



A Structured Framework to Assess the Business Application Landscape of Blockchain Technologies

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AGENDA

- 1 **Background**
- 2 **Methodology**
- 3 **Type of Applications**
- 4 **Type of Ownership**
- 5 **Type of Consensus Mechanism**
- 6 **Research results**
- 7 **Market analysis**
- 8 **Q & A**



1. BACKGROUND

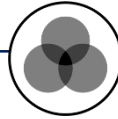
BACKGROUND



Humongous hype effect

There is a **huge hype effect** around blockchain due to the combined effect of:

- the overall value of the global market of **cryptocurrencies** - which has exceeded **\$160 billion** on August 2017, starting out at \$10 billion at the beginning of the year and hitting \$100 billion in June (Coinmarketcap, July 2017);
- the overall **investments** in blockchain-focused **start-ups** (Friedlmaier et al. , 2016);
- the entry of several **big names** far from financial services, such as **Walmart and Maersk** (R. Hacket, 2017) .



Lack of an holistic approach

- Most of the efforts spent by the academic world in the last 5 years have been devoted to **solve the challenges that are slowing down the potential disruption** led by blockchain and distributed ledger technologies, with a **main focus on Bitcoin** and other cryptocurrency applications. (J. Yli-Huumo et al. , 2016)
- Very few works have pointed their attention on **alternative applications of blockchain technologies**. (Friedlmaier et al. , 2016)



Rising of new organizations

Business leaders and practitioners are relying **on newly founded, non-academic organizations to address** the following unanswered questions:

- Which are the **main business applications of blockchain**, other than cryptocurrencies?
- Which are the **most affected industries**?
- Which are the **main technical features of blockchain platforms** currently implemented?
- Who **owns the blockchains** in current business implementations?



2. METHODOLOGY

METHODOLOGY



Framework development

On the basis of our analysis and the main academic/technical literature, **we built an assessment framework to map blockchain applications.** The framework entails **5 main building block variables** that could lead to a better understanding of the features that qualify a blockchain solution.



Market analysis

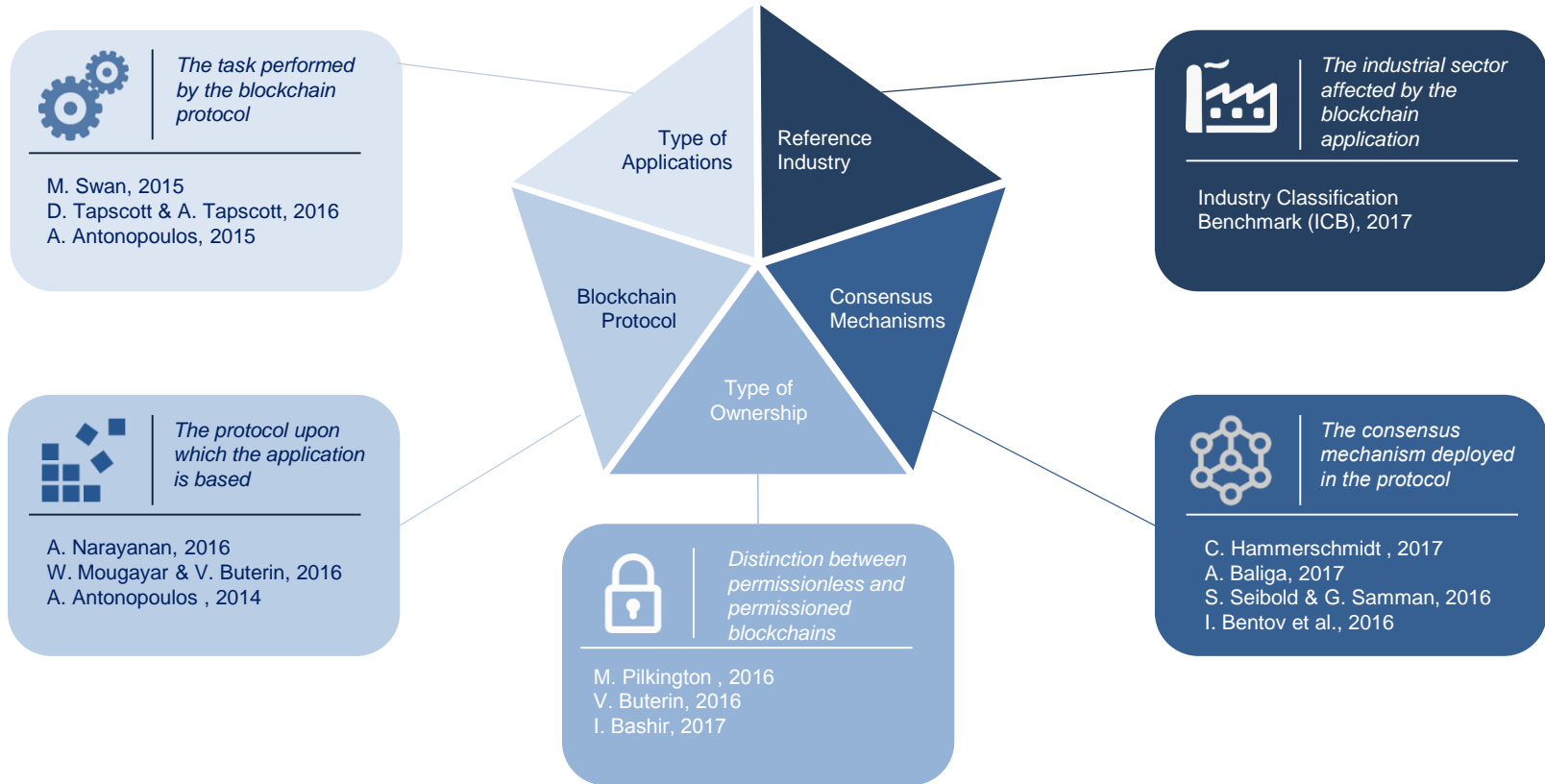
In order to perform an analysis as coherent and complete as possible, we built a dataset gathering data from two different sources (Coinmarketcap and Crunchbase), for a total of **460 observations.** To maintain a good compromise between the completeness and the significance of the sample, **we excluded the protocols with a market capitalization inferior to 500,000\$ at that date.**



Insights deduction

We analyzed the gathered data through **charts, tables and graphs** and **assessed the business landscape** of blockchain technologies.

ASSESSMENT FRAMEWORK AND METHODOLOGY



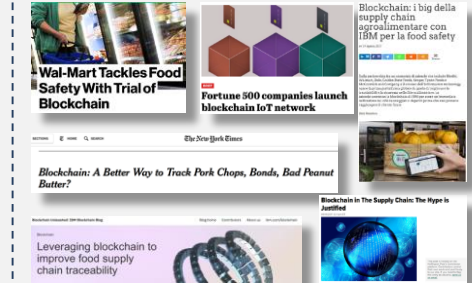
ADVANCED TRACKING

DESCRIPTION

The current IoT ecosystems rely on centralized, brokered communication models, otherwise known as the server/client paradigm. The **decentralized consensus** will create a **more resilient ecosystem for devices to run on**, eliminating a single point of failure. Moreover, the **cryptographic algorithms can guarantee a high level of privacy for the users**. Adopting a standardized peer-to-peer communication model to process the hundreds of billions of transactions between devices will significantly **reduce the costs associated with installing and maintaining large centralized data centres** and will distribute computation and storage needs across the billions of devices that form IoT networks.

SOME EXAMPLES

- [Chronicled](#)
- **Hyperledger (Walmart)**
- **IoTappo**
- ...



BLOCKCHAIN FACTS

Pros

- ✓ Cost reduction (no central data centres involved)
- ✓ Highly resilient ecosystem – no single point of failure
- ✓ High level of security and reliability

Cons

- ✗ Total dependency upon sensor's data quality
- ✗ Immutable storage might turn into a problem

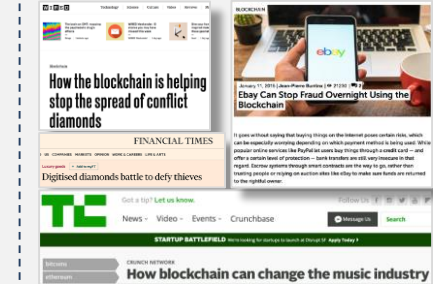
CERTIFICATION

DESCRIPTION

Blockchain represents one of the best ways to **fight various types of fraud** – such as subsidized housing sales and mileage manipulation in second-hand vehicles. In a blockchain it is (almost) **impossible to rewrite any data already registered**. Thus, it is the perfect tool to develop anti-fraud registries capable of putting an end to fraud schemes such as the ones mentioned above. **Timestamping data in an unalterable state while maintaining confidentiality is a perfect solution to avoid frauds**. It allows anyone to store a hash of any document into a blockchain, thus proving it existed at the time when a particular block was created.

SOME EXAMPLES

- Decentraland
- [Everledger](#)
- Espers
- Hyperledger (*Publicism*)
- IOTA
- Namecoin
- Radium
- ...



BLOCKCHAIN FACTS

Pros

- ✓ Frauds/counterfeiting resistance
- ✓ Immutable registers
- ✓ High level of security and transparency

Cons

- ✗ Certification authorities might be required

CLOUD STORAGE

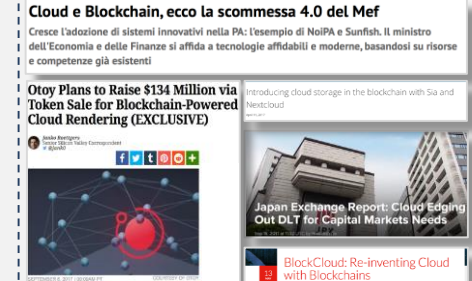
DESCRIPTION

On a blockchain platform, the same users can **host their surplus storage capacity or purchase this extra-storage from other users and upload files**. Basically, the blockchain could enable:

- **A complete decentralization** basically eliminating the possibility of one-point-of-failure;
- **A high privacy and security level** considering that a node does not control user data nor has a direct access to user files, but **only stores encrypted fragments of user data**;
- **A significant cost reduction**. For instance, blockchain storage costs around 2\$ per terabyte per month, compared with Amazon S3's 25\$ per terabyte per month.

SOME EXAMPLES

- **Sia**
- **[Storj](#)**
- ...



BLOCKCHAIN FACTS

Pros

- ✓ Real redundancy – eliminating one-point-of-failure
- ✓ High level of privacy and security level
- ✓ Cost reduction

Cons

- ✗ Immutable storage might turn into a problem
- ✗ Possible inefficiencies due to users' internet speed

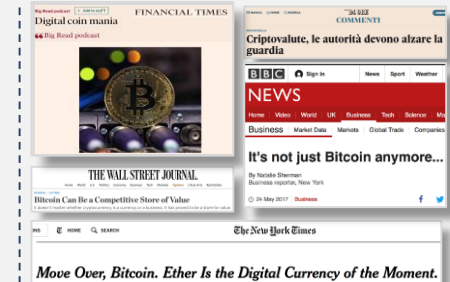
CRYPTOCURRENCIES

DESCRIPTION

Cryptocurrencies are any kind of **electronic money** created using **cryptographic technology**. They **regulate their own issuing and ensure the legitimacy of transactions conducted through them**. They can be considered as the original and first-proven application of blockchain technologies. Cryptocurrencies are **open-source algorithms**, which can (usually) **be programmed by anyone and facilitate peer-to-peer financial networking** without the need for third party arbitration, thereby reducing the dependency on banking systems. The global market of cryptocurrencies is continuously growing and has exceeded **\$170 billion on September 2017**.

SOME EXAMPLES

- [Bitcoin](#)
- Dash
- Monero
- Litecoin
- Ripple
- Verge
- Zcash
- ...



BLOCKCHAIN FACTS

Pros

- ✓ No central authorities
- ✓ Open access to everyone
- ✓ No country-specific
- ✓ High level of security
- ✓ Censorship resistant
- ✓ Immediate settlement

Cons

- ✗ High level of volatility
- ✗ Lack of regulation might turn into a problem
- ✗ Both anonymity and lack of anonymity might turn into a problem

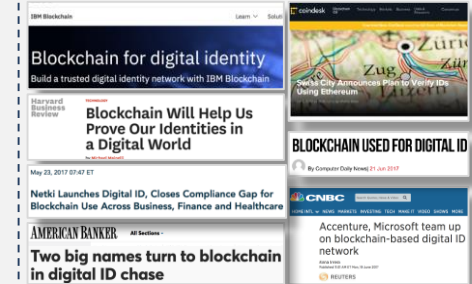
DIGITAL ID

DESCRIPTION

Issuing identity verification systems through blockchain technology could allow consumers to **verify their identity while there is no centralized storage of identity documents involved**. Moreover, it could empower people in developing countries with recognized identity. Blockchain offers an extremely **efficient way to capture, share and verify information**, and establishes a reliable, secure but relatively easy way for individuals to open a bank account, set up utilities, pay taxes, buy a car or make a purchase requiring personal ID.

SOME EXAMPLES

- **Hyperledger** (Credit Mutuel Arkea)
- **Eon**
- **Evernym**
- **HYPR**
- **Cambridge Blockchain**
- **Shocard**
- ...



BLOCKCHAIN FACTS

Pros

- ✓ High level of security (minimize identities frauds)
- ✓ High level of accuracy and accessibility
- ✓ Interesting breakthroughs (Voting, Citizenship, ...)

Cons

- ✗ Lack of regulation
- ✗ Lack of a commonly recognized standard
- ✗ Reliant on hackable ID data
- ✗ Central authorities might be required

ENERGY MANAGEMENT & DISTRIBUTION

DESCRIPTION

Blockchain could be used to develop a **peer-to-peer energy market**, which can guarantee that operational constraints are respected and payments are fairly rendered, **without relying on a centralized utility company or micro-grid aggregator**. Blockchain could be used to develop a digital contract permitting an individual party to **conduct and bill a transaction directly with another party (peer-to-peer)**. Moreover, it could be possible to develop a **decentralized energy trading systems** using blockchain technology, multi-signatures, and anonymous encrypted messaging streams, enabling peers to anonymously negotiate energy prices and securely perform trading transactions.

SOME EXAMPLES

- **Solarcoin**
- **The Brooklyn microgrid**
- **Powerledger**
- ...



BLOCKCHAIN FACTS

Pros

- ✓ Micro grid enabler (less dispersion, lower prices)
- ✓ High level of transparency

Cons

- ✗ Integration concerns
- ✗ Required interoperability and device standardization
- ✗ It is unlikely that individuals and companies will trade in the same market soon

FINANCIAL TRANSACTIONS

DESCRIPTION

Blockchain technologies can potentially allow the entire financial services industry to dramatically **optimize business processes** thanks to a new **secure, transparent and efficient system of data sharing**. The main benefits for the financial services would be: instant settlements, improved capital optimisation, reduced counterparty risk, improved contractual performance, increased transparency and reduced error handling and reconciliation. The most relevant applications could deal with:

- **Remittances**
- **P2P transactions**
- **Cross-border payments**
- **Derivatives**
- **Post-trade processing settlements**

SOME EXAMPLES

- **Artbyte**
- **Bitshares**
- **Liquid**
- **Neofund**
- **Stellar**
- **Transfercoin**
- ...



BLOCKCHAIN FACTS

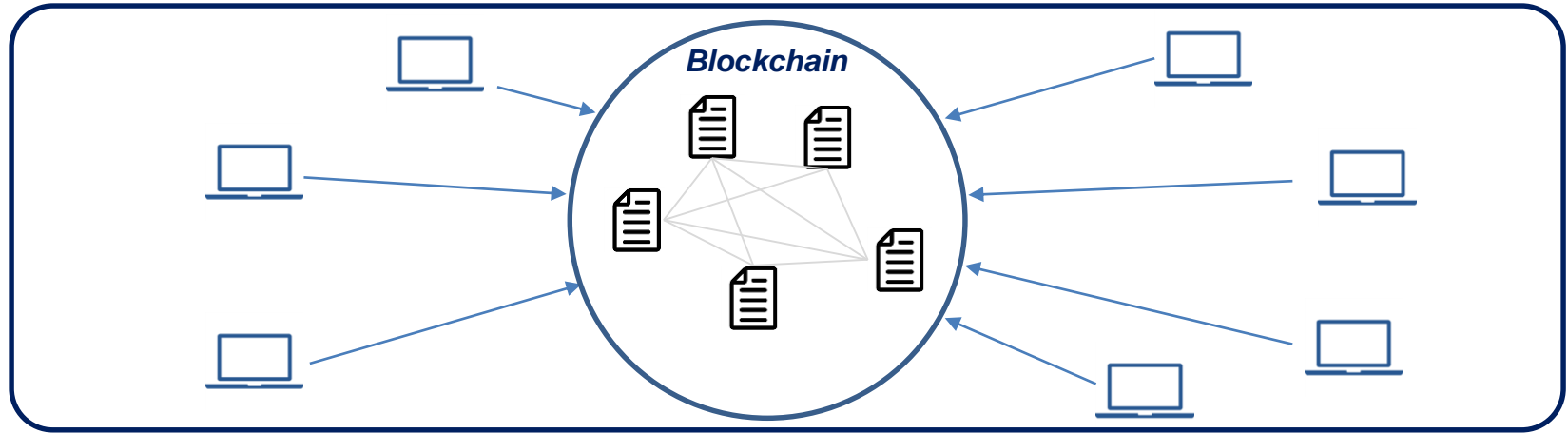
Pros

- ✓ High level of speed and transparency
- ✓ Possibility of providing banking services to unbanked people

Cons

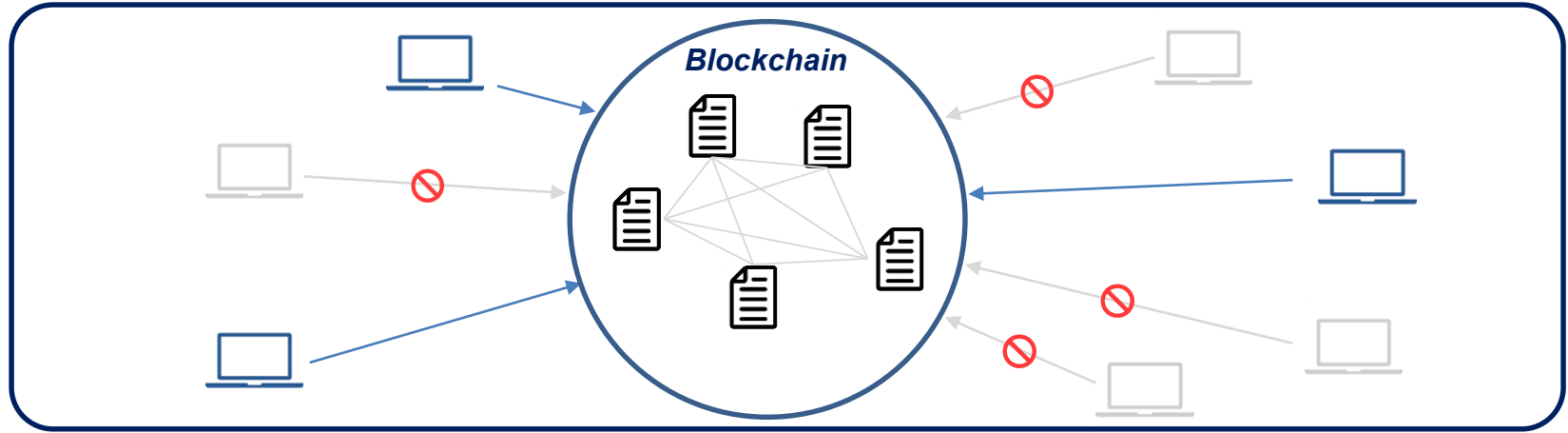
- ✗ Lack of regulation
- ✗ High instability of cryptocurrencies underlying the services

PERMISSIONLESS BLOCKCHAIN



- In a **permissionless blockchain** anyone can **read, send transactions and participate in the consensus** process. Permissionless blockchains are always **open source** – which means that the algorithm is completely public.
- They are mostly appropriate when a **network needs to be decentralized**. They are also suitable to ensure **full transparency of the ledger or individual anonymity**.
- **The costs are higher and the speed is slower** if compared to those of a private chain.
- The two most relevant examples of permissionless blockchains are **Bitcoin** and **Ethereum**.
- For this kind of blockchain, the most appropriate consensus algorithms are **Proof-of-Work** and **Proof-of-Stake**.

PERMISSIONED BLOCKCHAIN



- A permissioned blockchain is **kept centralized to one - or more - authorized users**.
- In permissioned blockchains, **only the authorized user(s) can confirm transactions**. **Read permissions may be public or restricted to an arbitrary extent**. Likely applications include database management, auditing, and more, that are internal to a single company.
- This kind of blockchain **enables greater efficiency** and allows transactions **to take place much faster**.
- Two significant examples of permissioned blockchains are **Hyperledger** and **Ripple**.
- For this kind of blockchain, the most appropriate consensus algorithm is the **Practical Byzantine Fault Tolerance**.

DECENTRALIZED CONSENSUS

Blockchain is, basically, a network-distributed database whose nodes continuously record information in “blocks”, assembled in a unique “chain”.

To safely realize such operation, it is necessary to properly solve the “**Byzantine Generals Problem**”. In other words, the problem is **to find an algorithm that ensures that the loyal users will reach an agreement on the current state of the ledger.**

Achieving decentralized consensus means to **share information without relying on a central authority.** **Currently,** there are 3 main **consensus mechanisms algorithms** that fulfill this task:

1

**Practical Byzantine
Fault Tolerance
(PBFT)**

2

**Proof of Work
(PoW)**

3

**Proof of Stake
(PoS)**

CONSENSUS MECHANISM – ANALYTICAL COMPARISONS

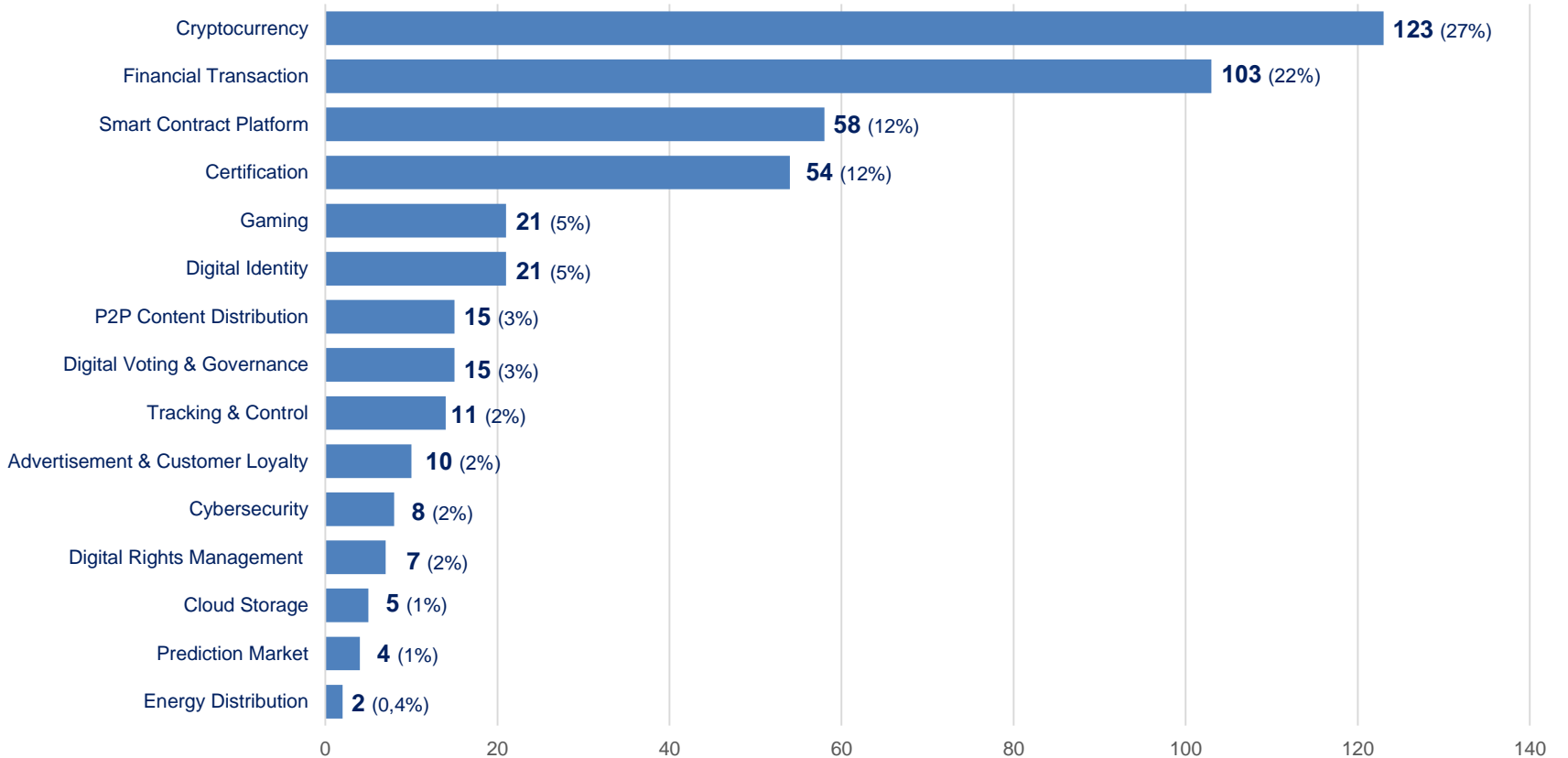
Features	PBFT	PoW	PoS
Node Identity Management	Trusted, nodes need to know IDs of all other nodes	Untrusted, entirely decentralized	Untrusted, entirely decentralized
Number of nodes	Limited	Unlimited	Unlimited
Performance (n° of tx/sec)	High	Low	High
Performance (latency)	Low (matches network latency)	High (lottery based on hash-rate problem solving)	Medium (lottery based on stake distribution)
Adversary	≤ 33% voting power	≤ 50% computing power	Depends on the specific algorithm used
Power Consumption	Low	Very High	Medium
Token Presence	No	Mostly yes	Mostly yes



3. RESEARCH RESULTS

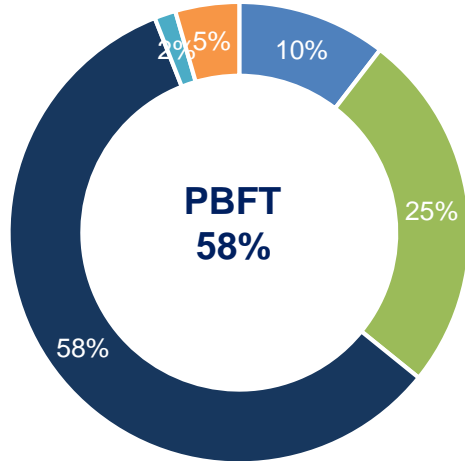
DISTRIBUTION BY APPLICATION

N. of applications (% on total)

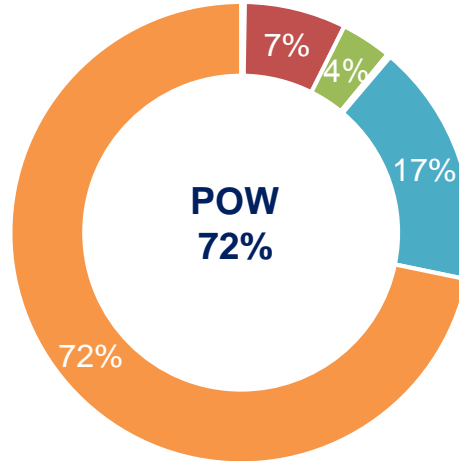


CONSENSUS MECHANISMS

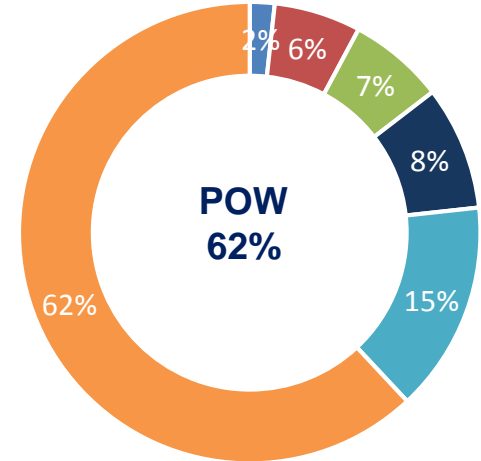
Permissioned



Permissionless



Overall



 PBFT

 POW

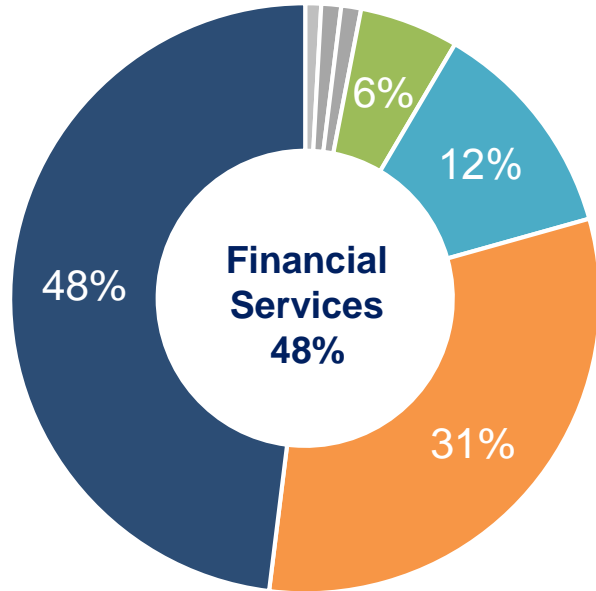
 POS

 FBA

 Hybrid

 Other

DISTRIBUTION BY INDUSTRY



- Financial services
- Consumer services
- Technology services
- Public administration
- Telecommunication
- Healthcare
- Utilities

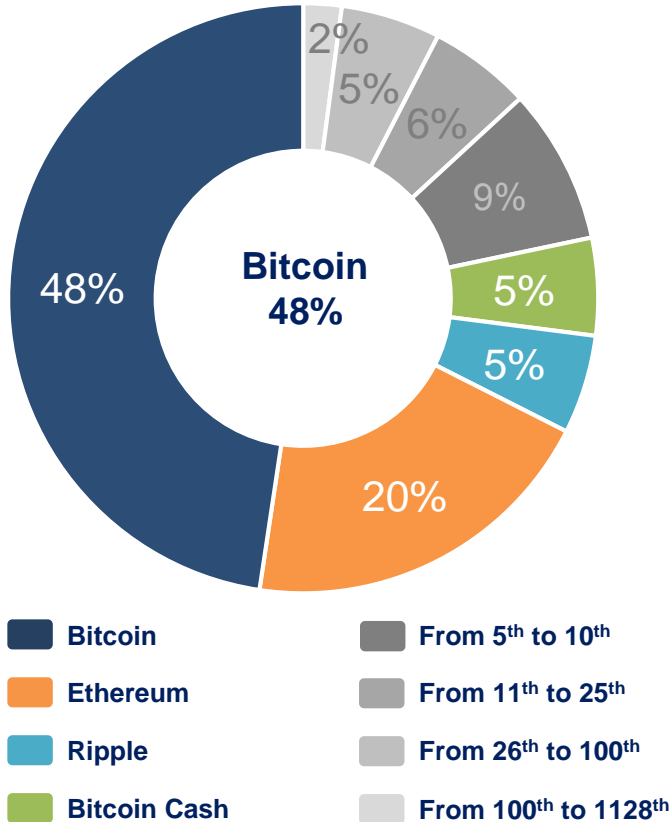
48% **Financial Services** | Mainly due to the presence of **cryptocurrencies** and **financial transactions**

31% **Consumer Services** | Mainly referring to **certification services** and **gaming DAPPs**

12% **Technology Services** | Composed for the vast majority by **smart contract platforms**

6% **Public Administration** | Mainly composed by DAPPs focused on **digital voting & governance** and **digital identity**

MARKET CAPITALIZATION [1/2]



48% **Bitcoin (BTC)**

Price: \$ 3954.23
Circulating Supply: 16 Mln
Volume (24h): \$ 1,108,050,000

20% **Ethereum (ETH)**

Price: \$ 289.3
Circulating Supply: 94 Mln
Volume (24h): \$ 323,075,000

5% **Ripple (XRP)**

Price: \$ 0.195
Circulating Supply: 38,343 Mln
Volume (24h): \$ 92,229,300

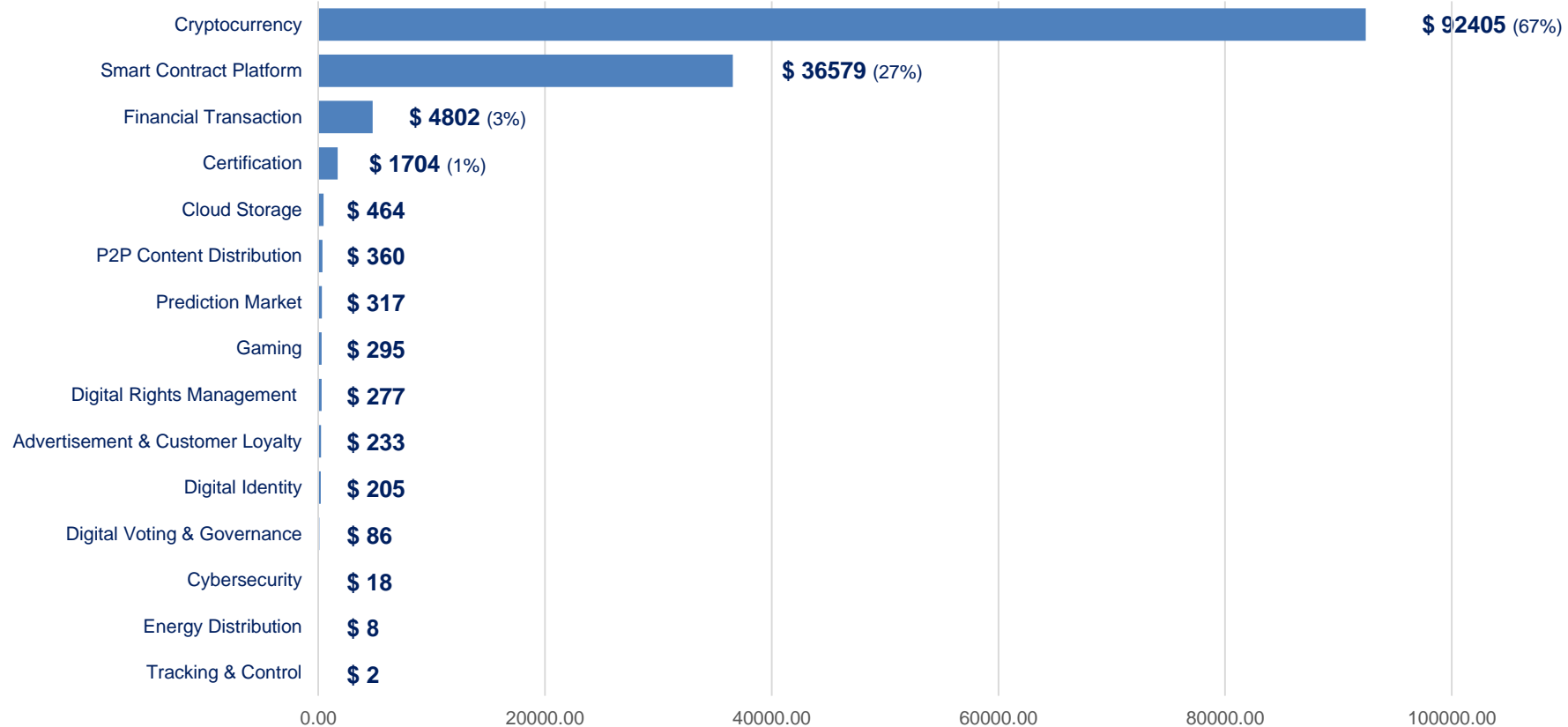
5% **Bitcoin Cash (BCH)**

Price: \$ 442.75
Circulating Supply: 16 Mln
Volume (24h): \$ 137,899,000

MARKET CAPITALIZATION [2/2]

SEP 27TH
2017

USD Millions (% on total)





Permissionless cryptocurrency

A **permissionless, PoW cryptocurrency** represents the **status quo** blockchain protocol. In numerical terms, there is no comparison - cryptocurrencies account for over **60% of the blockchain market**, and **PoW algorithms** are used in over **50% of the protocols**.



Bitcoin Dominance Effect

Bitcoin is the blockchain project **with the greatest economic impact**, with a capitalization equal to **48% of the entire market** (and the average before the 2017 boom was 85%). In addition, in many cryptocurrency exchanges, **Bitcoin is the reference currency**, not the USD.



Growing market

In any case, the **ecosystem is flourishing**. Apart from the industries already recognized by the literature, there are **others where blockchain might show great potential**: advertisement (\$ 233 Mln), digital rights management (\$ 277 Mln), predictive markets (\$ 317 Mln) are just a few examples.

