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**ERASMUS + Chaise Project - Module 2: Regulation,
Legal aspects and Governance of Blockchain systems
Lecture 3: Blockchain ecosystem**

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Module 2: Regulation, legal aspects and governance of Blockchain systems

Lecture 3: Blockchain ecosystem

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1 INTRODUCTORY PARAGRAPH

In this second module, we focus on the way blockchains are governed and regulated. In this second lecture, we focus on blockchain ecosystem.

First of all, capturing an ecosystem organisation is not so obvious. According to your best knowledge, can you define precisely what “ecosystem” means and how an ecosystem can be characterized? Is there one or different kinds of blockchain ecosystems? How can we identify a blockchain ecosystem? >Who are the main actors? How do these actors interact with their environment? How are they organised, how do they manage value? How can you identify a blockchain ecosystem?

All these questions and their answers are not so simple. Let’s think and brain storm regarding these questions

To allow describing Blockchain ecosystems, this lecture will provide you the necessary knowledge to characterize an ecosystem, identify the main characteristics of blockchain ecosystems before introducing some usage-based blockchain ecosystems characteristics.

To sum up, this lecture addresses different learning objectives regarding

1. Ecosystems, identifying key concepts and characterizing ecosystem boundaries, structure and interactions
2. Blockchain ecosystems, paying attention to the blockchain context, the ecosystem structure and key actors identification
3. Usage-based blockchain ecosystem, learning how usage can be characterized and providing concrete examples of blockchain ecosystem models

2 LECTURE NOTES

Based on these learning objectives, this lecture is organised in three main parts:

1. Introduction to ecosystems, identifying key concepts and organisation based on the systems theory leading to formalize ecosystems characteristics to support their description.
2. Blockchain ecosystems are described by identifying key characteristics based on the generic ecosystem description picked from part 1 before introducing a typology of the main actors involved in blockchain ecosystems
3. Usage-based blockchain ecosystems are presented. This last part identifies first the way usage can be characterize so that the constant evolution can be captured before proposing some illustrations focused on some current blockchain ecosystems

2.1 Ecosystems: key concepts and characteristics

2.1.1 Definition and key concepts

First of all, let's define what ecosystem means. The word ecosystem is defined as eco + system. As system may be understood according to the systems theory, i.e. a group of independent and interacting components that forms a complex whole, Eco may stand for ecology or economy. If we pick basic definition from dictionaries, namely Cambridge and Collins dictionaries, both of them bring to light few points:

1. An ecosystem is a complex object consisting of different components
2. It must be considered as a dynamic system: components "live" / "work" together leading to interactions between them and between components and their environment
3. It refers to complex systems which behaviours take advantage of the synergy issued from components interactions

These basic definitions show that an ecosystem is a "special kind" of system which includes "living" components or a set of business activities. This is quite close to the systems theory and system science. Defining an ecosystem involves first defining precisely the system by setting

1. Clear boundaries, i.e. rules to identify what is a part of the system and what belongs to its environment. For example, the system associated to an information system hosted on an external IaaS platform includes only software components and the infrastructure belongs to the environment whereas both software and hardware belongs to the system if the infrastructure is not outsourced. By defining these boundaries, we can capture the way the system interacts with its environment
2. A global structure including different components. For example, an information system includes both "human" components, i.e. people in charge of a manual process and IT components such



as DB, software components, network infrastructure... Each of these components can be described recursively as a system including sub-components.

3. What the system does, i.e. its purpose / functioning.

To sum up, a system has a structure in charge of different activities to meet the purposes for which it has been designed. An ecosystem consists in autonomous living components or business activities, interacting together. But how can we capture this dynamic behaviour and the system organisation?

Based on the system characteristics, models are sets describing the system according to different points of views. Models can describe the system static organisation and properties, the information it manages, decision / control process associated to its behaviour. This leads to different models for example data models, process model, decision model, control models...

Interactions between components or with the environment are also described by the models. Characterising these interactions leads to describe information / material / decision flows between components or between the system and its environment. Interactions with the environment allow capturing external information / material as inputs to the system and providing material / information as output of the system.

Such a description is quite close to the control theory but of course, inputs and outputs may be more complex

2.1.2 Business Ecosystems characteristics

As stated in the basic definition, a business ecosystem relies on a business community, in charge of business activities and working together. This lead to identify first the business purpose related to the business activities achieved by he community. How can we describe these activities, their purposes? For short, business means buying or selling a product / a service. We can identify the ecosystem purpose by identifying the kind of product / service it produces. It means that either the community members will produce the same kind of product / service, sharing common regulation rules, reference knowledge... or that they will contribute to the production of a kind of product / service.

The ecosystem community, which can be used to “draw” the business ecosystem boundaries, gathers multiple parties working to meet the common purpose. Focusing on the way the ecosystem community is structured, different organisations can be identified:

1. The business community can be associated to a business area. In such case, it gathers independent organisations that are linked thanks to their business activity field, sharing a common knowledge and know-how. Organisations may cooperate according to a “one shot” P2P interaction (for example a simple order). In such case, there are no real interactions between members of the community, each of them defines processes, fitting the business field regulation rules, according to its own value chain. Consequently, the global ecosystem does not take advantage of community synergy.



2. The business community can be organized in a centralized way, gathering different partners of a main stakeholder. Such a community is structured hierarchically as each member of the community can also develop its own ecosystem gathering its own hierarchically-dependent partners. Interactions between community members are directed by the hierarchical organisation, following the main stakeholder value chain. Supply chains can be seen as examples of such business ecosystem.
3. Collaborative networked organisations denote a community where each member may collaborate with others, taking advantage of the networked value chain. Such community organisation requires important coordination between two or more parties while working on the common activities, leading to distributed decision organisation to improve the global synergy in a win-win vision.

The business ecosystem also interacts with its environment by providing the products / services associated to its purpose. Of course, these interactions can be defined “formally” as orders and delivery operations. These interactions may be associated to the value they carry. This leads to new questions: how can we define and measure the value? Is there a unique and universal value or does value require a more complex definition? Regarding “simple” production system, value may be defined as the financial value associated to the price or the added-value of the product / service. It may also be defined according to the social impact, the usefulness of the service or the product, the environmental impact, i.e. providing an environmental benefit or consuming environmental resources, a cultural impact... Let’s take an example from the blockchain field. Creating a NFT transaction can be associated to the financial value of the transaction, the Proof of Work block validation has also an environmental impact due to the energy consumption whereas the NFT development impact the artistic creation, having a cultural impact... Defining a multi-criteria value associated to the global impact of a system on its environment requires aggregating these different impacts. This is often done by integrating “financial regulation” i.e. integrating costs / benefits associated to non-financial impact. For example, adding carbon taxes or costs related to protection measures for the environmental impact...

While value represent a measurable impact on the business ecosystem environment, it cannot fully describe the business ecosystem. Value is not created ex nihilo: it requires an operating system to produce the product or the service. This operating system consists in different interacting components, each of them is in charge of parts of activities contributing to the value creation. The ecosystem community is organised to support value creation, defining each member potential role and relationships with partners / competitors. These interactions are managed according to the pre-defined decision system, integrating decision flows, the way activities and value are shared. Of course, sharing activities and value represent a risk for the different partners. The challenge is to set a win-win organisation so that cooperation can benefit from an improved synergy. This involves paying attention to the business context and business development strategy.

Depending on the business and market context, different business strategies can be used such as the Competitive strategy (Red Ocean), new industry creating demand strategy (Blue Ocean), sustainability strategy (Green ocean) and survival-sustainable strategy (Black ocean).



Porter introduced Red Ocean strategy in 1980. It denotes a highly competitive environment where enterprises have to “fight” to survive (red ocean is introduced to reflect the bloodshed due to the hard fighting conditions). In this case, the market is well known and differentiation or lower costs are key elements to survive. Value is measured with monetary units.

Kim and Mauborgne introduced Blue Ocean strategy in 2004. It is associated to highly innovative industries, creating new demands and market. In this context, innovation is the key to survive, leading to high-value product / service creation. Such new industry may be a result of the red ocean necessary differentiation. In this case, the innovative company alters the existing market border and creates a new demand. As in the Red Ocean, value is mostly considered in monetary units.

Purple Ocean strategy denotes a mix between red and blue ocean strategies. Few differentiations create new demand and possibly new parts of the market. Then according to a longer-term point of view, the market becomes well known and more competitive.

Green Ocean strategy has been introduced recently, taking into account sustainability, environmental impacts. It takes advantage of both blue and red ocean strategies by exploiting new demand in a green market space (i.e. paying attention to the environment), introducing self-competition as a key strategy to pursue continuous improvements. However, it breaks the differentiation/ low cost alignment involved in both red and blue ocean strategies to set sustainable growth alignment.

Black Ocean strategy consists in “closing the market for competitors”, i.e. when high investments must be done with high-perceived risks, the temptation consists in “closing the market”, may be using unethical means, to avoid new competitors to survive. The existing rules are changed so that unfair advantages can be used to survive.

2.2 Blockchain characteristics

After introducing what an ecosystem is and the way it can be characterized, let’s come back to our blockchain context. In this section we will focus on the blockchain key characteristics to fix their ecosystems.

2.2.1 Context and key characteristics

As an IT system the blockchain ecosystem can be considered as a service system. Whatever the blockchain technology is, different parties are involved in a blockchain-based system, each of them adding value depending on the service they provide. As transaction fees are paid using the blockchain token, it leads to build « closed » ecosystems associated to the different blockchains. Only few actors develop a new business to support token transfer from one blockchain to another.

The blockchain interacts with its environment by providing a service to clients. As in other service system, the “client experience” and the value-added provided by the blockchain ecosystem are key differentiator to favour its large adoption. Consequently, it requires heavy investment for the supporting infrastructure, developments... increasing the QoS and QoE.



Of course as other economic system, a fair balance between Investment and Return On Investment is necessary to have a sustainable organization. If the blockchain is used as a fiat currency, note that speculation is at the core of the ecosystem as “payments” are made thanks to tokens (i.e. the blockchain own “currency”).

As a distributed system, we have to pay attention on the way the ecosystem is structured. Is there competition or co-operation between parties?

Focusing on the core process of the blockchain, validating a transaction relies on competition between different competitors (either miners for PoW or token owners for PoS systems). Co-operation can occur between competitors, sharing resources (and profits) to be able to validate transactions. This is mostly done in PoW systems. Whereas the consensus management rule is supposed to manage interaction between block validators, “off-chain” interactions between parties can occur, either to improve the validation infrastructure or to speculate on the token value.

External incentives can also impact the ecosystem organisation. Although blockchains are highly distributed systems, without “real world” borders, national incentives can also affect the ecosystem organisation. These incentives may refer to the blockchain business development as the Initial Coin Offers (i.e. seeking to raise money to develop a new coin), to the legal status of smart contracts, in order to promote and develop Blockchain usage. Focusing on the “physical” infrastructure, energy and data-centres subvention to develop “sovereign” blockchain offers can also affect the ecosystem organisation by providing extra support to dedicated actors.

Identifying the ecosystem boundaries involves identifying exactly its trading / catchment area. Of course, as the blockchain provides a virtualized service, the catchment area is heavily related to the provided service. As a disruptive technology, different kinds of customers can be considered, including final customers, intermediaries providing “extra accessibility” services...

For permissioned blockchains, there’s a well-known ecosystem perimeter, i.e. the provided service and the parties involved in the ecosystem are well-known. Collaboration agreements are often set between business partners, allowing a mid-term cooperation and shared processes may be set. To sum up, the ecosystem boundaries are rather fixed and follow the collaborative business organisation own boundaries.

For permissionless blockchain, the ecosystem is semi-opened, leading to more “fuzzy” boundaries although the “core ecosystem” is fixed. Initial core contributors (i.e. investors, blockchain developers and a first set of miners/transaction validators) fix the ecosystem governance rules and the trading area. Then extra validators can join the ecosystem provided that they accept the ecosystem rules. Regarding users, they are mostly related to the trading area and “companion” usages may emerge while “intermediaries” provide extra services on the initial ecosystem.

2.2.2 Actors typology

To sum up, there are different kinds of actors in the blockchain ecosystem. First, blockchain developers and block validators are the core of the blockchain ecosystem. To support their activity, they interact

with their environment and more precisely with infrastructure providers, i.e. hardware and cloud providers as well as distributed system management tools to optimize the infrastructure.

In order to identify actors / component ecosystem we can use the Deloitte’s multi-layered Blockchain service model. This technology stack is based on competencies and is inspired by the IT market and allows identifying 3 main types of parties involved in the ecosystem: Infrastructure contributors, core platform services, application oriented services.

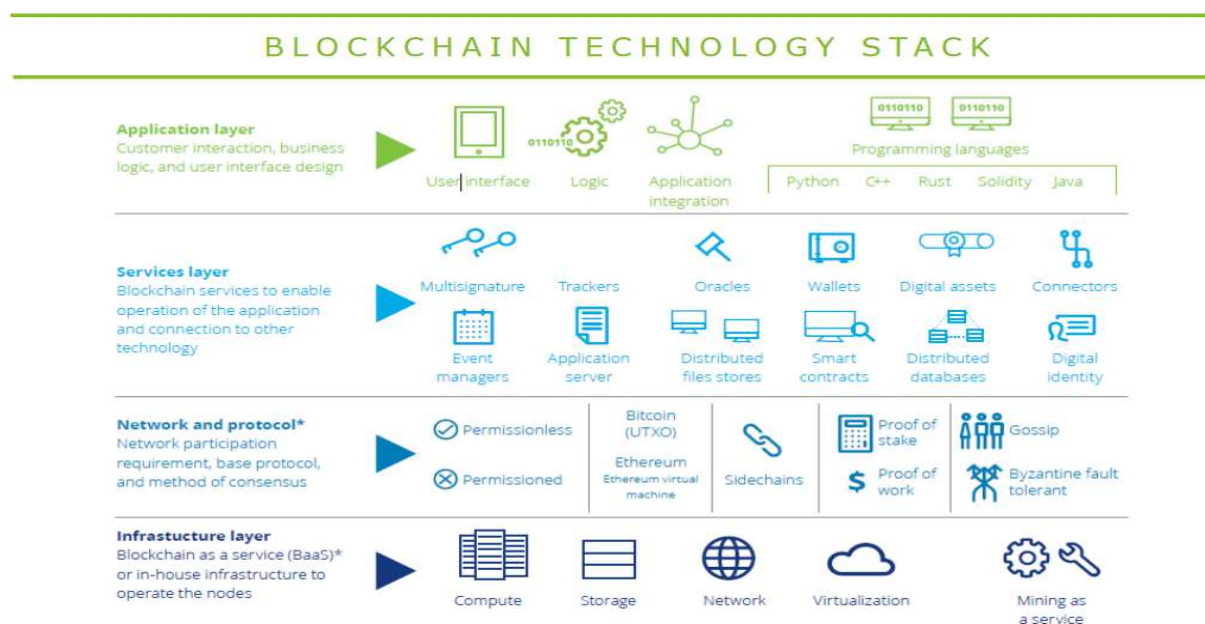


Figure 1. Blockchain stack picked from <https://www2.deloitte.com/content/dam/Deloitte/in/Documents/industries/in-convergence-blockchain-tech-stack-noexp.pdf>

Globally, the blockchain technology stack is organized into 4 levels

1. Infrastructure layer: this layer includes both computing resources AND mining resources. Basically, transaction validation requires complex and efficient computations. This requires efficient processors, adapted to the mathematical computation, adapted computation software, including parallel computation management, scalable computing resources management (i.e. cloud and network resources) and ledger storage facilities. The development of mining as a service involves being able to share federate the necessary resources to validate the transaction. While operating on different blockchains, this service requires also a strong coordination of the transaction validation processes to optimize the way resources are used. Co-operation between “mining providers” can also be supported in this mining as a service organization.
2. Distributed ledger management is the core of the blockchain technology, it includes the development of blockchain access control to support permissioned or permissionless blockchain enactment. Blockchain protection, avoiding perfidious transaction validators, must also be processed here. Development related to this layer deal with consensus protocols components to support consistent distributed transaction validation. These protocols are used by lower level

components in charge of the mining process. Tokens management components refer to the strategy of the token attribution.

3. The blockchain service layer consists in components used to connect the blockchain to other applications / simply use the blockchain coins. Depending on the blockchain technology and the target usage, it can include different components used to manage the crypto currencies on the user side (i.e. wallets), authentication, i.e. prove the digital identity / to manage signature (and even multi-signatures) and smart contracts execution by managing events or setting oracles. It also includes components to connect the blockchain to other applications by providing connectors or managing application servers or distributed database as well as digital assets management features
4. The application layer is devoted to services allowing the integration of the blockchain technology in digital systems, i.e. providing a convenient user interface or improving application integration.

To conclude, Blockchain is a “rather new” and disruptive technology, leading to various and dynamic development. From this blockchain ecosystem synthesis provided by Reddit, you can notice that lots of actors are involved in blockchain project ecosystems based on the target business area. Development strategy is heavily related to the potential market. Paying attention to crypto-currencies, their development is heavily coupled to FinTech and Value exchange so that more and more users can join the ecosystem to interact with the blockchain market.

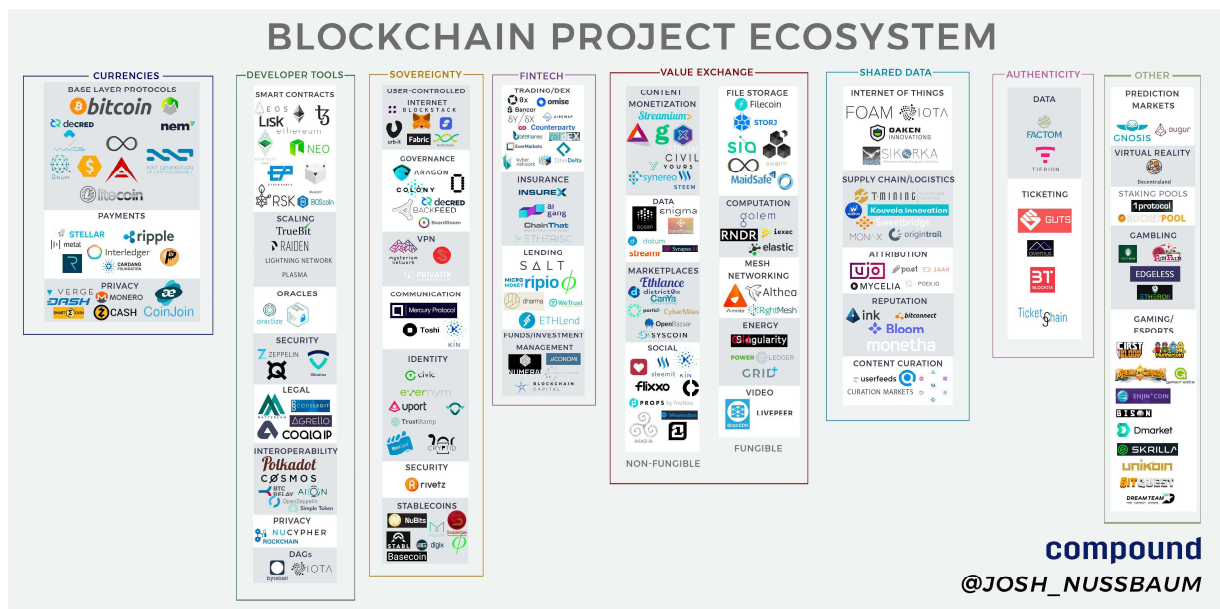


Figure 2. Example of Blockchain project ecosystems picked from https://www.reddit.com/r/CryptoCurrency/comments/76x6cx/crypto_ecosystem/

2.3 Usage-based blockchain ecosystems



Is there a unique blockchain ecosystem or are there multiple and independent blockchain ecosystems?
What is the blockchain business strategy model?

At first, let's qualify the business environment. Even now, blockchain development leads to consider blockchain as a disruptive technology creating a new demand. So, we can say that blockchain is related to the blue ocean strategy. Nevertheless, if we consider the blockchain core technology, the mining industry is a highly competitive environment adopting the red ocean strategy. Different developments on the blockchain sounds as Purple Ocean differentiations whereas the non-interoperable markets using semi-private blockchain to support distributed applications may be seen as "unfair advantages" associated to a Black Ocean strategy. Such a "rainbow" business environment shows that there are different ecosystems depending on the type of blockchain.

2.3.1 Characterizing usage oriented ecosystems

Identifying ecosystem development based on blockchain usage is heavily related to blockchain characteristics: it provides trust, immutability and consensus. In the truth about Blockchain (<https://hbr.org/2017/01/the-truth-about-blockchain>), a 2-dimension classification is proposed to evaluate new blockchain features: degree of novelty and amount of complexity and coordination.

1. Single use are associated to less costly and focused solution such as payments / micro payment. They provide only low novelty and require low coordination. The blockchain is used to certify and store transaction in its distributed ledger instead of paying a trusted party.
2. Localization quadrant is associated to high novelty and reduced coordination, requiring only few users to set the business. Some Fintech applications such as providing a distributed ledger to process transactions (such as the technology used for the Nasdaq) belongs to this quadrant.
3. Substitution is a low-novelty but require high amounts of users. Such applications use the blockchain as a new medium to exchange gift cards, certify diploma, shipments documents...
4. Transformation involves high novelty and high amounts of new users. This quadrant is mostly related to smart contract. This involves rethinking applications to fit the digital transformation. For example, sharing energy with neighbours involves new economic models and large scale. For example, new service models extending the "pay per use" model to a "pay per consume" one can be developed to manage digital rights, Ads...

2.3.2 Examples

As stated in the introductory lecture on blockchain background, Blockchain 1.0 has been introduced as the Bitcoin and addresses the fiat currency area. These crypto-currencies are not interoperable and blockchain technology has been introduced as a support for a trusted P2P currency transfer without any intermediary, except the blockchain. Nevertheless, the ecosystem is not reduced to the "core" miners, it also requires wallet managers, merchants, brokers, traders, crypto-startups providing crypto-currency trading apps... as well as long term investors are necessary

Blockchain 1.0 has some limits that affect their ecosystem:



1. Transaction delay makes the blockchain 1.0 hardly scalable. This limit impacts the ecosystem regarding the computing resources required by the potential validators community
2. Crypto-currency “isolation”: there’s no way to “mix” different cryptocurrencies (such as Bitcoins or Counterpartycoins). This has led to the development of crypto-asset brokers and traders so improve crypto-asset trading
3. Crypto-currency price, expressed in traditional currencies, are highly volatile. This is due to the intrinsic organization of the Proof of Work Blockchain model where miners are paid using cryptocurrencies while they must use traditional currencies to pay for the computational resources and energy. As a consequence, they can speculate on the crypto-currency to get the best return on invest.
4. Fiat currencies are not currencies as their value is not guaranteed by goods (such as gold or any state income which is related to real valuable goods). They must be considered as tokens, not as currencies. As a consequence, they are not “recognized” by the different states. Their pricing is heavily dependent of the number of its users. It may change from one place to another as there’s no international regulation.

This leads to a competitive FinTech ecosystem where value is mostly related to trading. From this illustration, we can see that the core of the ecosystem is built on exchange platforms, valuing the asset transfer from one crypto-currency to another one. Based on these platforms, trading services such as portfolio management, analytical tools, trading bots, trading exchange services are developed. A key point for such business development is related to the way the catchment area is increased, i.e. increasing the total number of transactions and users interacting with the ecosystem. This is shown by the integration of influencers, used as marketing development support in this ecosystem.

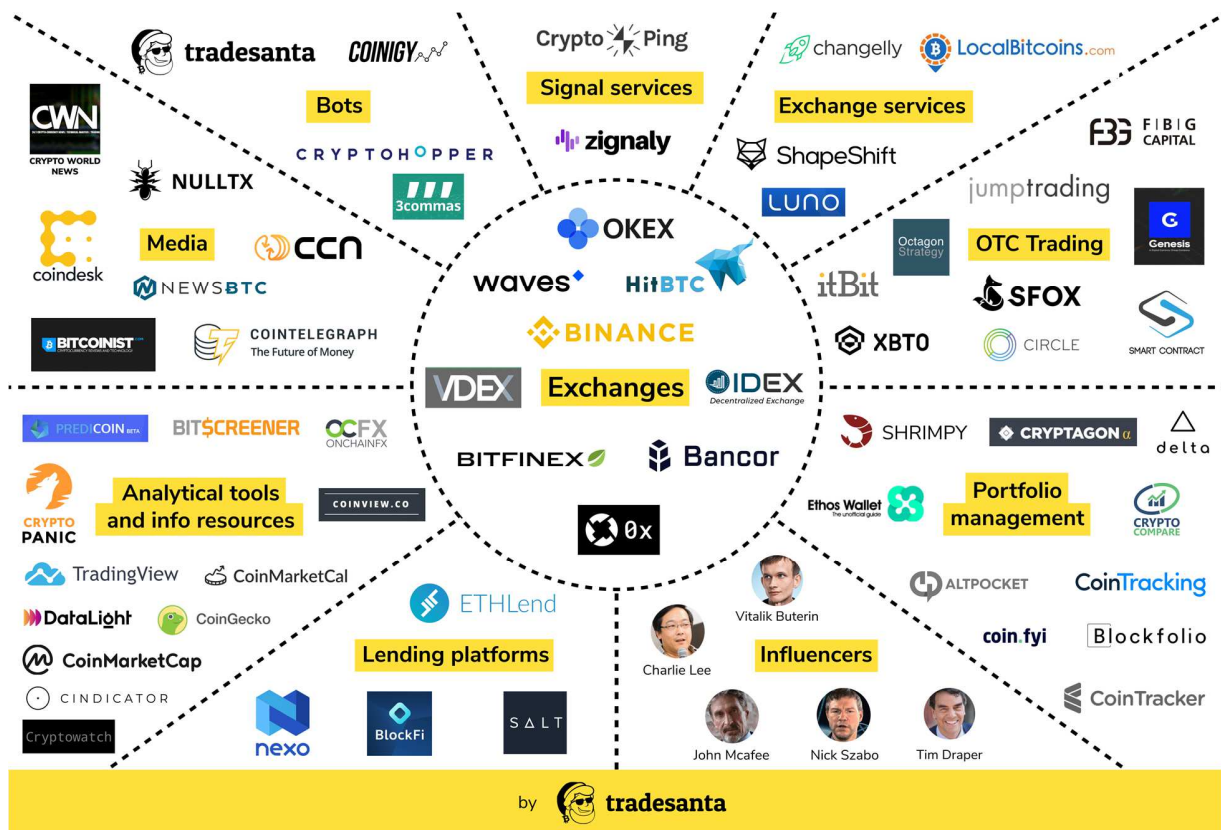


Figure 3. Crypto-currency ecosystem picked from from <https://tradesanta.com/blog/cryptocurrency-trading-ecosystem>

Blockchain 2.0 has introduced smart contracts which couple distributed application AND contract-based organisations. Basically, a smart contract is a computerized transaction protocol. As such, the contract execution is fully automatized. The code is publicly stored and operates on the blockchain. It is executed according to the “contract terms”. As consequence a smart contract mixes both technological and legal views.

The smart contract execution is associated to events and assets transfer. This may be seen as a link between a token and a “valuable” service. As in the “real” contracts, contract terms represent the valuable good/service that must be executed to support the token transfer so that the transaction payment is included as well. Paying attention to the digital economy organization, smart contracts appear as an event driven organization that may be opposed to the traditional control flow organization of IT systems.

Focusing on the ecosystem, as in the Blockchain 1.0, it requires a core of active investors, dedicated infrastructure and network and protocol services. Similarly, this leads to establish different and non-interoperable systems requiring exchange services. To fit the digital economy development constraints, adapted infrastructure and scaling services must be offered as well as event management features. Lastly, application layer related tools may be developed to fit specific business areas requirements. In this Ethereum ecosystem illustration provided by Redi, we can notice that two specific business areas

are mentioned: the digital asset management related to the specific NFT part of the ecosystem and the decentralized finance (DeFi) which include numerous actors.

Ethereum Ecosystem

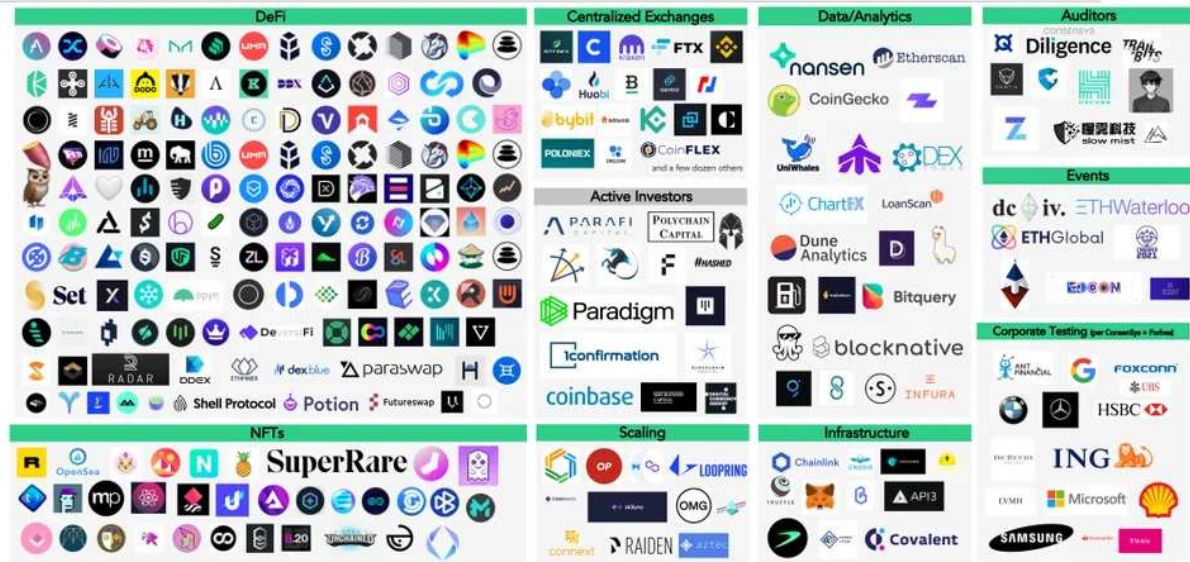


Figure 4. Ethereum ecosystem picked from from https://www.reddit.com/r/ethereum/comments/m9sggj/ethereum_ecosystem/

Blockchain 3.0 has been designed to overcome limits of Blockchains 1.0 and 2.0 such as

- lack of scalability: the delay related to transaction validation do not fit the real-world economic constraints
- lack of interoperability: blockchains are isolated so there's no way of sharing transaction / data / tokens, making harder complex process authentication when parts of them are registered transaction in different blockchain systems
- lack of sustainability: the energy consumption and the computation costs involved in the public Proof of Work based blockchain make this technology "unsustainable".

There are several potential distributed applications areas, including Fintech, healthcare, gaming, education... as shown by the eosio dApps landscape

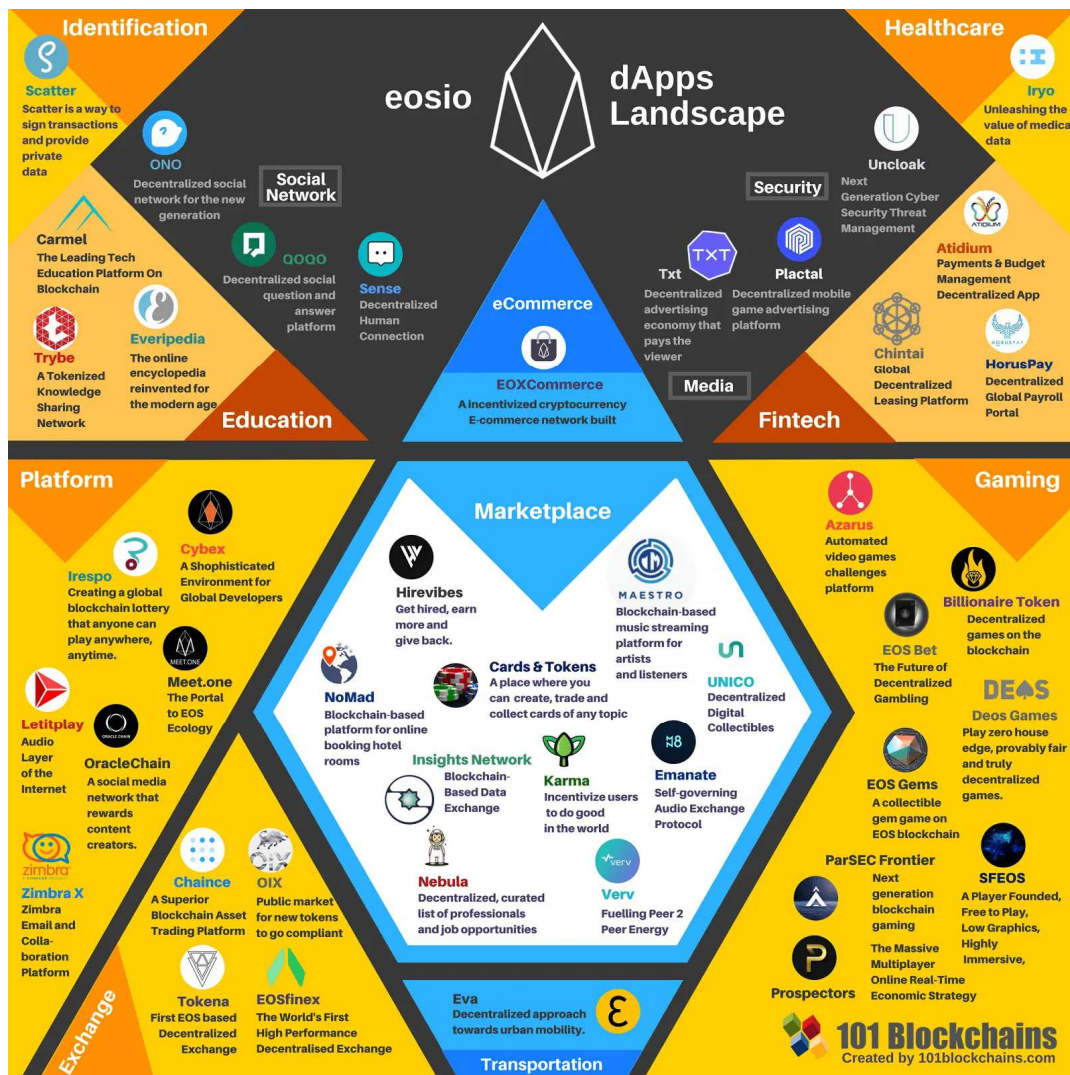


Figure 5. Example of Blockchain 3.0 ecosystem picked from <https://101blockchains.com/eos-dapps-landscape-complete-list/>

2.4 Conclusion

In this lecture we have introduced the basic knowledge to characterize an ecosystem, i.e. identify its boundaries, key participants, internal structure and the interaction with the environment. Focusing on the blockchain ecosystem, we have proposed key characteristics to identify ecosystems before presenting usage-based blockchain ecosystems. The blockchain market is a fast-growing one, leading to different ecosystems enactment depending on the technology used. By now, FinTech have largely taken advantage of the blockchain 1.0 and 2.0 technology, organising a decentralised finance area. Nevertheless, the core blockchain technology with its intrinsic event-based transactions can appear as the “internet missing element” to develop new digital economy support. As shown on this figure several



business areas are addressed by the current blockchain technology and further works related to Blockchain 4.0 adoption in the Industry 4.0 context will also serve the web 3.0 development.

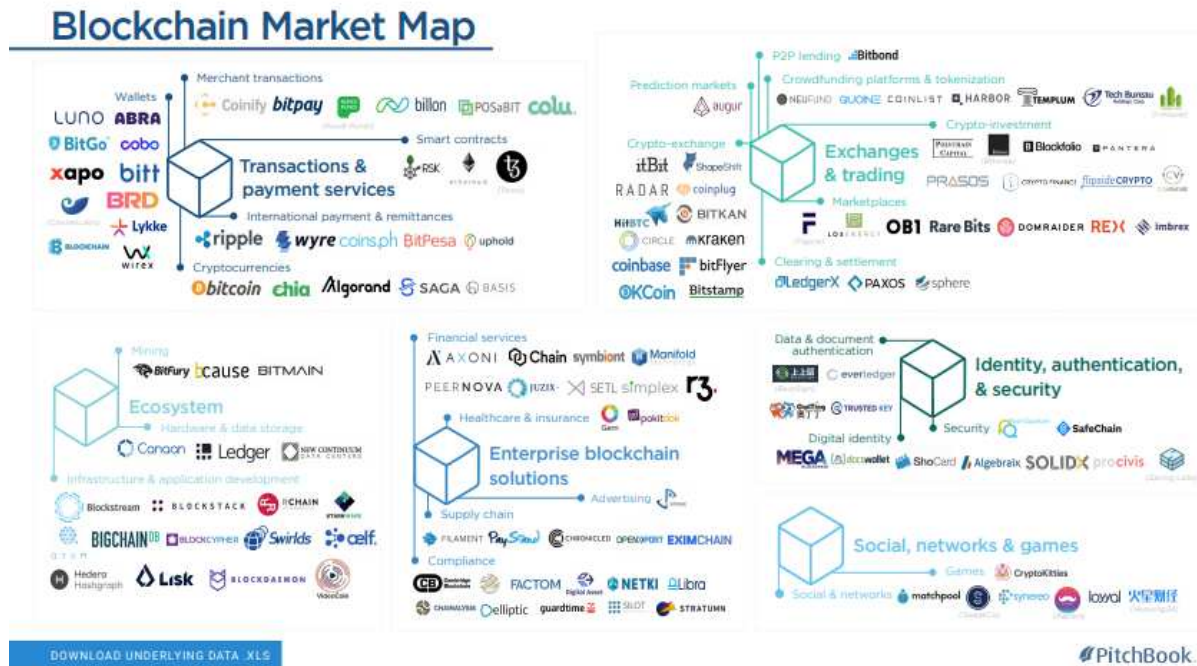


Figure 6. Blockchain market map picked from <https://medium.com/humble-ventures/blockchain-ecosystem-explained-in-one-chart-68bdc5e18335>



3 PRACTICAL EXERCISES

This practical exercise shows how you can identify some blockchain regulation and governance challenges. The case study used in the different exercises from this module is based on a supply-chain / industry 4.0 case study.

Let's consider the organisation of a "producer to consumer food supply-chain". Different producers are involved in the food procurement and transformation. Each member of the supply-chain ecosystem can integrate its own suppliers in a "sub-supply chain". In order to eliminate wastes, the supply chain is managed in a Just in Time strategy. Increasing the product quality and the production transparency leads to track each product / transformation process so that consumers can be called in case of trouble.

Identify the blockchain ecosystem and its interaction with its environment according to this context

To solve this problem, you need to identify

- The business-oriented ecosystem context (target participants, key evolution management)
- The core blockchain ecosystem boundaries
- The usage-based ecosystem

For each topic you need to ask some Who / What / For What / From where / Why / How questions

- The business-oriented ecosystem relies on the collaborative networked production organisation. As this organisation is rather partner-centered, identify the different types of participant (main stakeholder,...)
- Focusing on the business organisation, identify the interactions between business partners and relate it to the blockchain requirements
- Identify also the different interactions the business organisation has with external actors (motivation, type of interaction...)
- Regarding the core business function: identify (from previous solution you've built in lecture 1 and 2) the type of blockchain that should be set. Identify the core blockchain participants (do not forget infrastructure support participant). Identify the exact role of each kind of participant and the type of interaction they will have.
- Paying attention to the usage, identify if extra participants are required to improve the interaction with external users.

Analysing the requirements shows that:



1. Focusing on the business organisation, a partner centred organisation is set. It means that main participants of the supply chain must be involved in the business ecosystem. "Side participants" may also be concerned (participants associated to sub-supply chain of a main participant)
2. According to the business model, these participants interact using supply / delivery relationships. The product tracking is associated to delivery interactions. It should integrate the participant "production signature" but the sub-interactions involved in the participant own process should not appear.
3. We can identify different kinds of actors having interactions with the collaborative organisation:
 - a. End users: they just want to get more information on the product they buy
 - b. Sanitary regulators: they want to access to trusted tracking data, including precise production identification
 - c. Transportation partners may be interested by reporting extra transportation condition.
 - d. Business partners (resellers...) can also take advantage of this quality process
4. Focusing on the blockchain ecosystem: the key question it may be a hybrid blockchain. A Blockchain as a service model may be used so the ecosystem must include developers, infrastructure support. Founding "investor" members are associated to the business ecosystem
5. Extra services development can be provided to improve the Quality of Experience for end users. Other services related to "external business partners" can be developed by these partners to integrate this tracking information in their own information system.



4 CASE STUDIES

Case study Title

A group of agri-food enterprises want to set a NFT based loyalty program associated to the product they sell. Each company will provide some “loyalty score” depending on the customer activity. These loyalty scores are managed by a dedicated entity. Each customer can apply for a given NFT attached to a rare “real product” provided that he gets enough validated loyalty score. These NFT are used to grant access to the product ordering. Identify the key characteristics of the associated business and blockchain ecosystems.

or

Choose an example of blockchain project and analyse it in a similar way as what was done in the exercise.



5 QUESTIONS AND ANSWERS

Description

Question and Answer No.1

Q: How can you characterise a business ecosystem?

A: An ecosystem is characterised by its purpose, i.e. the business field and the product/service it provides AND by its community, i.e. the interacting participants

Question and Answer No.2

Q: Provide some examples of the impacts an ecosystem has on its environment

A: An ecosystem can have multiple impacts on its environment: financial, cultural, social, environmental...

Question and Answer No.3

Q: Can you identify few actors of a blockchain ecosystem

A: A blockchain ecosystem integrates various kinds of actors such as developers, block validators (miners), cloud and other infrastructure providers

Question and Answer No.4

Q: According to you in a Proof of Work blockchain, which kind of business environment qualify the miners community?

A: Miners compete to validate blocks. As such, their business environment can be described as a Red Ocean context

Question and Answer No.5

Q: Focusing on the 2-dimension usage-oriented ecosystem characterization, how can you qualify the Blockchain 2.0 ecosystem?

A: The Blockchain 2.0 ecosystem belongs to the Transformation quadrant. The introduction of Smart Contract involves rethinking applications, tuning them into data/event dependent transactions. This motivates a high novelty and a potentially high number of users characterizing the Transformation quadrant.



6 MULTIPLE-CHOICE QUESTIONS

Multiple Choice question No. 1

Q: Identify the types of impacts an ecosystem may have on its environment

A: all impacts except conceptual impact

- Financial impact
- Social impact
- Environmental impact
- Cultural impact
- Physical impact
- Conceptual impact

Multiple Choice question No. 2

Q: In the Bitcoin blockchain ecosystem, miners business environment refers to

A: Red Ocean

- Red Ocean
- Blue Ocean
- Purple Ocean
- Green Ocean
- Black Ocean

Multiple Choice question No. 3

Q: Developing a Private blockchain ecosystem refers to

A: Black Ocean

- Red Ocean
- Blue Ocean
- Purple Ocean
- Green Ocean
- Black Ocean

Multiple Choice question No. 4

Q: Miners belong to



A: Core blockchain community

- Core blockchain community
- Blockchain usage development community
- Blockchain infrastructure community

Multiple Choice question No. 5

Q: Developers belong to

A: Core blockchain community and blockchain usage development community

- Core blockchain community
- Blockchain usage development community
- Blockchain infrastructure community

Multiple Choice question No. 6

Q: Cloud service providers belong to

A: Blockchain infrastructure community

- Core blockchain community
- Blockchain usage development community
- Blockchain infrastructure community

Multiple Choice question No. 7

Q: Initial investors belong to

A: Core blockchain community

- Core blockchain community
- Blockchain usage development community
- Blockchain infrastructure community

Multiple Choice question No. 8

Q: Blockchain 1.0 ecosystem is

A: An ecosystem supporting a crypto-currency

- An ecosystem supporting a crypto-currency
- An ecosystem supporting distributed applications
- An ecosystem supporting generic blockchain services



Multiple Choice question No. 9

Q: Blockchain 2.0 ecosystem is

A: An ecosystem supporting distributed applications

- An ecosystem supporting a crypto-currency
- An ecosystem supporting distributed applications
- An ecosystem supporting generic blockchain services

Multiple Choice question No. 10

Q: Blockchain 3.0 ecosystem is

A: An ecosystem supporting generic blockchain services

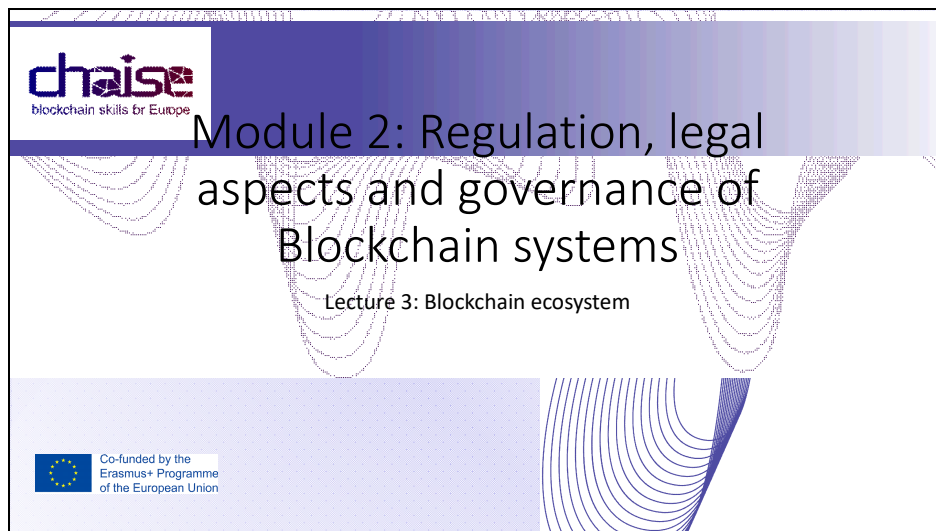
- An ecosystem supporting a crypto-currency
- An ecosystem supporting distributed applications
- An ecosystem supporting generic blockchain services



7 REFERENCES

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8 Slides





2. REGULATION, LEGAL ASPECTS, AND GOVERNANCE OF BLOCKCHAIN SYSTEMS		
Explain blockchain-related regulations, legal aspects, governance, and their impact in the public and private sectors.		
Knows / Aware of:	Able to:	Capable to:
<ul style="list-style-type: none"> - Blockchain-related legal environment. - Legal underpins of Blockchain technology and smart contracts. - Implications of blockchain technology for society, regulators, policy makers, governments, law professionals. 	<ul style="list-style-type: none"> - LO2.1: Describe blockchain-related legal environment in Europe and the World. - LO2.5: Explain implications of blockchain technology for governments, policy makers, law professionals, regulators and society. 	<ul style="list-style-type: none"> - Take responsibility when deciding about the blockchain, cryptocurrencies and use of smart contracts. - Participate in discussion regarding blockchain technology impact and blockchain governance decisions.
EQF level		EQF Level 5

chaise
blockchain skills for Europe

How can you describe the blockchain ecosystem?

- What is an ecosystem, how can you characterize an ecosystem?
- Is there one or different models of blockchain ecosystem?
- How can you identify a blockchain ecosystem?



How can you describe the blockchain ecosystem?

- In this lecture you will
 - Learn key elements to characterise an ecosystem
 - Identify the basic characteristics of blockchain ecosystems
 - Learn how to identify and characterize a blockchain ecosystem



Learning objectives

Ecosystem

Key concepts
Ecosystem
characterization

Blockchain ecosystem

Key characteristics
Key actors

Identifying usage-based blockchain ecosystems

Usage analysis
Key blockchain
ecosystem models



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- ▶ Ecosystem
 - ❑ Key concepts
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 - ❑ Key blockchain characteristics
 - ❑ Actors typology
- ▶ Usage-based blockchain ecosystems
 - ❑ Usage characterization
 - ❑ Example of blockchain ecosystems
- ▶ To conclude

Ecosystem?

- Etymology
 - Ecosystem = Ecology + system
 - Ecosystem = Economy + System
- Basic definition
 - From Collins
 - a system involving the [interactions](#) between a [community](#) of living [organisms](#) in a particular area and its [nonliving environment](#)
 - From Cambridge dictionary
 - all the [living](#) things in an [area](#) and the way they [affect](#) each other and the [environment](#)
 - any [complicated system](#) consisting of many different [people, processes, activities](#), etc., [especially relating to technology](#), and the way that they [affect](#) each other
 - a [group](#) of [businesses](#) or [business activities](#) that [affect](#) each other and [work](#) well together
- Both define communities and interactions between “members” of the community and their environment



Characterizing an ecosystem

- System
 - Boundaries
 - Components / structure
 - Purpose / functioning
- Model
 - Multi-views
 - Static model
 - Dynamic model
- Interactions
 - Internal interactions
 - Interactions with the environment

Characterizing business ecosystem

- Purpose
 - Business field
 - Product / service driven
- Ecosystem community
 - Independent organisations
 - "One shot" P2P orders
 - "Centralized" organisation
 - Main stakeholder and its business partners
 - Value driven by the main stakeholder value chain
 - Collaborative networked organisation
 - Networked value chain
 - Improved multi-tier coordination
 - Distributed decisions



Ecosystem's interactions

- Interactions with its environment:
 - Formal interactions
 - Impacts
 - Financial
 - Social
 - Environmental
 - Cultural
- Internal interactions
 - Community organisation
 - Relationships with partners / competitors
 - How value is shared
 - How to be more attractive than competitors

Qualifying business environment (1)

- Red Ocean (Porter 1980)
 - Highly competitive environment
 - Well known demand
 - Value measured in monetary units
 - How to survive: differentiated or cheaper product / service
- Blue Ocean (Kim and Mauborgne 2002)
 - Highly innovative industry
 - New demands and markets
 - Value is measured in monetary units
 - How to survive: creating a new product and the associated market



Qualifying business environment (2)

- **Purple Ocean**
 - Mixing both Red and Blue ocean strategy
 - Value measured thanks to monetary units
 - How to survive: identify innovations to get market advantage
- **Green Ocean**
 - Integrating sustainability and environmental impact in the value
 - New demand for « green products »
 - Sustainability is a driver for innovation
- **Black ocean**
 - Closing market to competitors to reduce risks regarding the investments
 - Unfair/unethical advantages to survive

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Blockchain ecosystem: context

- Blockchain community
 - Different parties
 - Each party contribute to the global value
 - Blockchain is a value source or each party
 - Share the “internal token currency”
- Service system
 - Importance of the “client experience”
 - Requires some investment
 - Development
 - Infrastructure
- Fair balance regarding investment / Return On Investment

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Blockchain ecosystem organization

- Co-operation or competition?
 - Transaction validation
 - Competition between validators
 - Resource sharing strategy can be used to support co-operation
 - Transactions shows co-operation between parties
- Internal mechanisms
 - Consensus management rule
 - Speculation on token value
- External incentives
 - Initial Coin Offer
 - Legal status of blockchain transactions, smart contracts...
 - Energy subvention to support data-centers / “sovereign blockchain” enactment

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Blockchain ecosystem boundaries

- Blockchain as a product
 - Trading area
 - Multiple "customer" profiles
- Permissioned blockchain
 - Well-known ecosystem
 - Agreements between partners
 - Support common shared collaborative processes
- Permissionless blockchain
 - Core contributors
 - Developers
 - Initial investments
 - Determine governance and regulation rules
 - Users
 - Trading area

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Typology of the main actors

- "Core blockchain"
 - Developers
 - Block validators - miners
- Interaction with infrastructure
 - Cloud providers
 - Hardware development
 - Distributed system management
- Interaction with the usage
 - Developers
 - End-user
- Investors

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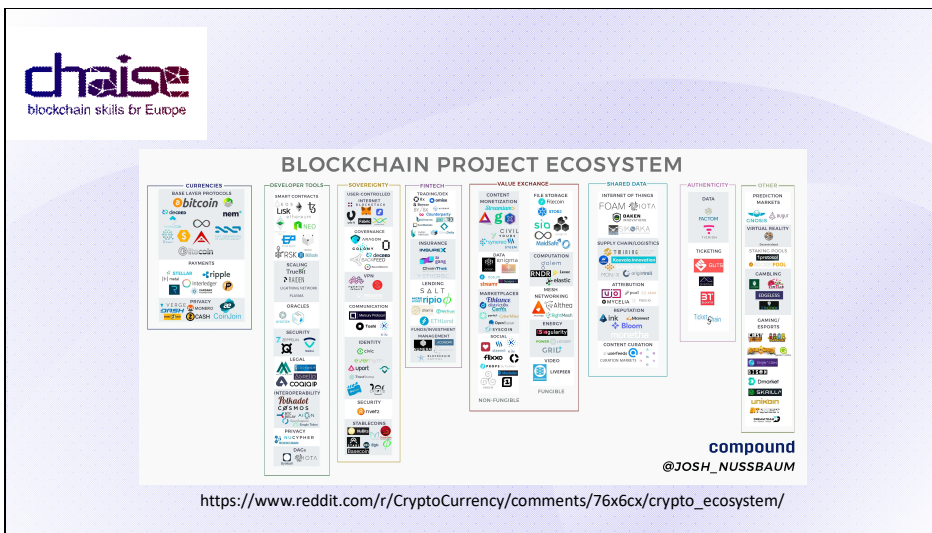
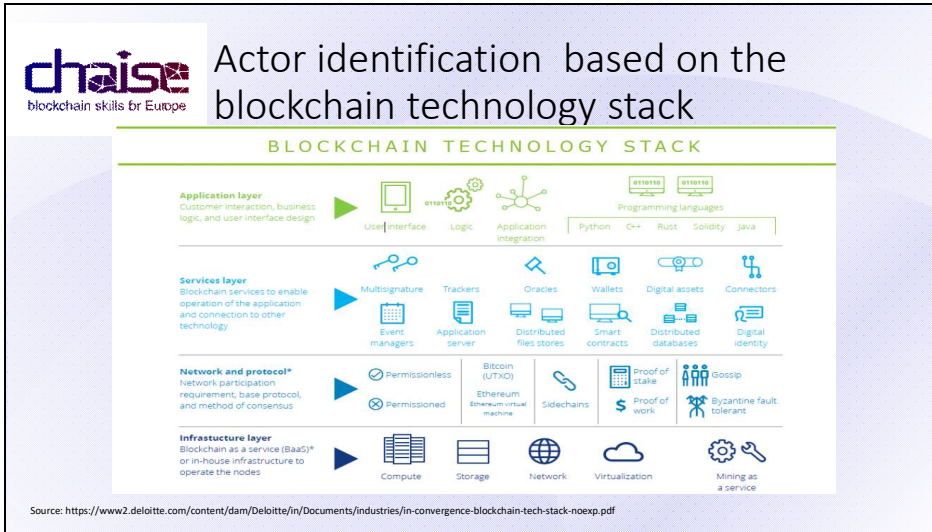


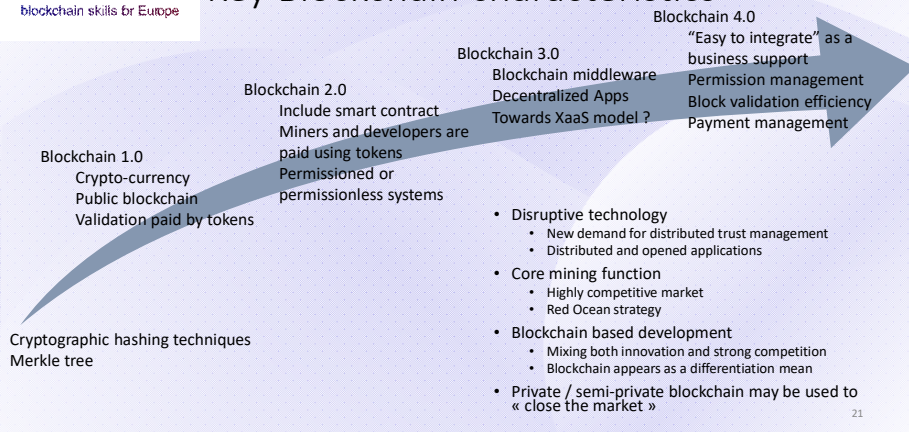


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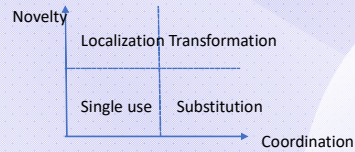
Key Blockchain characteristics





Blockchain potential usage

- Main characteristics:
 - Trust, immutability and consensus
 - Potential community and coordination requirements
 - Novelty



- Picked from the truth about Blockchain (<https://hbr.org/2017/01/the-truth-about-blockchain>),

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Blockchain 1.0 ecosystem key elements

- Fiat currency
 - P2P currency transfer without intermediaries
 - But it requires miners!
 - No valuable good exchange to support the crypto-currency
 - First introduced as Bitcoin
- Ecosystem
 - Miners – Transaction validation
 - Traders
 - Brokers
 - Gambling / wallet manager
 - Users

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Crypto-currency ecosystem

- Basic currency ecosystem
 - Exchange centered
 - Trading tools
 - Analytical tools
 - Portfolio management
 - Bots
 - Marketing
 - Influencers

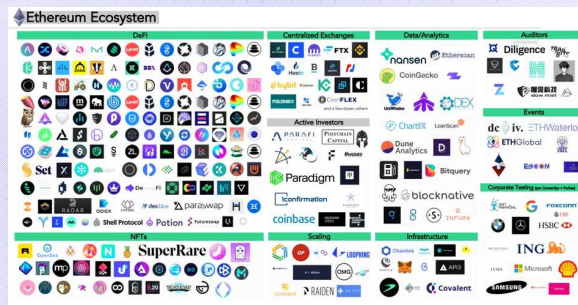


Picked from <https://tradesanta.com/blog/cryptocurrency-trading-ecosystem>



Blockchain 2.0 key elements

- Smart contracts
 - Distributed application
 - Contract based organization
 - Event driven
 - Integrates the transaction payment
- Ecosystem
 - Infrastructure
 - Event management
 - Token management
 - Application tools



Picked from https://www.reddit.com/r/ethereum/comments/m9sggj/ethereum_ecosystem/



Blockchain 3.0 Key elements

- Designed to overcome Blockchain 1.0 and 2.0 main limits
 - Lack of scalability
 - Lack of interoperability
 - Lack of sustainability
 - Off-line governance strategy
 - lack of transparency
- Designed to develop dApp
 - Blockchain middleware approach
 - Multiple business areas
 - Different blockchains
 - Lack of interoperability



Picked from <https://101blockchains.com/eos-dapps-landscape-complete-list/>

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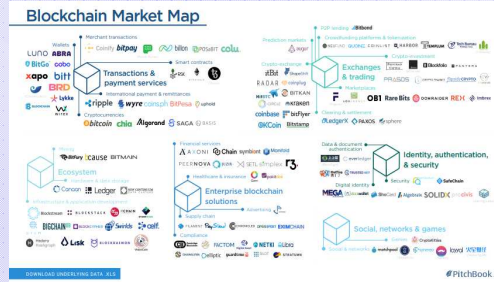
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To conclude

- Ecosystem characterisation
 - Identify the boundaries
 - Interactions with the environment
 - Ecosystem structure
- Blockchain ecosystem characteristics
 - Dynamic area
 - Importance of the FinTech field
 - Real Blockchain market



Picked from <https://medium.com/humble-ventures/blockchain-ecosystem-explained-in-one-chart-68bdc5e18335>

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