy providing technology, economic and regulatory advisory services to start-ups in the field of blockchain technology and applications	<ul style="list-style-type: none"> - Media coverage - Partnerships with large corporations - Organisation of collaboration events
Coinprism	Ireland	Platform providing tools to identify and track transactions in cryptocurrencies	<ul style="list-style-type: none"> - Media coverage - Launch of an open source permissioned ledger
COLU	Israel	The company is able to add metadata to the bitcoin blockchain and enables the transaction and its associated block in the chain it to be linked to an actual physical and/or digital asset	<ul style="list-style-type: none"> - Media coverage - Attraction of risk capital investments
Eris Industries	UK	Platform providing tools to produce blockchain applications	<ul style="list-style-type: none"> - Media coverage - Attraction of risk capital investments - Partnership with large corporations
Scorechain	Luxembourg	Platform providing analytical and monitoring tools for regulatory compliance of businesses using blockchain technology in the financial industry	<ul style="list-style-type: none"> - Media coverage - Attraction of risk capital investments
Skuchain	United States	The company applies blockchain technology to track the flow of goods through the supply chain. It allows trustable interactions between buyers and sellers in international trade.	<ul style="list-style-type: none"> - Media coverage - Pioneering collaborative commerce platforms applying blockchain technology - Attraction of risk capital investments

Problem 1 – Empowering individuals to use the public ledger

Innovative solution 1 – Providing wallet solutions to render the use and access to the bitcoin blockchain easy for any individual

Blockchain.info provides an opensource solution to empower people to use the bitcoin blockchain. People are enabled to manage their bitcoin transactions through the opensource software that provides a digital wallet. Additionally, Blockchain.info provides a developer platform that facilitates the development of applications for bitcoin transactions. In essence, the solutions provided by



Blockchain.info are intended to ease the use of bitcoin tools by a wide population.

Problem 2 – Identification, traceability and representation of underlying assets in a digital manner.

Innovative solution 2 – Linking physical and digital assets to the blockchain

COLU is an SME utilising blockchain technology to provide solutions in the field of asset transactions and record management. The innovative application adds metadata to the bitcoin blockchain and enables the transaction and its associated block in the chain to be linked to an actual physical and/or digital asset. The company is also currently active in the steering of the blockchain community to help accelerate the uptake process and trajectory of the technology and its various applications.

COLU also provides a platform that makes it easy for regular users to connect the public blockchain ledger and carry out transactions; it is a user friendly solution to issue and manage assets. The solutions COLU provides are intended for a generic utilisation of the technology, any individual or organisation may connect to the platform and manage real assets through proof and transfer of ownership embedded in the blockchain. As an illustration, such an application will be particularly beneficial for societies with low levels of bank account holders, where asset management (record, ownership, and transfer) may be easily performed directly between two individuals without bank accounts.

Coinprism is a company that provides services to access, track, and represent underlying assets in a digital manner allowing transparent trading relationships with reduced roles of third trustee parties. The principal market served by the company is the financial sector where substantial time and cost reductions can be made by implementing transactions using transparent and decentralised ledgers of information. The utilisation of this technology leads to time and cost optimisation achieved on reconciliation and reporting activities within the financial industry in which complex IT systems and heavy regulation account for large shares of spending and investment.

Problem 3 – Building, testing, and operating applications with a blockchain backend.

Innovative solution 3 – Developing distributed applications and smart contracts with a blockchain backend

Eris Industries is a platform for building, testing and operating distributed applications with blockchain backend (smart contracts). Historically, the founding project started as a way to experiment in the design and implementation of smart contracts, which then turned into a scalable business. Smart contracts are currently generic and applied across several vertical industries with the objective of automating

business processes and applications by cutting across the duties of general stakeholders. Eris has experienced demand from clients located mainly in the US and the EU. In the near future the natural development of the company will include an expansion in Asia and other global markets for business automated processes.

This is an ongoing process facilitated by the fast diffusion of applications in the financial sector, by the recent spur of innovative start-ups in the financial industry, and by the interest financial institutions have in these applications and start-ups. Accessing the market of smart contracts for the financial sector represents a challenge from the perspective of organisational change. In terms of internationalisation and networking events for market access, the industry size is still relatively small, which leads to the advantage of not requiring a strong marketing effort to continue on the scaling strategy. At the moment, only global financial institutions have expressed an interest in the technology, although Eris Industries' objective are to reach the market of regional ones.

Problem 4 – Providing professional services to blockchain start-ups

Innovative solution 4: Compliance services for financial institutions using blockchain technology

Scorechain is a blockchain technology company providing applications for financial institutions and any Bitcoin or digital assets/smart contracts users (either individuals or companies). Scorechain also provides analytical and monitoring tools to meet regulatory compliance requirements for smart contracts in a trusted based economy. The general vision is that subtracting third party trustees from current economic business models will relieve the third party from duty while preserving validation and verification of the contractual terms implying cost and time efficiency while preserving transparency operability. These applications may be developed not only for the financial industry, but also for any other industry where laws and technology are interrelated such as compliance, accounting, tax, or the Internet of Things (IoT).

Most of the companies currently active in the blockchain industry provide applications in the sector of money transfers which are based on tools to manage the information about a transaction. As such, today most of the industry revenues are drawn from services, although in the near future these will rather be drawn from the commercialisation of tools developed by platforms.

In consequence, blockchain technology is disrupting considerably the established business models in the banking and insurance industries. As a clear example of this situation, it may currently takes several days to move funds between different geographic zones even though these are only records within databases. The application of blockchain



technology can optimise the time and costs, associated to any transaction with rapid and verified movements of records up to 1 hour since it is easier to track transactions in a blockchain than across a myriad of intermediaries.

Similarly to the development of the internet, which enabled society to move information at high speeds across the globe, blockchain applications and smart contracts may enable our societies to move ownership at high speed across the globe. The challenges associated with this capability are therefore related with the management and tracking of digital IDs for verification and validity of transactions.

However, today many start-ups in the blockchain industry lack sufficient knowledge of regulatory frameworks that apply, potential partners for collaboration, and general knowledge of the industry. **Chainsmiths** is a consultancy firm providing professional services to start-ups utilising blockchain technology and selling blockchain applications. The company's innovation resides in its knowledge of the blockchain industry, its key players, and the evolving regulatory frameworks it is subject to. The company is able to help accelerate the organic growth of its clients by connecting the right people engaged to work on this field on both sides: those willing to finance projects, and those with blockchain related skills. The genesis of the company can therefore be attributed to the need of matching and closing the gap in the financial industry between established large institutions and blockchain start-ups providing appropriate applications.

3. Impact of the trend

3.1. Investing in the transformation of industries – The financial sector as an early adopter

Taking as example the financial sector, where blockchain technology has been actively developed during the recent years, developments in these digital technologies have set in motion a behavioural transformation in established financial institutions. New markets have been developed by firms that provide innovative services ranging from payments to local and international value transactions.³

Such developments have raised the interest of investors in such companies. As an illustration, the overall venture capital funding in the UK for fintech related business attained over EUR 465.3 million for the year 2014. This industry represented and estimated contribution of more than EUR 28.2 billion to the UK economy during that year, and comprises several fintech incubator initiatives.⁴

Problem 5 – Efficiency in international trade is undermined by non-optimal optimal procedures along the value chain

Innovative solution 5: Compliance services for financial institutions using blockchain technology

Skuchain is a company operating at the junction between the fields of payments, short term financing, and business operations and customer relationship management systems. Its purpose is to enable buyers and sellers to interact directly with each other with transparency, decreasing transaction costs and increasing in efficiency in international trade operations. Today, international trade is inefficient mainly due to burdensome procedures in payment methods such as documentary collections, letters of credit, and open account transactions that aim at ensuring that goods are shipped and paid in full and in time, and that risk is reduced to a minimum for all trading parties.

The company relies on its talents, highly skilled workforce balanced between cryptography and business development specialists who apply blockchain technology where no one else has yet developed solutions to decrease transaction costs and improve efficiency in international trade. The objective of the firm is to help otherwise mutually untruthful parties to accelerate international businesses and exchange of goods by giving full and continuous visibility to every step of the supply chain to reduce considerably the time required to proceed to payment, as opposed to those systems that immobilise value in time and has important transaction costs.

Member States such as the UK or Luxembourg have expressed their will to attract such start-ups by creating an appropriate eco-system that provides the right conditions and incentives for their growth.

Today, the demand for blockchain applications comes from the financial sector, specifically to solve issues within systems of accounting through fast record, identification, and track of transactions. Applications in the financial industry will lead to potential uses in securities, syndicated lending, trade finance, swaps derivatives etc. As an example, the report on 'fintech 2.0' published by Santander's fund InnoVenture⁵ states that distributed ledgers supporting **smart contracts could potentially reduce infrastructure costs of banks by between EUR 13.8 to 18.4 billion per annum** by 2022.

"New problems start to demand blockchain solutions such as the accounting system of loyalty points for airlines and virtual transactions in the gaming industry with implications in the real world" - Coinprism.



Blockchain applications in the field of leasing and asset financing could also reduce inefficiencies in the valuation of collateral by reducing the costs of obtaining detailed information on the assets. These inefficiencies were estimated at EUR 3.7 billion per annum in 2011.⁶

In addition to identity validation, investors have also given attention to innovation in alternative payments systems. Nearly EUR 4.6 billion have been invested in **cheaper, faster and more secure domestic and cross-border payment systems** utilising simple, secure, and instant blockchain technology. These innovations have a considerable potential of disruption in the field of international payments enabling faster, lower-cost, and transparent movements of value.

Even if most applications of blockchain technology are related today to the financial sector, several are being developed to respond to needs in different industries. The development of electronic public and distributed ledgers has the potential of keeping track of public registers and transactions. Blockchain technology has the potential enable applications that will allow to keep, identify, and trace exchanges and registers at minimum cost avoiding the potential risk of corruption and losses of information through time-stamped tamper-proof databases.

3.2. Reducing transactions costs and improving efficiency

Today, R&D and investments in the operationalisation of public, semi-public, and private distributed ledgers has increased the interest of large organisations in the cost-reduction potential of blockchain technology. In particular, private ledgers may provide individuals and companies with the ability to **speed up internal processes** of information manipulation, identification, exchange, and validation, therefore reducing costs and improving efficiency and effectiveness.

The need for vetted participants within an industry to vouch for the validity of information and any acts in legal affairs may be **optimised by embedding**

"The costs are optimised by the reduction of claims corresponding to the actual added value created by the application instead of heavy sunk fees associated to the fixed operations of intermediaries" - Scorechain.

the information in a blockchain; consequently, value will be created from the transformation of notary activities and its associated costs reductions and time efficiency. Private or semi-public blockchain models may need less security than other business models relying solely on third party trustees, and can

implement business rules to validate exchanges only if a number of participants in the network endorse them and/or if preceding exchanges have been completed first.⁷

Finally, blockchain applications may also help improve efficiency in organisational processes. To illustrate this, we take the example of the Nasdaq stock market which recently announced the launch of its blockchain enabled platform 'Nasdaq Linq'. The platform constitutes a digital ledger using blockchain to "facilitate the issuance, cataloguing and recording of transfers of shares of privately held companies on the Nasdaq private market".⁸ The purpose of this platform is to **improve efficiency in the management** of capitalisation stock plan administration by providing transparent comprehensive historical records on issuance and transfer of securities.

In essence, the application of blockchain technology across different industries will provide benefits in the form of cost effectiveness and time efficiency for any internal process inherent to industry operations. As efficiency is improved and transaction costs are reduced, vendor costs will start to decrease allowing space open to an increase of value up stream along the value chain in different industries. Such shift in value will enable new forms of collaborative commerce based on trust and transparency in economic exchanges paving the way for smaller and efficient organisations creating value up stream in the value chain.

3.3. Benefits of smart contracts for society – reducing fraud

Today, the success of a contractual relationship relies on the capacity of individuals, businesses and governments to **accurately identify and verify the characteristics of users who provide information.** Blockchain technology may therefore be applied to provide accurate identification of individuals through transparent registers by issuing secure and trusted digital credentials through distributed ledgers, hence **improving management of risk-of-fraud.** Examples of potential benefits from this utilisation of the technology include actions taken by governments (e.g. Greece and Honduras) to build transparent and efficient systems for land registries.⁹ Additional illustrations include several banks in the UK (e.g. Lloyds) that are exploring the possibility of providing and verifying digital identity services.¹⁰

The application of blockchain technology for identification, verification and validation purposes may also allow an optimal identification of goods and the traceability of their associated transactions. Such blockchain-based applications may allow society to have transparent and accurate knowledge about the series of exchanges undergone by a product. As an illustration of the benefits such applications may provide, **industrial scandals in the food and agro industry may be limited** given the capacity of the technology to provide non-tampered information on the past exchanges. The industry of luxury goods and/or works of art may also benefit from such applications, which can **help**



limit the access of counterfeit goods to the market through an optimal identification and traceability of goods.

In conclusion, the uptake of blockchain applications will enable society to improve the management of official records, reduce fraud, and limit risks.

3.4. One step closer to a fully operational internet of things

With the uptake of the IoT, valid and verifiable information exchanges among devices will be vital for an IoT-based economy. These exchanges may be performed either through large centralised data centres, or through distributed peer-to-peer computing (blockchain based model). Between these two models, the latter will likely improve cost effectiveness associated with the operability of an IoT network.

Adopting a decentralised model for IoT communications and transactions will depend on the **capacity of the network to prevent trust issues** stemming from central trusted third parties and single points of failure.

Blockchain technology may provide the solutions for the development of applications that will serve as tools to ensure trustless¹ and valid network environments for the IoT. It will ensure that that exchanged information, file storage and other transactions among devices are carried out in a reliable and transparent manner.

According to the IBM's 2015 report on the future of the IoT¹¹, IoT blockchain applications will be able to support trustless peer-to-peer messaging, secure distributed data sharing, and coordinate large numbers of devices.

These applications will innovate the current models of peer-to-peer computing by improving the **capacity to transfer and store information in a trustless environment** benefiting from mechanisms of highly encrypted communication among devices. They have the potential to disrupt the current cloud-based file storage and transfer, thus enabling optimised communications, software, and firmware updates among devices.

According to the report, maintaining private, secure, and trustless information exchanges among devices is challenging. Scaling up a decentralised and distributed IoT, where the principal actors are a significant number of devices (in the order of billions), requires a validation and consensus process that may be ensured through blockchain applications.

Blockchain applications will enable devices in the IoT to execute smart contracts by verifying the trustworthiness of peer devices. A blockchain supported IoT will provide new opportunities and disrupt existing business models by enabling devices to act as **self-contained business units, employing production factors such as energy connectivity and capital to provide services and exchange with other devices at minimum transaction costs.**

In conclusion, the disruptive power of the technology, especially in the field of IoT is compelling, though its most important advantage resides in its capacity to new markets for products and services operating at minimised transaction costs.

¹ Trustless exchanges between two parties are defined as systems to exchange tangible or intangible objects without the intervention of a third party or authority such as trading operators, institutions, and or governments.



4. Drivers and obstacles

4.1. Optimising cost and time efficiency in the financial industry

Blockchain technology is considerably disrupting the established business models in the banking and insurance industries. As a clear example of this situation is given by the time it currently takes to move funds between different institutions and geographic zones even though these are only records within databases. The application of blockchain technology can optimise the time, and hence costs, associated to any transaction with rapid and verified movements of records since it is easier to track transactions in a blockchain than across a myriad of intermediaries.

Costs are optimised by the reduction of claims corresponding to the actual benefit created by the application instead of heavy sunk fees associated to fixed operations made by intermediaries. A parallel can be established with respect to the development of the internet that enabled society to move information at high speeds across the globe; analogously, blockchain applications and smart contracts can enable our societies to move ownership and values at high speed across the globe.

Some of the drivers helping the development process include the access to and modernisation of broadband infrastructure and online tools, which is enabling a wide diffusion of the blockchain applications and services. In the long term, the technology will represent a big opportunity to redesign current processes within several verticals; in particular those in which there is room to improve the degree of cost and time efficiency.

4.2. A new and disruptive industry appealing for growth

Today, the business model associated with the application of blockchain technology is fundamentally different from any existing business model of value transfer and ownership management. In the short term, this nascent industry will most likely undergo several changes, particularly at the regulatory level. The industry is relatively young and disruptive; it will likely face some consolidation movements, even if it is still too early to speak about mergers and acquisitions. Under these circumstances, **piloting and experimentation across verticals** is part of a natural strategy for blockchain companies exploiting their capacity to develop solutions implementing peer-platform business models of high-speed transactions limiting the role of third party trustees.

Companies will continue to develop their products and interact with potential clients to **enlarge their base of customers**. Enlarging the base of customers implies establishing long-term relationships with 'big partners' willing to use the technology and confirm the benefits it provides. Reaching out to these big corporations for partnerships is often a straightforward exercise since these generally appreciate the potential of blockchain applications, although the organisation risk still represents a barrier to adoption for many corporations due to the complex IT systems already in place. The industry has recently benefited from a hype momentum stirred up by the attention the international media is currently giving to blockchain technology, even though key players in the industry point out that the expectations on the technology stemming from this hype are either misleading or will not be fulfilled.

"During the last months financial institutions have gained interest in blockchain start-ups enabling them to access commercial partnerships for development. The current hype has given momentum to this process even though today, many firms are still at a stage of R&D" – Chainsmiths.

Today, the industry is still in a phase of research and experimentation where many start-ups do not have revenues and where the lack of standards pushes start-ups to lock in own-product oriented strategies rather than solution oriented strategies underestimating the actual needs of their potential clients. Currently, the disruptive potential of the technology is compelling for actors in several industries (e.g. finance, insurance, engineering, manufacturing, etc.) although the key players are still trying to figure out which will be the most realistic and beneficial applications. As an illustration, this process has become evident in the financial industry with applications allowing the reduction of settlement time and transaction costs associated to securitisation of trading operations. In this industry, blockchain start-ups are dependent on investments from large financial institutions backing research on potential applications and standards.

4.3. Increasing transparency and confidence

The future of the technology will depend on the awareness of the key actors about the benefits that can be drawn for the utilisation of this technology. Transparency and confidence in the successful implementation of the technology will be determined by the capacity of firms, media, and decision makers to de-stigmatise the industry



from past failures it experienced, in particular related to virtual currency applications.

“Technically, the technological advantages of the solution can be applied at a global level through generic contracting regardless of the territorial jurisdiction in a straight forward manner; although heterogenic regulatory frameworks and compliance needs may hinder this advantage.” – Eris Industries

The concept of distributed ledgers imply that that each transaction is visible to all participants in the network. Since every transaction is visible, the encryption process is vital to preserve the privacy of the information within the transaction while at the same time enabling peer validation and verification. As the encryption process currently relies on the provision of

unique keys, considerable work is still necessary in the area of key recovery and hacking prevention, where not many start-ups are active.

The main question around the future of the industry relates to the privacy of a blockchain ledger and the need for several computing nodes to access the information in order to provide verification and validation, which would limit the interest of private organisations in exploiting public ledgers. Nowadays, security issues associated with transparency and confidence represent a potential barrier to the development of the industry.

4.4. Uncertain regulation

Awareness about the potential impact of the technology is increasing among key actors; from an industry point of view, particular attention must be given to the development of an appropriate regulatory associated with the blockchain industry. A focus on the development of new rules instead of simple re-interpretations and adjustments of existing ones may stimulate the development of SMEs within the industry and ensure the reduction of legal and operating uncertainties providing stability for business and innovation.

A clear and stable regulatory framework is necessary to provide a confidence environment for the development of blockchain start-ups. In the financial industry, regulatory advancements include operating licences for companies providing transaction services. A clear example of legislative stability is the recent ruling by the ECJ on the VAT exemption for bitcoin transactions, which shows the will of legislators to understand the potential and implications of blockchain applications in the financial sector. Taking such decisions, from an institutional point of view requires thorough discussion with actual industry players, but these discussions and debates are necessary for innovators, since innovating without legal stability is difficult and risky.

The legal dynamics in this industry are vital for the development of blockchain systems compliant with regulatory frameworks; indeed, since smart contracts can be

applied across several vertical industries with the objective of automating contractual relationships between stakeholders, there must be a regulatory process underpinning the development and uptake of these applications. EU regulators are perceived by key actors as having done a good job in understanding the technology and providing a response to it; only time will tell whether the current responses are the most beneficial or not.

4.5. Lobbying pressures from the establishment

On the other hand, the uncertainty about the development and trajectories of regulatory frameworks at the international level on blockchain applications creates pressure on investors and slows down on the development of the industry. Debates and regulatory adjustments may take several years (as it was the case for the peer-to-peer distribution of music); these delays create a barrier for the development and uptake, but can also be seen as an opportunity for experimentation to find and settle markets before they are shut down by regulators and lobbyists.

Today, the speed of diffusion and adoption of blockchain applications require coordination between start-ups and key actors in the industry with established organisations who representing potential customers. The purpose of such coordination is to understand, through means of experimentations and proof of concept, about the nature of blockchain applications and what will best suit the needs of society in the future. Today, large financial institutions such as Visa, Goldman Sachs, or Nasdaq are starting to invest in R&D in the sector.

Nowadays, technology is advancing exceedingly fast making it harder and harder for policy makers and regulators to keep up with it. The pervasive side of this process is due to the lag between the innovation and the regulation, where decision makers face the risk of becoming the prey of lobbying pressures from established business models. Lobbying pressures have the potential to dramatically slowing down or halt the innovation process and its associated benefits. This behaviour has been limited in the financial industry, where established institutions are rapidly assessing with interest the potential of the disruptive innovation, which reflects in the R&D funding and partnerships with start-ups that help redefine the roles of each actor.

Government support for the development of the industry is neither strong nor weak, and is unable to deal with deviant behaviour from established institutions hindering the development of the blockchain industry. As an example, there have been cases where barriers to uptake come from potential customers themselves with banking institutions refusing to open or even close the accounts of start-ups operating in the blockchain industry selling applications for cryptocurrencies.



5. Policy recommendations

5.1. Facilitating collaboration

"Harmonisation and standards within the industry will provide benefits for global commerce. However, the development of standards would not only need to take into account technical solutions, but also customer needs. As an example, concepts such as KYC, AML, and CTF need to be part of discussions regarding standards if we want the industry of blockchain applications to expand and prevail". – Skuchain.

Successful uptake of blockchain technology requires that innovators and established industries collaborate towards a common purpose. Adding up capabilities and resources will help define the most appropriate standards allowing to optimally exploit the benefits of the blockchain technology.

The particular characteristics of blockchain technology for record management and information transfer require the substitution of single points of control by flexible approaches to project management. And the distributed consensus mechanisms and new

models of information management need close coordination among key actors. Collaboration between start-ups and established firms is particularly important to develop and diffuse blockchain applications.

However, in an industry where firm survival is an issue and where technology is advancing at high pace, it is important to note that coordination and collaboration may have to come with limitations. In the case of blockchain technology applied to the financial sector, most procurement procedures form established banks take several months. Often too long for blockchain start-ups operating on limited budgets. In addition, many start-ups experimenting with projects are not even a registered as legal entities, rendering the process of procurement more complicated and uncertain.¹²

At the same time, some large institutions want to accelerate the standardisation process within the industry and a few key players are starting to define its future standards by engaging in consolidating strategies such as partnerships and acquisitions.

Policy makers can stimulate the collaboration processes between start-ups and established firms through commercialisation events gathering key actors.

5.2. Providing support for the creation of standards

In an effort to collaborate and define the future of blockchain technology, 22 banks have recently joined efforts

to participate in the blockchain-initiative consortium. R3 CEV aims at designing common standards to apply distributed ledger technologies to global financial markets.¹³

The short term future of the blockchain industry will require some degree of consolidation, some companies will fail and some will succeed in securing revenues. But most importantly, standards regarding the management of the blockchain public ledger will be developed. The development of the World Wide Web followed a similar trajectory, with closed networks that eventually interacted with each other. In essence, the future of blockchain technology, especially the blockchain public ledger will require the **development of a common language with specific rules for interaction**, which will be achieved through standardisation processes.

Standards may appear as the diffusion and uptake process speeds up. Today many organisations understand the cost efficiency problem blockchain applications address, and are willing to invest in the development of solutions. However, there are also currently too many blockchain projects for problems that do not necessarily need the application of blockchain technologies.

"Private blockchains will still be good internal management solutions for databases in large organisations, but this type of application may miss the thorough potential of the technology" – COLU.

Policy makers can provide help and support for the development of standards by not only encouraging the coordination among key actors, but also **recognition of initiatives that work towards the adoption of common standards** within the industry. That can take the form of public demonstration events or the sponsorship of hackathons* that facilitate collaboration.

5.3. Developing favourable regulatory frameworks

Following the interest of large corporations and media, decision makers have also recently increased their awareness of the industry. As an example, Luxembourg's agency responsible for the regulation of the financial sector (Commission de Surveillance du Secteur Financier - CSSF) took the decision to adapt the regulatory framework to the

* Hackathons are 'coding-day' events organised with the objective of encouraging intensive collaboration amongst programmers, and other actors involved in software and hardware development.



advances and applications of this technology. Governments start to understand the potential of the technology, and change the regulatory views on blockchain-based products and services, especially within the financial sector.

However, legal frameworks in most Member States are still difficult to apply to blockchain companies. Therefore, instead of modifying the existing regulation, public authorities should **develop new adjusted frameworks taking into account the characteristics of the technology**. Such regulatory frameworks need careful observation and lessons learnt during the early diffusion process of the technology. Few EU Member States (such as Luxembourg and the UK) have started moving forward towards this type of regulation.

The development of tailored regulatory frameworks will facilitate **close collaboration between industry and consumer's representatives, and regulatory agencies** with the objective of building coherent regimes for the application of blockchain technology. Collaboration between these principal actors needs to address the key areas such as security and safety in goods and services provided, competition, consumer protection, privacy and data-protection.

5.4. Raising awareness and a gradual change of mind to expand the industry

Today, most blockchain applications are developed in the financial sector, where institutions are starting to explore

and develop tailored uses and products. Prior to 2015, blockchain start-ups went through considerable efforts to demonstrate the potential of the technology to institutions within this sector. However over the first half of 2015, many financial institutions approached start-ups within the blockchain community with the purpose of developing partnerships to provide alternative methods for payments, clearing and settlement processes cutting down costs and increasing time efficiency. These partnerships enabled a **still ongoing process of experimentation**, showing how the industry is changing its perception.

At the same time, since several blockchain start-ups have been hosted at incubators or accelerators, the university laboratories are also starting to experiment with the technology. It shows that there is a **general interest in fostering a gradual change of behaviour and opinion about blockchain technology** and its applications. That might help to expand the base of potential partnerships and customers, ensuring its uptake and growth.

"Compared to other jurisdictions which have regulated first and asked questions later, most EU member states have taken a more thoughtful and considered approach to policy for the industry". –
Blockchain.info



6. Appendix

6.1. Interviews

Company	Interviewee	Position
Blockchain.info	Peter Smith	CEO
Chainsmiths	Kevin Loaec	Managing Director
Coinprism	Flavien Charlon	CEO
COLU	Elad Shabi	Head of Business Development
Eris Industries	Casey Kuhlman	CEO
Scorechain	Pierre Gerard	CEO
Skuchain	Travis Giggy	VP of Customer Development

6.2. Websites

Company	Web address
Blockchain.info	https://blockchain.com/
Chainsmiths	https://chainsmiths.com/
Coinprism	http://www.coinprism.com
COLU	https://www.colu.co/
Eris Industries	https://erisindustries.com
Scorechain	https://www.scorechain.com
Skuchain	http://www.skuchain.com/

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