



Distributed Ledger Technologies (DLT)

Blockchain in Catalonia

January 2020

Technological Report

Distributed Ledger Technologies (DLT). Blockchain in Catalonia: technological report

ACCIÓ

Regional Government of Catalonia (Generalitat de Catalunya)



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Execution

ACCIÓ Strategic and Competitive Intelligence Unit

Collaboration


Secretariat of Digital Policies, Regional Government of Catalonia (Generalitat de Catalunya)

ACCIÓ Innovation Unit

Barcelona, January 2020


Technology trends target

This study is part of a collection of reports on the different disruptive technologies detected in the ACCIÓ Technology Trends Target (2018), which are expected to have a great impact on Catalan society and its productive fabric in the years to come.




- Virtual reality and augmented reality
- Artificial intelligence
- Internet of Things
- DLT and blockchain

DIGITAL




- 3D printing
- Nanotechnology and new materials
- Robotics
- Quantum science and photonics

PHYSICAL



- Neuroscience
- Advanced drug design
- Omics
- Biotechnology and synthetic biology

BIOLOGICAL



- Big data
- Connectivity – 5G
- Cybersecurity

TRANSVERSAL



- Drones
- Connected vehicle
- New space

TECHNOLOGY HYBRIDISATION



The reports published as of 1 January 2020 appear in blue. Those pending publication appear in red.

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1. DLTs. Relevance to the industry and main uses



Definition of DLT and blockchain

The concept of **Distributed Ledger Technologies** (hereinafter, DLT) groups together technologies that store, distribute and facilitate value exchange between users both on a public and private level. It is an open technology for creating distributed databases.

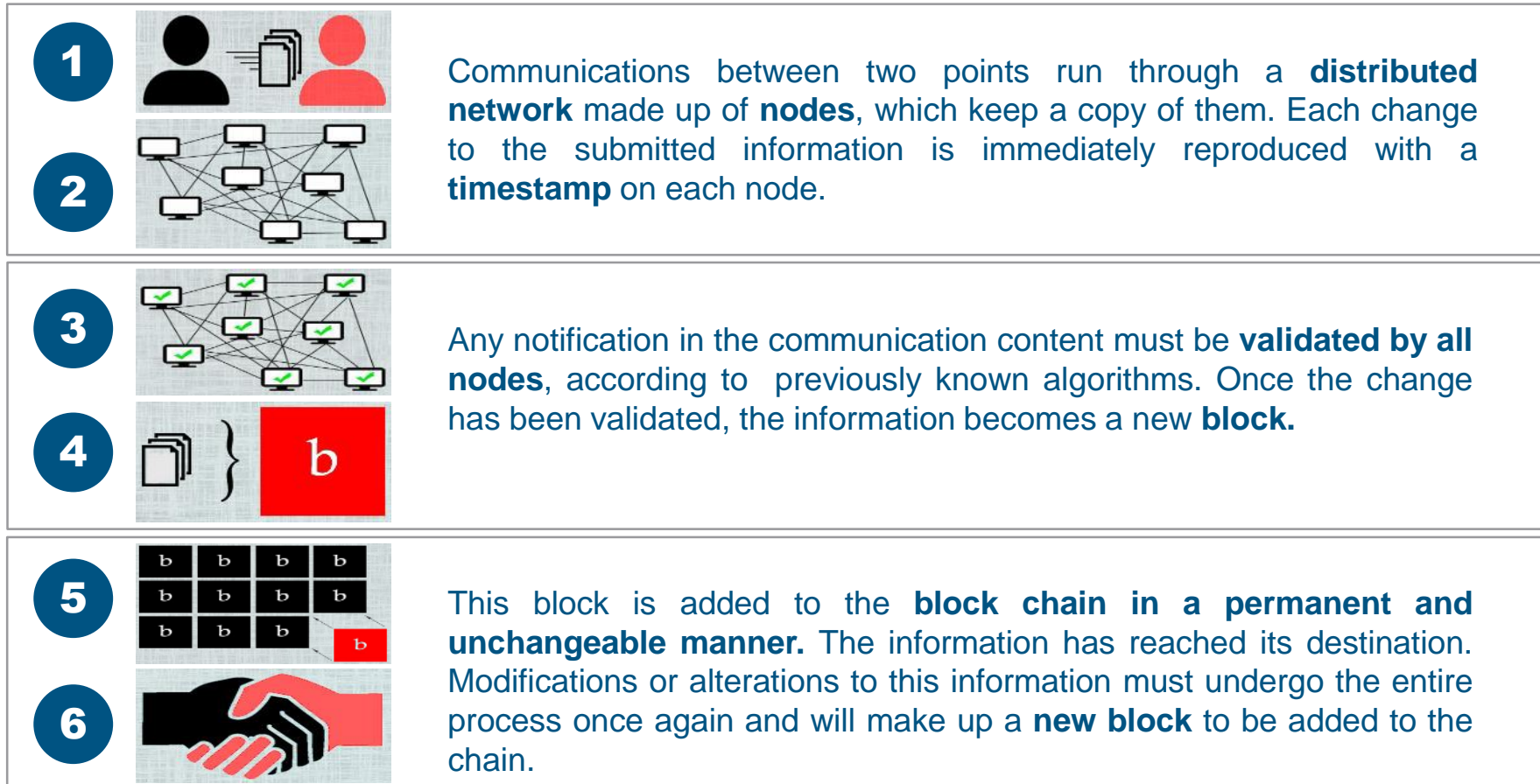
Within this framework, blockchain was the first functional DLT. Thus, blockchain is a subcategory within a broader concept. Blockchain is a distributed, decentralised database made up of **block chains** designed to prevent them from being modified, once data has been published, which uses a digital time stamp and links a block to the previous one. It allows financial and non-financial **transactions** between two participants in a secure, reliable and irreversible way, **without the need for an intermediary or a central authority** to establish a trust relationship between the parties or to check the transactions.



Source: own compilation based on Frost&Sullivan, Expansión, CecaBank, 8Wires

Operation of DLTs

The operation of distributed ledger technologies follows the process below:



Source: own compilation based on SmartCatalonia

Main DLT features

The **main features** of distributed ledger technologies are as follows:

Open

Safe

Efficient

**Easy to
use**

**Multiple
applications**

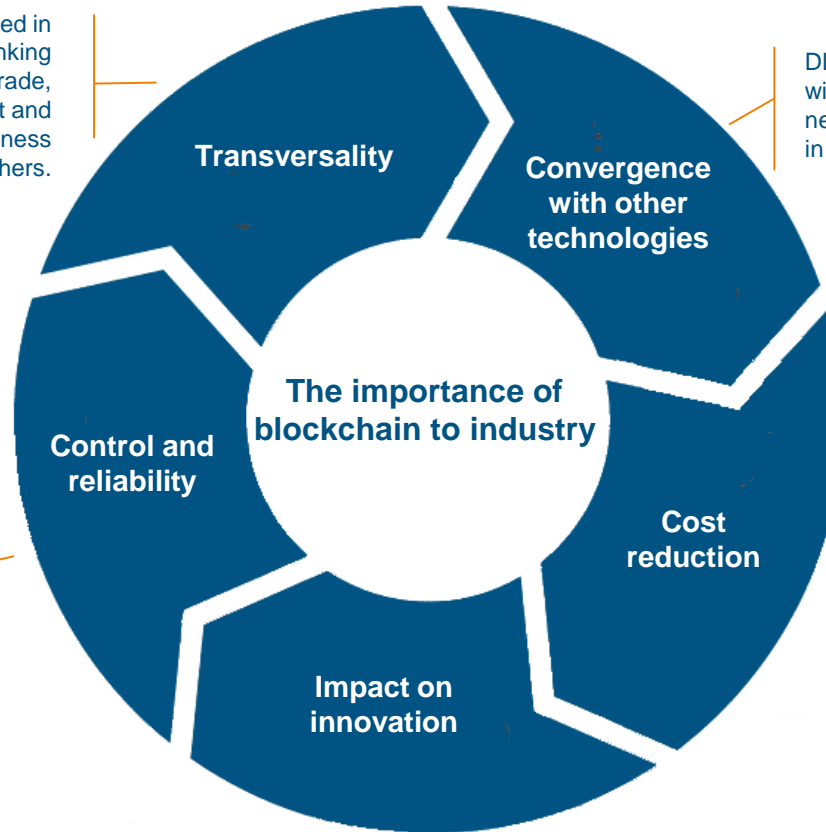
- **Open** → All participants are aware of the movements and changes that have been made to the document.
- **Safe** → They use cryptographic keys to create, modify, share and store information, and the community is responsible for protecting the data it contains.
- **Efficient** → There is no such thing as an intermediary; thus, the process is optimised.
- **Facilitating consensus** → This allows for transactions between people who do not know each other and who, in theory, do not trust each other.
- **Multiple applications** → It can be applied to many actions involving multiple users.



Source: own compilation based on CecaBank

Importance of Distributed Ledger Technologies (DLT) for the industry

This is a technology which is applied in many sectors, both in the field of banking and finance, as well as in security, trade, the cloud, transparent government and the development of new business models, among others.



DLTs will achieve long-term convergence with the Internet of Things and will also allow new disruptive technologies to be developed in the future.

It is a reliable database system that guarantees user security, as their data is protected.

More efficient processes that allow us to reduce or eliminate processing costs, inefficiency costs due to the presence of intermediaries and long periods of time or bank commissions that will disappear thanks to the new smart contracts.

Distributed ledger technologies generate innovation opportunities for companies in different fields (products, processes and business models).

Source: own compilation

Main uses of DLTs: cryptocurrencies (I)

Cryptocurrencies are one of the most well-known applications of DLTs. A cryptocurrency is an electronic currency that can be exchanged without a third party acting as a mediator. According to Kapersky (2019), 19% of the world's population had purchased some cryptocurrency before 2019.

The main applications of cryptocurrencies could be as follows:

- International financial transactions that improve efficiency and significantly reduce costs.
- Financial inclusion in those countries where a significant portion of the population is unbanked, who could store cryptocurrencies in a digital wallet linked to their mobile phones.

There are different cryptocurrency classes, depending on the issuer: private, central bank or synthetic ones (those issued by the central bank, but customer interaction is carried out by private institutions). As private cryptocurrencies are issued by private institutions, their value depends on the degree of acceptance or use they have; thus, their value is very unstable, as is the case of bitcoins. For this reason, stablecoins have been launched, which link their value to a more stable asset, with the aim of minimising the volatility of their value.



Source: CaixaBank Research, 2019

Main uses of DLTs: cryptocurrencies (II)

Cryptocurrencies. Associated risks and challenges

Cryptocurrencies entail a series of associated risks and challenges, which could be summarised as follows:

- **Default risk.** It remains to be seen whether the digital wallets hosted for private institutions would have a deposit guarantee. Even in the case of stablecoins, their value stability is not guaranteed.
- **Risk of financial stability.** If a private cryptocurrency dominated a significant fraction of transactions, a potential provider bankruptcy or weakness would have an effect on the international payment system.
- **Monopoly.** When a currency is attractive as a means of payment, the number of agents using it grows, and a natural monopoly may be established.
- **Loss of control over monetary policy.** If a cryptocurrency manages to occupy a significant part of the market, it will erode the ability of central banks to control money supply and interest rates.
- **Illegal activities.** Cryptocurrencies allow decentralised and anonymous exchanges. It is unclear how compliance with regulations under which traditional digital payments are made may be guaranteed.
- **Data management.** Institutions managing these digital wallets would have access to large amounts of personal and financial data from users.



Following the Facebook announcement of the creation of their own stablecoin, the EU Council of Ministers of Finance will soon discuss the need for the ECB to issue its own public digital currency.

Main uses of DLTs: smart contracts

Smart contracts are contracts that work exactly as programmed, without any possibility of delay, censorship, fraud or interference by third parties, with conditions known to the contract parties. The basis of smart contracts is that they are programmed by a computer code that allows you to automatically verify and enforce contract clauses, as it does not require the approval of an intermediary, such as a judge or a bank, to execute transactions.

However, smart contracts often have to rely on external agents to verify compliance with a certain condition: the oracles. Oracles are computer tools that allow you to validate the conditions established in the contract from external information that lets you know if a clause in the smart contract has taken place or not.



Source: *Blockgeeks*

Thus, smart contracts increase the speed of transaction execution and, as a result, make it possible to close more agreements with lower compliance risk.

Source: own compilation based on López, A., Navajo, J., Mancía, P.

2. The global blockchain market



Global market. Current and prospective data

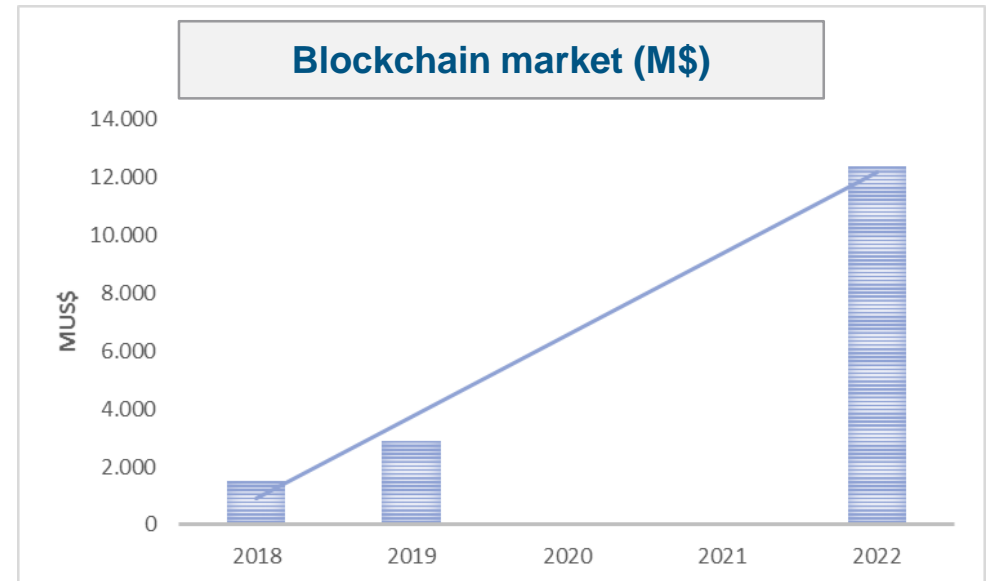
Global blockchain spending is expected to reach \$12.4 billion by 2022

Blockchain market size

Global spending on blockchain solutions is projected to be nearly \$2.9 billion in 2019, an 88.7% increase over the \$1.5 billion spent in 2018.

Blockchain spending is expected to grow at a good rate during the 2018-2022 forecast period, with a 5-year compound annual growth rate (CAGR) of 76.0% and a total spend of \$12.4 billion by 2022.

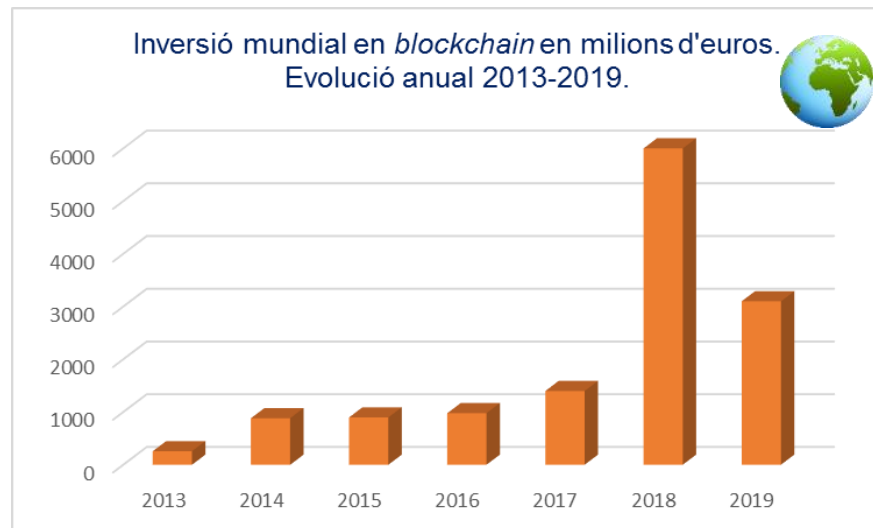
53% of senior executives believe that blockchain will be disruptive to their business in the next 24 months and place this technology as one of the top 5 priorities of their business (Deloitte, 2019).



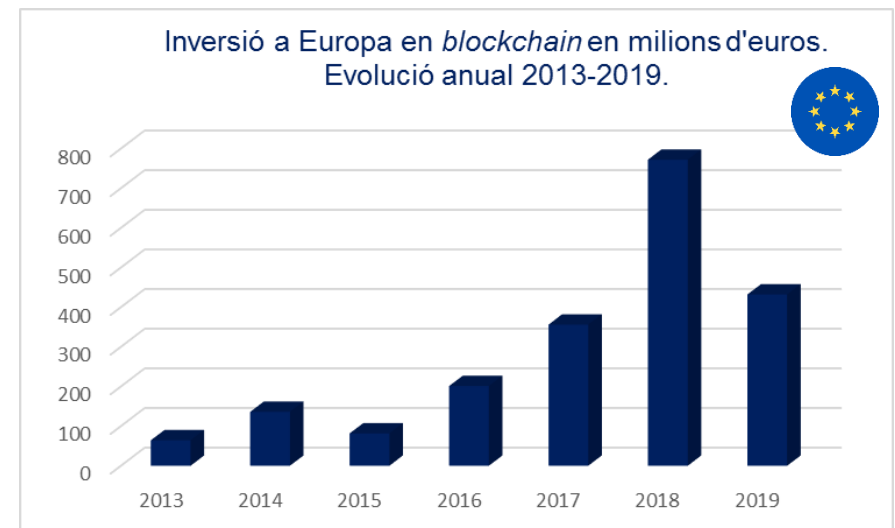
Source: own compilation based on IDC, 2019

Investments in the blockchain sector (I)

- In recent years, global blockchain investment has skyrocketed. Thus, it has gone from 256 million euros invested in 2013 to 6 billion in 2018, which represents an increase of 2,344% in 5 years.
- In the same period, investment in Europe grew by 1,202%, hence reaching €772 million in 2018.
- However, investment in this technology has dropped in the first quarters of 2019, coinciding with the collapse of bitcoin. It is estimated that, between January and November 2019, global blockchain investment has reached 3.2 billion euros, although in 2018 it had been 6 billion.



*Investment data from 2019 to 15/11/2019

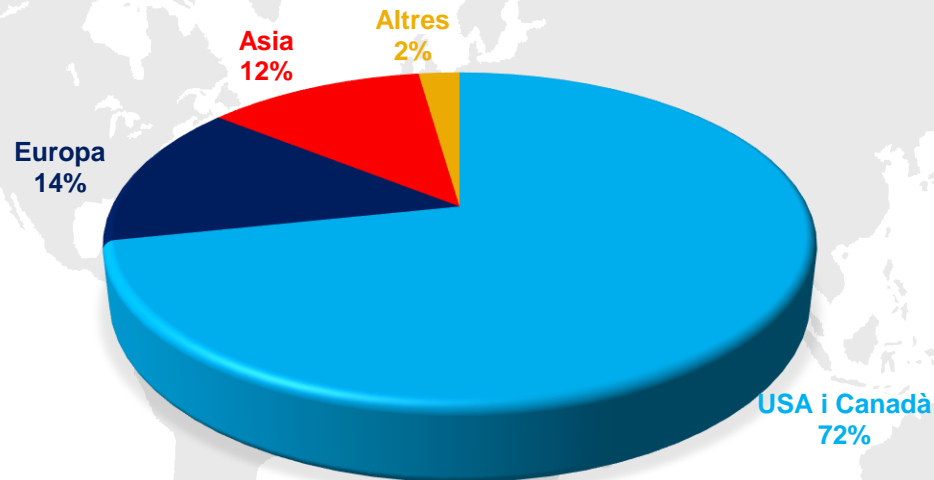


*Investment data from 2019 to 15/11/2019

Source: own compilation based on data by dealroom.co

Investments in the blockchain sector (II)

Global blockchain investment distribution by regions (2019)



The United States and Canada are leading global blockchain investments, with up to €2.2 billion between January and November 2019. This represents about 72% of the world's investment in this technology.

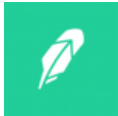




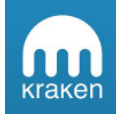












By far, Europe ranks second in world investment, with 432 million invested in the same period, which represents 14% of the global total amount. Asia lags is behind, with a total investment of 368 million euros in the same period, 12% of the total amount.

Source: own compilation based on data by dealroom.co

Investments in the blockchain sector (III)

The main funding rounds

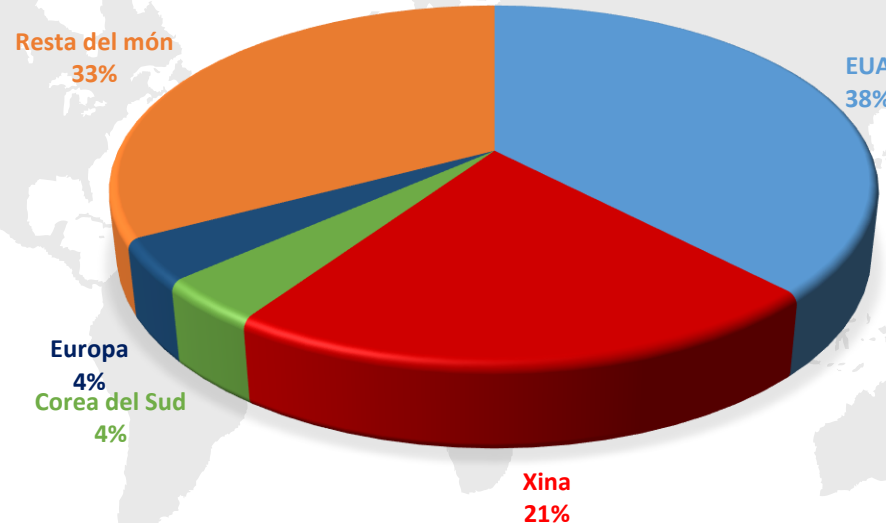
The 10 most important funding rounds this 2019, related to blockchain technology, have been (in millions of euros):

	Robinhood, July 2019 Round value: M€323			Golden Technology, October 2019 Round value: M€141	
	Stripe, September 2019 Round value: M€250			Kraken, February 2019 Round value: M€100	
	Marqeta, May 2019 Round value: M€250			NEO, May 2019 Round value: M€100	
	Bakkt, January 2019 Round value: M€182			Stripe, January 2019 Round value: M€100	
	Acronis, September 2019 Round value: M€147			Figure, February 2019 Round value: M€65	

Source: own compilation based on data by dealroom.co

Global blockchain patent market (I)

Blockchain patent percentage by world market country/region (2019)

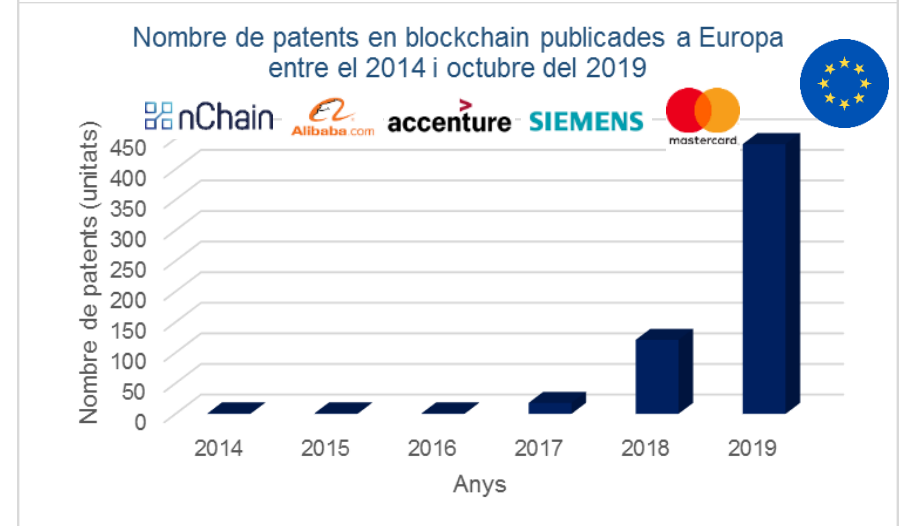
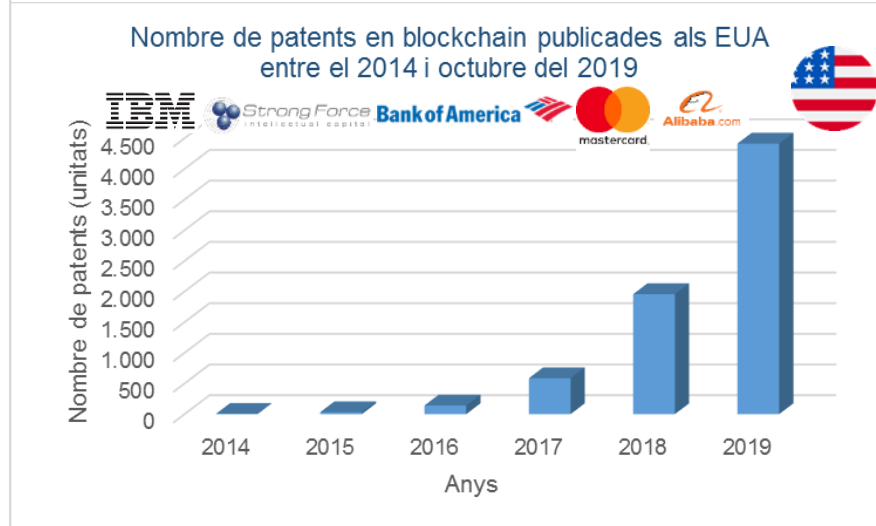
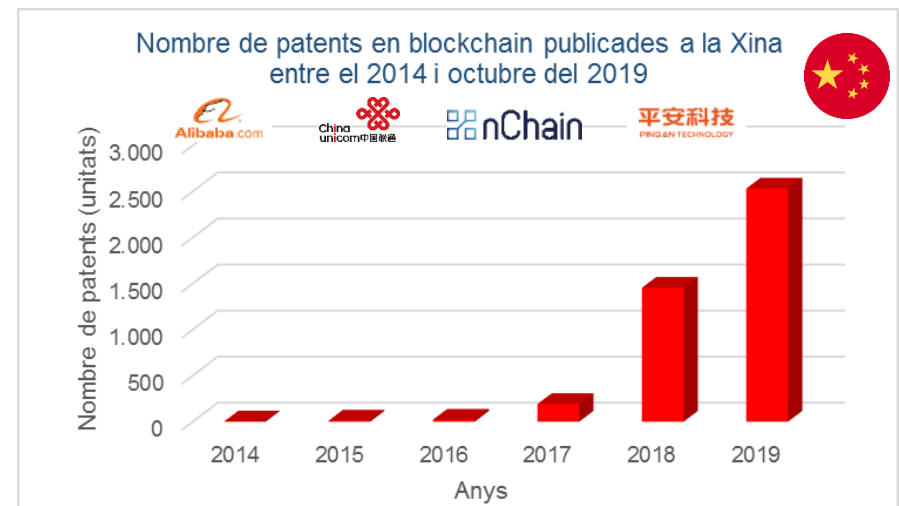
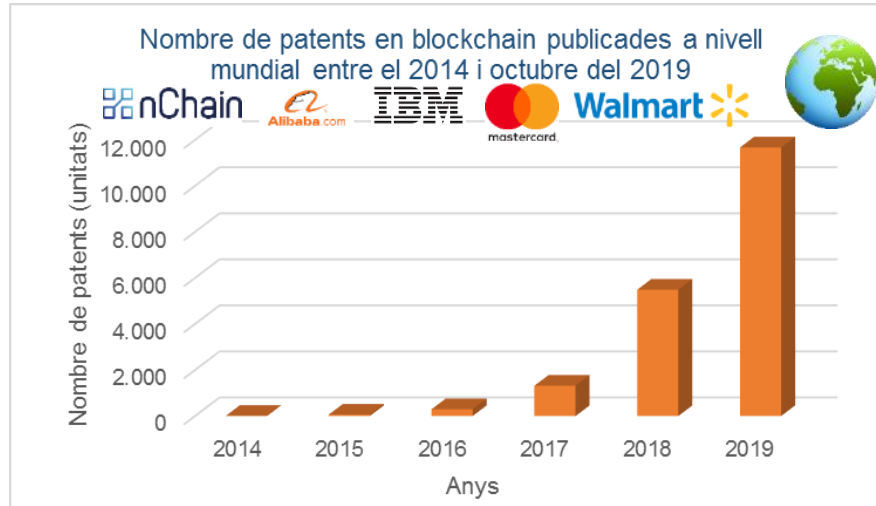


The United States currently leads the number of patents worldwide, with 4,413 patents, which is 38% of the global total amount. **China** ranks second, with a 21% share.

Europe and **South Korea** are competing for the third rank, with virtually identical patent numbers; both powers feature around 4%.

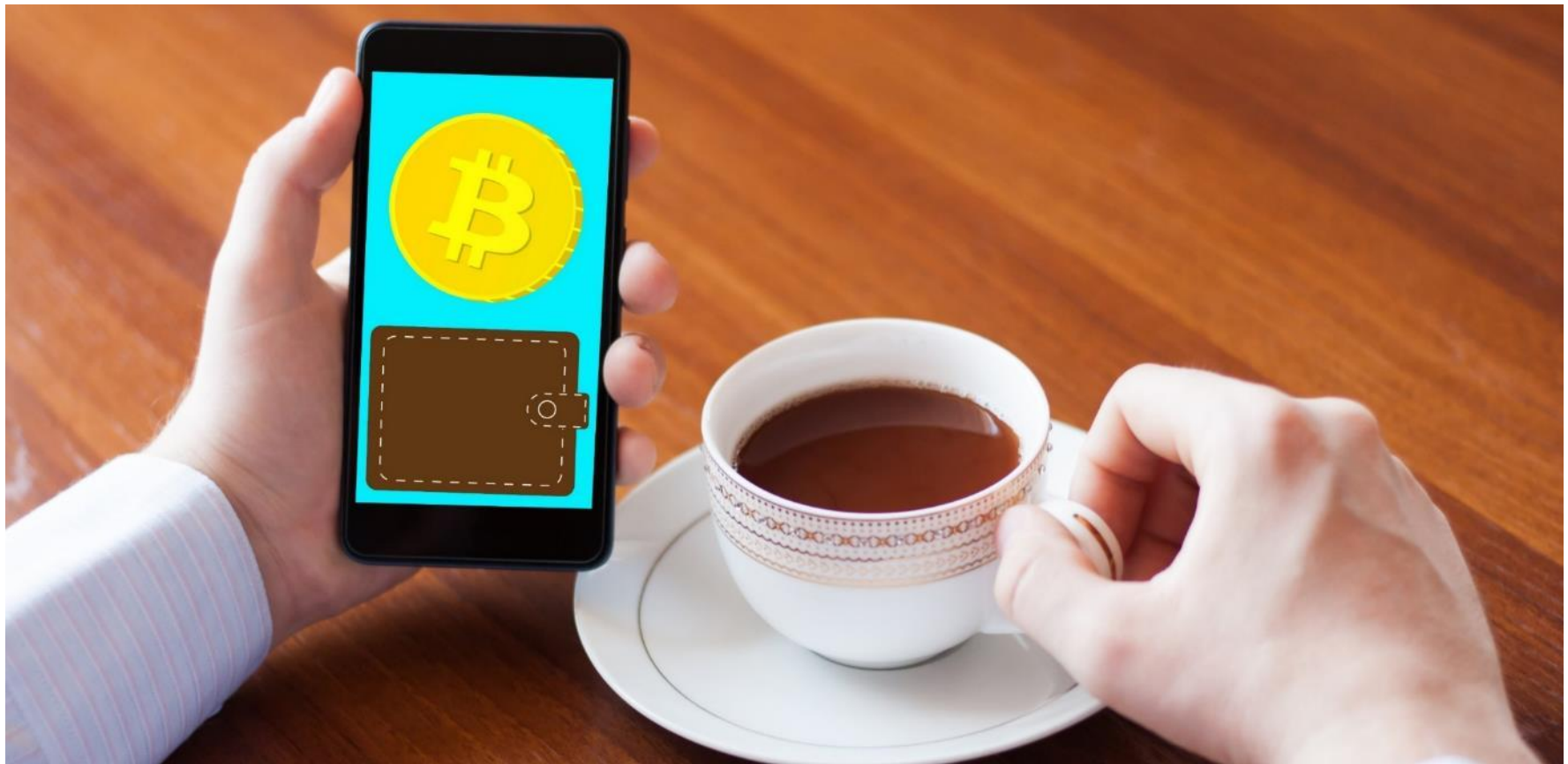
Source: own compilation based on data by lens.org

Global blockchain patent market (II)



Source: own compilation based on data by lens.org

3. Main recent and prospective applications by demand sector and SDGs



Applications of distributed ledger technologies by demand sectors (I)

Healthcare



With the use of shared ledgers, smart contracts and encryption technology, pharmaceutical companies and medical device manufacturers can eliminate costly intermediaries and more effectively ensure security, immutability, transparency, auditing and trust throughout the value chain.

Banking and finance



The impact is noticeable in a number of areas, such as cross-border payments, smart contracts and bill financing.

Aerospace and defence



DARPA (Defense Advanced Research Projects Agency) is investing in blockchain to protect highly sensitive data on biological weapons and military satellites.

Retail



The impact is likely to be observed in areas such as the identification of counterfeit goods or the location of stolen goods.

Energy



DLTs ensure data coordination across a wide variety of grids, enable automated trading platforms and create open access for innovative products and services.

Oil and gas



The impact is noticeable when providing greater efficiency in the offshore and onshore drilling process and when reducing the cost of operations.

Source: own compilation based on Frost & Sullivan Cognizant

Applications of distributed ledger technologies by demand sectors (II)

Teaching



In the field of teaching, distributed ledger technologies would allow for the creation of a new system for issuing and certifying official documents and qualifications, which, thanks to this secure technology, would ensure the accuracy of evaluations and qualifications. On the other hand, a DLT-based intellectual property register could also be created.

Logistics



Blockchain technology enables a secure network to be established between all parties involved in the logistics chain. In addition, smart contracts reduce the risk of default in this industry. These technologies are also a significant improvement in chain traceability and allow us to know the product state in real time.

Public sector



One possible application of DLTs in the public sector will be their possible implementation in electronic voting.

Real estate



As for real estate, DLTs allow for the creation of a new property register, which guarantees that data cannot be altered. The Republic of Georgia is already working on creating such a register. On the other hand, smart contracts help to close real estate deals more efficiently, as no intermediaries are needed.

Industry



Blockchain technology improves product traceability in the industry. Moreover, smart contracts can provide multiple benefits in this field. Overall, this technology can have a positive impact on all industries, thanks to the advantages it offers in terms of efficiency and transparency.

DLTs and OBJECTIUS DE DESENVOLUPAMENT SOSTENIBLE

Partnerships to achieve the SDGs

Thanks to DLTs and smart contracts, any agreement in determining the Sustainable Development Goals between the parties can be effectively managed.

Strong institutions, peace and justice

DLTs could trigger greater citizens' trust in institutions, due to the immutability and disintermediation of DLTs. This improvement in confidence could indirectly strengthen peace and justice.

Responsible consumption and production, climate action, underwater life and life of terrestrial ecosystems

The fulfilment and interpretation of international agreements on these matters by individual countries is often troublesome. Thus, smart contracts would improve consistency and transparency, as the fulfillment of commitments by states could be monitored and checked.

Decent work and economic growth, industrial innovation and infrastructure, sustainable cities and communities

Underpaid or migrant workers are often exploited by intermediaries or third parties. The immutable nature of DLTs and transparency of transactions can provide wage protection and reduce worker exploitation.

End poverty and hunger. Health and well-being

DLTs could improve aspects regarding the distribution of drugs and humanitarian goods. Through these technologies, the parties can send and track the health goods lifecycle thanks to the immutability and transactional integrity of DLTs, which ensure improvements in health and wellbeing.

Quality in education, gender equality and reduction of inequalities

The financial and logistical commitments to education and gender equality by central and regional authorities could be ensured through smart contracts between all parties.

Clean water and sanitation; clean and affordable energy

Infrastructure development contracts to ensure access to clean water, sanitation and energy could be routed through DLT technologies and, thus, end fraud and improve trust between the parties.



Source: EIC (DGI-ACCIÓ) based on Hughes *et al.*, 2019

4. Distributed ledger technologies in Catalonia



The DLT ecosystem in Catalonia (I)

76 companies working with DLT in Catalonia were detected, representing a 117% increase over those detected in 2018.

DLTs in Catalonia



It is estimated that there are currently 397 jobs in Catalonia and a turnover of €9.46 million directly linked to distributed ledger technologies.

On average, the detected companies feature an estimated annual turnover of €120,000 and 5 employees.

The DLT ecosystem is an emerging ecosystem that is largely made up of microenterprises. 68% of these companies are start-ups.

The DLT ecosystem in Catalonia (II)

Partial illustration chart*



Note: This is a partial illustrative representation of the main companies forming part of the ecosystem of the DLT sector in Catalonia, but there may be other companies that have not been detected in the mapping process, due to the sector's dynamism. Companies are ranked according to their estimated turnover

Catalonia's Blockchain Strategy

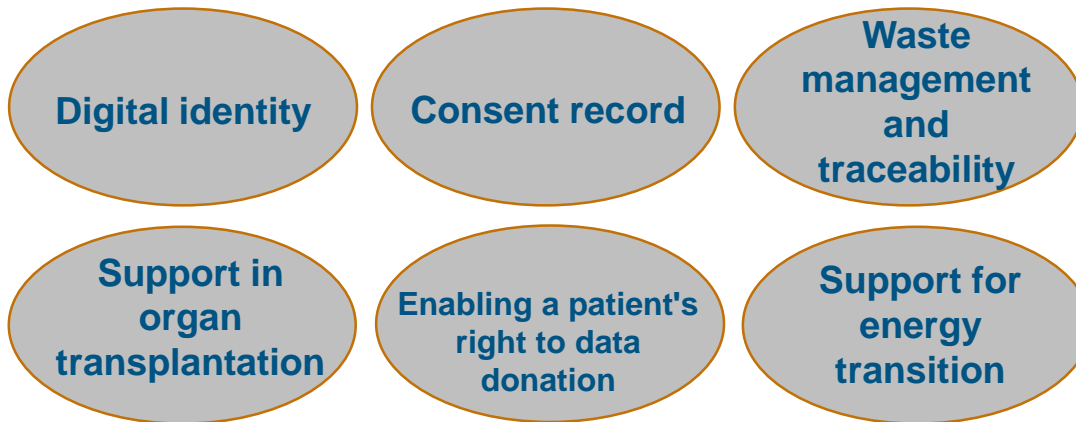
In June 2019, the Government of Catalonia approved the Catalan blockchain strategy, with the aim of turning Catalonia into a leading country in the use and development of DLT technologies, which, applied to Public Administration, allow us to increase transparency, ensure citizen confidence and, at the same time, facilitate solution integration and strength. Thus, it is particularly suitable for the management of public services, as well as for implementing citizen participation processes.



Estratègia
Blockchain
de Catalunya



Some of the projects that are already underway at present or that will be launched soon in the field of public administration are as follows:



Buisness cases in Catalonia



Vottun

Certification and traceability for any type of industry



ScytI

Electronic voting, management and electoral modernisation



Block Tac

The one-time digital certificate for fraud reduction



Ubiquat

Digital payments and online financial platform management



Freeverse

Digital assets for online games



ViDsigner (validatedID)

Comprehensive electronic signature service



Finboot Technologies

Automatic bank transactions



Agència de residus de Catalunya

Traceability in waste management

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See the Snapshot here:

www.accio.gencat.cat/ca/serveis/banc-coneixement/cercador/BancConeixement/el-blockchain-a-catalunya



More information about the sector, news and opportunities:

www.accio.gencat.cat/ca/sectors/tic/

If you are interested in the whole report, you can send an e-mail to irodriguez@catalonia.com