



# ERASMUS + Chaise Project - Module 2: Regulation, Legal aspects and Governance of Blockchain systems Lecture 2: Governance and regulation background

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

## **Lecture 2: Governance and regulation background**

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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 governance and regulation background.

First of all, can you define precisely governance? Regulation? Based on your knowledge on blockchain systems, can you define the way the different stakeholders interact in the blockchain, which rules are applied to manage such a distributed organisation consistently? Can you also define the way the blockchain system (and all its stakeholders) interact with their environment? Are there particular rules / laws that must be fulfilled?

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

To allow defining governance and regulation for blockchain systems, this lecture will provide you knowledge on how governance and regulation are commonly defined. As blockchain is basically designed to manage transactions in a distributed way, we will focus on the way transaction-based organisation are set before defining how responsibility and decisions are managed in distributed organisations.

To sum up, this lecture addresses different learning objectives regarding

1. Governance and regulation, identifying key definitions and characterizing the blockchain context
2. Collaborative and distributed organisations, identifying key
3. Transactions based models as blockchain are used to managed transaction. We will address key definition regarding transactions and contracts

## 2 LECTURE NOTES

Based on these learning objectives, this lecture is organised according to these 3 main topics

1. Defining more precisely what governance and regulation means and capturing key blockchain context related to these governance and regulation
2. Defining more precisely distributed organisations, paying attention to the collaboration strategy and to the impact on the blockchain key governance and regulation requirements
3. Define more precisely transaction-based models.

### 2.1 Governance and regulation: key concepts and requirements

#### 2.1.1 Key definitions

First of all, let's go back to basis to define what governance means. We can pick definitions from classical dictionary such as Collins and Cambridge dictionaries. From both, governance can be associated to way a system or an organization is controlled and managed. Applied to system, governance refers to internal rules and processes used to regulate the system interaction.

As blockchain systems are de facto distributed organisations integrating several stakeholders, we can also refer to enterprise governance. As defined by Wilson, enterprise governance refers to rules regulating the organization to improve its own performance (global performance, infrastructure performance...). But how can we manage the global performance of a distributed organisation? Is it an addition of the performance related to each stakeholder's own management strategy or should the performance of the global distributed organisation be managed separately? As the addition of local optima does not provide the global optimum point, a distributed organisation requires its own governance, based on a set of rules that provide the necessary mechanisms to align the different stakeholders' interests.

Let's focus now on regulation definition. Having a look to the same reference dictionaries provide a core definition for regulation: it is a set of official rules or laws used to control something. If we adopt an automation point of view, regulation does not refer to law but to a set of rules used to manage complex systems. This means that regulation is associated to rules governing the interaction of a system with its environment, i.e. organizing interactions between entities.

As you can notice, these definitions are rather similar: governance aims at defining rules to managed internal interaction in a system whereas regulation means defining a set of rules / laws to manage the interaction of a system with its environment.

#### 2.1.2 Blockchain context

Defining blockchain governance and regulation requires paying attention to the blockchain context. As you know, a Blockchain system is a complex and distributed organisation, integrating several



stakeholders in a complex ecosystem. There are different kinds of stakeholders: blockchain developers, blocks validators, users... Each of them has particular goals and interests, but all of them accept that a blockchain is a distributed trust system, storing immutable blocks containing approved transactions. This involves that all of them accept the common rules set to build the distributed trust system, namely block validation rules and the global system organisation, including rules related to its access control. These rules can be automated and defined as on-chain regulation.

Of course the blockchain system also interacts with its environment. As other IT systems, it requires infrastructure means, computation resources, energy... This involves defining rules controlling the way such a system is financed.

As shown in the first lecture, a blockchain is not a simple technological object. It is also designed to provide a service for a dedicated usage. As such, it interacts with its environment and must respect the legal constraints related to the usage field. For example, Blockchain-based FinTech development must comply with financial regulation.

As the blockchain can be used to store approved transactions between parties, solving the double spending problem by storing the transaction in the distributed ledger, a particular attention must be paid on the way trusted interactions are defined. For example, a smart contract requires defining trusted sources used to « fire » the smart contract execution. Parties must also be identified clearly. Basically, users are identified according to their private key, without relating this pseudo-identity to the real one. This pseudonymous identification must also be considered regarding legal constraints related to ability.

Based on these first definitions, we can try to define blockchain governance and regulation mode precisely.

As a blockchain is a distributed organisation, the blockchain governance is similar to the enterprise governance definition. The shared objective is building a distributed trust system. So core internal interactions between stakeholders refer to the way each of them trust the distributed ledger, i.e. accept the integration of a validated block. Such decision refers to the strategy used to approve the block and get a consensus between the nodes. This block validation rule implements the core on-chain governance. As the blockchain is an (opened) distributed organisation, other rules must be set « off-chain » and accepted by all members (who share the common ledger) to manage more complex situations such as stakeholder admittance for permissioned blockchain, fork decision for hacked ledgers...

Blockchain regulation refers to the interactions with the environment and to the applicable laws governing the blockchain activity. Capturing the applicable laws may be difficult as a blockchain system can be deployed worldwide. This means that different laws may be applicable depending on the country hosting a part of the system, a user... This regulation may also depend on the targeted usage context as particular rules may be set depending on the business area (such as fiscal rules, market regulation, e-health, transportation...).

### **2.1.3 Regulation requirements**



So what should be the blockchain regulation requirements? We can first focus on requirements related to the core blockchain technology.

First, this distributed trust system relies on cryptography for validating and signing blocks as well as for identifying a party. As cryptography can « hide » sensitive information, different regulations are applied. This may affect the location of the validators' infrastructure. Focusing on the asymmetric cryptography used to identify users, this refers to identity management. The pseudo anonymity brought by this technique may contravene the legal provisions requiring the accountability of actions.

Second, the blockchain system provides a support to manage Peer to Peer transactions. Setting P2P transactions relies on solving and proving a double-spending problem. This is traditionally done by defining precisely processes and their logs on each peer in « interchange contracts ». By this way, transactions following these processes can be set and each peer logs its own process, what is exchanged and the answers of the other peer. By this way the full P2P process is logged, tracked and approved by each party. As the blockchain proposes to store the approved transaction in its own distributed ledger, it acts a « transaction validation tier », solving the double spending process as its core activity. This involves that regulation rules devoted to P2P transaction management must be applied to blockchain systems. For example, as P2P transactions often include financial counterparts the Regulation (EU) 2015/2365 of the European Parliament and of the Council of 25 November 2015 on transparency of securities financing transactions and of reuse and amending Regulation (EU) No 648/2012 must be applied.

Third, a blockchain system is a distributed organisation. Accountability requirement involves that parties and their responsibility limits must be clearly identified. Although token exchange can be tracked, there's no information on the way the validation process is executed, which resources are used... The opacity of this blockchain core process may lead to a vulnerability facing internal threats from felon validators: it may be difficult to prove the collusion of several actors as their responsibility is not clearly established. This responsibility identification must also be taken into account while identifying external risks, internal responsibility: clear accountability and responsibility are essential while defining a common security policy of the shared ledger.

Then, let's focus on the socio-economic environment. How does a blockchain interact with its environment?

First, tokens are defined as a core component of a blockchain system. As introduced in lecture 1, tokens may have different status depending on the blockchain system. While utility tokens are tolls allowing the owner to use the network, to take part in the network decision process, security tokens are considered as financial means, requiring to apply financial regulation. Lastly, payment tokens are transnational and unregulated crypto-currencies. Their financial value is purely speculative and contrary to sovereign currencies, it is not associated to any "physical" guarantees. As such crypto-currencies are managed by state-independent organisations, there are still challenges to regulate this crypto-currency based economy. Moreover, due to the pseudo-anonymity of blockchain users, regulation facing dark economy launder processes should apply at the "interface" with the "legal currencies".

Second, blockchain computations require infrastructure of course energy to run these infrastructure components. This energy consumption has an environmental impact. Particular regulations on data-center implementation can constraint the blockchain system deployment.

Third, blockchain governance is a complex problem. As each blockchain system is managed separately, uses its own token... defining common governance rules to provide system transparency and interoperability is almost impossible. This increase the call for a global blockchain regulation which will provide at least common guarantees for blockchain users.

## **2.2 Collaborative distributed organisations**

Blockchains are distributed organisations, gathering various kinds of stakeholders. Capturing governance requirements involves paying attention to the collaboration strategy and to the distributed organisation.

In this section, we will introduce the main collaborative and distributed organisation principles before identifying the key governance and regulation requirements due to such distributed organisations context

### **2.2.1 Collaborative and distributed organisation: key models**

Distributed organisations are sets of co-operating organisations. They have been introduced in the 80s-90s as Virtual Enterprises or Collaborative Networked Organisations. Different distributed organisations are set depending on the collaboration strategy:

1. Informal collaboration: such distributed organisation is mostly based on trust between partners. There's no real common process and co-operation may be achieved thanks to P2P relationships. Governance of such collaboration framework is reduced to the description of the P2P co-operation
2. Contract-based collaboration: in this case, a common business process is designed to coordinate the different activities achieved by the partners. Legacy systems are not connected and each partner remain responsible of his own activity. Contracts are set to support partners interactions, defining precisely the way decisions are set. In such organisation, governance rules can be associated to the contract, increasing the global trust level.
3. Fully integrated co-operation: in this case, activities involve the co-operation of the different partners, leading to a common BP. As a consequence, there are strong interactions between legacy systems and a real distributed collaborative application is set. Making legacy IS cooperate involves solving different challenges such as interoperability and transaction management to identify each partner responsibility in the activity fulfilment. This can lead to manage multiple contracts.

Focusing on the way distributed and collaborative organisation are set, we can identify different modes



1. **Partner centred organization:** Such distributed organisation is based on a main stakeholder and includes its related business partners. Established according to at least a mid-term collaboration strategy, such a distributed organisation sets strong relationships between partners, leading to interconnect their different BP to set efficient collaborative BP. Such an organisation is used by Supply Chain to connect first level suppliers to the main stakeholder whereas sub-level suppliers are connected only to their main stakeholder according to the centralized partner main process. Such an organisation gathers well identified and trusted partners and the associated ecosystem organization is driven by the main stakeholder value chain
2. **Centralized Business networks:** this organisation built according to a mid/long term strategy gathers also a main stakeholder and its partners. Although it takes advantage of the trust level established through the central-partner based organization to set a trusted community, this centralized business network collaboration strategy allows transversal collaboration and relationships between all partners, so that other collaborative business ecosystem and their related collaborative BP may emerge leading to a networked value chain between a reduced set of partners.
3. **Fully decentralized collaborative organisation:** Set according to a (shared) business development vision and to clients value chain, such collaborative strategy takes advantage of relationships between partners. In such distributed organisation, that each partner aims at improving its own part of the value chain. Such “opportunistic” organisations are set according to a reduced time-frame (short or mid-term collaboration) and establishing trust between partners is a key challenge. These organisations require a trusted BP interconnection and a trusted event-based value flow may be necessary.

### **2.2.2 Governance and regulation requirements**

Setting collaborative organisations involves trusting partners or at least to managing trust while setting contractual transactions with partners. From a first basic question to define why a partner is trusted or not, we can derive different questions to identify how trust is established, built and managed, how trust levels are identified and set... Trust can refer to subjective and objective criteria. For example, informal collaborations are often set between rather close organisations because people are used to meet each other on a daily basis, are used to exchange with each other... These “social” relationships can also be coupled with business related criteria, mainly non-functional properties as cost, delay, product / service quality indicators..., security and privacy policies related to the IT support services, mix of criteria including human relationships or other cultural criteria. These requirements can be expressed in contracts or requires at least getting “trusted information” on these objective criteria observed in previous collaborations.

Focusing on these objective criteria involves setting supervision and governance function to manage these different Key Performance Indicators. According to Enterprise Architecture frameworks, these supervision and governance functions are deployed at both business and technological levels. Most of

the works refer to the technological level and elementary criteria to set Service Level Agreements (SLA) that can be combined to set Business Level Agreements (BLA) associated to business transaction, following the way basic IT services are composed to support the business services and transactions. Of course, management and governance functions related to these business level KPIs are required, affecting the business strategy and organisation to improve these KPIs.

For mid/long term collaboration strategies, collaboration / business agreements may be set, integrating the different kinds of Business Transaction agreements and formalizing the global collaborative process. Setting Business Process agreements / collaborative organization agreements requires integrating these different Business Transactions agreements to provide “objective” non-functional property tracking features to support business trust development. Nevertheless, although such collaborative business process may appear as a “connection” of processes managed by each partner, such distributed BP is not a simple composition of partners’ own private BP: this process is tuned, governed and supervised according to the collaborative organisation own goal. Making this global process efficient, safe and consistent requires:

1. Interoperability: this requires defining interoperable model / standard to manage proper mediation service to “understand” the common information model, define legacy IS connectors as well a IoT data collection service if necessary. Interoperability must also be applied to supervision and tracking services to allow partner collect, manage and supervise proper KPIs
2. Global supervision and governance: the common BP is not a simple combination of each partner own BPs, it is designed according to common goals and must be supervised accordingly. This means that each partner must provide the required monitoring data to supervise the process consistently. This supervision process is set globally, identifying each partner own responsibility and promises to get the required quality and efficiency level. This involves also defining global governance rules to adjust objectives and react properly to context evolution.
3. Although the Business Process is supervised and governed globally, activity accountability is necessary to manage properly the responsibility of the different partners, identify clear KPI value at the different stages of the process. This transparent performance evaluation also contributes to increase the trust level.

Similar to traditional organisations, collaborative and distributed organisation must comply legal constraints as these organisations create value. Consequently, a particular attention must be paid to the associated to financial flows as well on responsibility limits, of each actor. Meeting these legal requirements, these organisations make heavy uses of transaction processing and of Electronic Data Interchange mechanisms which have been introduced to provide IT support for “legal” documents interchange between partners, including both standard / interoperable documents description (paying attention to the interoperability challenge) and transaction recording support on each partner side, to manage process accountability and non-repudiation, fitting the “double-spending”

tracking proof required by Transaction Processing. As Blockchain solves the double-spending problem by storing immutably the transaction in an independent distributed ledger, this allows fulfilling the transaction recording constraint for each peer of the transaction, provided that both of them accept the blockchain recording. Focusing on the blockchain own collaborative organisation, parties involved in the core block validation process a legally responsible of the transaction recording and tracking.

Another constraint picked from interchange contracts, is related to trusted parties identification. Blockchain parties are identified thanks to their private key used to sign and certify each transaction. This provides a unique identification of a stakeholder, fitting accountability requirement BUT this identity is not related to the “real one”. Managing “legal” and certified accreditation process is a main challenge to meet legal constraints.

Lastly, as blockchain are worldwide organisations, a particular attention must be paid on the “hosting countries” for the distributed ledgers as well as on the blockchain legal recognition depending on the international context.

## **2.3 Transactions-based models**

After identifying the main characteristics and challenges associated to distributed and collaborative organisation, we have pointed out the heavy use of contractual relationships and of transactions.

In this section, we will focus on transaction-based models

### **2.3.1 Key definitions**

Basically, organisations’ interactions are governed by contracts. Using basic definitions from Collins or Cambridge dictionaries, contracts are agreements approved by parties they involve, defining the purpose and the execution conditions. A contract involves at least 2 and may be more parties and all parties has to sign the contract, certifying that they approve it. After being established and signed by parties, contracts have a legal status and all parties are linked together. An order is a basic contract: it defines who will provide what to the customer, some execution conditions related to the price and payment, the delay...

Once the contract is defined, let’s focus on the contract execution. From the Collins and Cambridge dictionaries, we can notice that transaction is associated to Business and IT. From the business point of view, the traditional definition of a transaction is that transactions are associated business deals and reflects the execution of the associated action. For short, a transaction can represent the contract execution. From an IT point of view, Transaction Processing has been introduced to manage data consistency when concurrent action may occur. A transaction allows “locking” the access of data, achieving the required actions and then unlock the access after all actions succeeded. In case of troubles, “rollback” actions are set to restore the previous stable state. By this way data are in consistent stable state before and after the transaction.

More precisely a Business transaction can be set between at least 2 parties. As an economic event fired according to execution condition, business transactions are logged for accounting purposes and must be supported by a source document so that this economic activity, measured in monetary unit can be registered and proved. As Collaborative and distributed organisations are designed for business purpose, stakeholders have economical interactions, formalized as business transactions. Focusing on these interactions, it means that “launching” conditions and the business transaction own execution “connect” and coordinate stakeholders Business Process, allowing “on the fly cooperation”. Moreover, as Business Transactions are logged by all business parties involved, these “instantaneous cooperation” can be mined to improve the global collaborative organisation, supporting more fluent and efficient business interactions on a mid-term basis.

Of course, these business transactions are implemented thanks to IT support. Such complex and distributed processes involve consistent and persistent data management, relying mostly on Transaction Processing.

Transaction Processing (TP for short) are systems supporting Peer to Peer IT transactions, requesting complex exchanges between parties. A transaction can be validated if and only if all the associated operations succeed. IT transactions have been set to manage data consistency even if they are involved in different complex processes at the same time. To this end, transactions are set according to the 4 following rules:

- 1: Atomicity: a transaction must be fully executed otherwise, it should be aborted and all data modification must be rolled back. This means that all processes involved in the transaction need to be coordinated and their execution state must be reported to identify whether the transaction is active, partly committed, fully committed or is aborted and requires roll-back to restore the initial state of the data involved in all sub-processes.
- 2: Consistency: this property refers to the Data consistency. It means that the data base must evolve from stable state to stable state so that data integrity is protected.
- 3: Isolation: it means that each transaction is executed at a time or that concurrent transactions use independent set of data so that each of them is fully isolated from others’ execution context
- 4: Durability: it means that once committed, all changes impacting data are persistent and stored safely in data-bases so that the effect of the transaction are never lost. This means that dedicated recovery mechanisms must be set to ensure that the persistent support remains available.

Transactions are important features in complex Information System. They can link different partners processes, managing and coordinating the way they exchange information, fitting the common process organisation. This means that transactions require authenticating each party, linking the “IT identity” to the real-world one. To this end, several level of certification may be used. The lower level consists in a simple declaration of the party using a login feature to be authenticated when it’s needed: your identity is proven because you manage to solve a challenge, i.e. you know a secret thing (the password associated to the login). When a higher certification level is required, strong authentication can be used, i.e. requiring solving different challenges. For example, this can be done by implementing multi-factor

authentication mixing something you know (login / password), something you have or something you have (for example an SMS received on your mobile phone). Trusted parties can be used to provide stronger authentication services. For authentication requiring proving that the digital identity fits the real “physical” one, dedicated processes can be set by these trusted authorities, requiring the control of identity documents. After the third-party has managed this control, it becomes responsible for the identity certification. As the authentication process may be complex, transaction pricing also includes the retribution of the trusted authorities.

Proving parties’ identity is not enough to ensure consistent P2P transactions. Proving that the transaction has occurred requires proving, on both parties’ side that all operations are managed properly. To solve this double-spending challenge, each party logs operations committed on its own side, defining exactly what is sent / received and when this is sent or received. Managing these traces, the TP system can manage the transaction properties “globally”, although different TP systems may be involved.

This means that transactions require dedicated infrastructure and software and that integrating transaction into collaborative processes need dedicated engineering activities, agreement management... Consequently, setting transactions involve processing costs related to the consumed resources. Some value-added services such as party authentication certification, safe persistent and certified storage of the transaction logs... can also be used. This means that people may pay for these services, for example, people can pay to get a trusted and certified identity management. So, similar to other software services, each transaction has also a price.

### **2.3.2 Agreements in a blockchain context**

Let’s now focus on the Blockchain context to identify agreements set between parties of these distributed organisations. Different kinds of stakeholder cooperate and interact in a blockchain system, including core developers, validators and users. Contributing/using the system means that all stakeholders agree with it, i.e. have set an implicit acceptance, but are there some “formal agreements”?

Private blockchains are closed distributed organisations. Due to the required investment to deploy a blockchain system, this is not a “one shot” collaborative organisation and it is worth defining formally the provided services, the collaborative organisation... Such private blockchain deployment can lead either to the creation of a dedicated legal entity in charge of the blockchain or to contracts between parties defining how they will interact to support this distributed organisation deployment. In both cases, contracts are established, defining precisely the parties, the way their identity will be certified and rules to manage new partners integration, which service they will provide / use, the requested Quality of Service and the associated costs and penalties as well as the purpose, the technical organisation and governance rules of the blockchain system.

Public blockchain agreements are different. As far as developers are concerned, the software license can be seen as a basic contractual template. Core blockchain functions define the blockchain validation and usage strategy. Some stakeholders can of course set their own organisation to fulfil some functions,

mostly regarding validators, wallet managers... leading to different contract-based organisations. Public blockchain are mostly set according to a “market-based regulation”: using or participating to the blockchain distributed architecture means approving the internal rules of the blockchain. Nevertheless, such usage-based implicit approval does not mean that users really know these internal rules, they only agree to use the provided service, similar to Data Processing Agreements or Terms of Service approval! To sum-up, setting a public blockchain community involves a clear definition of the block validation strategy and a well-managed token market to guarantee the usability of the system. Different stakeholder status can be defined in the initial agreement so that different governance rules can be set.

Another kind of blockchain agreement is the Smart Contract. Defined in Blockchain 2.0, smart contracts are stored in blocks. Due to the ledger immutability property, smart contract stored in the blockchain as usually defined as “code is law”, meaning that the operations defined and certified in the smart contract stored in the blockchain are accepted by parties and will be executed without any changes. The operations associated to the business transaction described in the smart contract are launched if and only if the activation event defined in the smart contract occurs.

So what is the status of a smart contract? Can it be defined as a contract or as a transaction?

Similar to traditional contracts, smart contract store safely terms associated to a business transaction, namely execution conditions and basic actions but it does not integrate the physical peer identification. For example, AXA has launched a web-based insurance offer, launching a smart contract that triggers a refund as soon as the plane delay is noticed without having to claim for it, sending documents... This business transaction is fully described in the smart contract that reflects the insurance contract. It specifies the flight information and trusted flight tracking tools to that the transaction can be fully automated.

Nevertheless, smart contracts have no legal status. From our insurance example, the insurance contract is set and approved independently. The smart contract is then generated as a support for the potential business transaction.

So, could blockchain technology take a part in the fast adoption of the digital transformation involved by the Web 2.0 and 3.0? Blockchain can be a convenient business transaction support system, providing several value-added services. As stated previously, a transaction is associated to a contract execution. More precisely, a business transaction consists in a set of approved operations as described in a source document. As the blockchain provides an immutable and safe storage in the distributed ledger, contracts can be stored and logged in the blockchain, increasing transparency and trust. Second, business transactions often rely on “simple” operations. Smart contracts provided in the blockchain 2.0 can be worthy used to implement them, defining clearly approved events to launch them. In such case, the blockchain appears as the “trusted tier” in charge of controlling the business transaction execution.

Despite its interest, there are few limits. First, blockchain supports P2P business transaction. It means that more complex transactions cannot be implemented directly in the blockchain. Second, blockchain’s stakeholders identification relies on cryptography: each user has its own private (secret) key allowing to sign a transaction. This pseudonymous feature does not allow a trusted real identification and this does



not comply contracting parties identification. Lastly, smart contracts and blockchain have no universal legal status increasing the call for regulation.

To sum up, blockchain can take an important part in the solution but it is not THE solution.

## **2.4 Conclusion**

After defining governance and regulation, defined main collaborative organisation strategies and transaction-based models, it's time to conclude.

Governance and regulation are major challenges while setting a distributed organisation as a blockchain. Governance refers to the internal decision system whereas regulation refers to law, controlling the way blockchain interacts with its environment. To capture governance and regulation strategies, we have to pay attention to the way the distributed organization is set. We have presented the main collaboration strategies and tried to identify key governance and regulation challenge. Distributed business means also contracts, business transactions... In the last part of this lecture, we have defined more precisely these terms, defining how blockchain and its smart contract can be considered as a business transaction support system.



### 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 governance and regulation requirements adapted to this particular context.

To solve this problem, you need to identify

- The type of collaborative and distributed organisation using the blockchain
- The way the collaborative organisation can evolve
- The transaction that will be stored in the blockchain and the token status
- The regulation context, identifying particular usage constraints

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

- The type of collaborative organisation involves defining the collaboration time-frame, which kind of interaction is concerned, if the organisation will be in charge of the blockchain or will use an existing project
- Based on this first analysis, the distributed organisation governance strategy can be identified. Then you have to discuss the type of implementation you will propose (private or public)
- To define the type of transaction, you must identify who will store what in the blockchain. Then to address the token status, you have to identify if payments / currencies are involved in the process
- Focusing on the regulation, are there regulation rules that may be applied to this usage?

Analysing the requirements shows that:

1. The collaborative networked organisation is designed to support a mid-long term collaboration. Producers and suppliers are involved in a Just in Time supply chain, this means that they need to react quickly and know exactly what they can provide to each other. Such supply chain model is often designed as an interconnection of Business Processes based on the SCORE model.
2. Regarding the collaborative networked organisation, delivering high-quality products means that all participant in the supply chain reach the necessary quality criteria. This lead to organise





co-optation process to decide whether new members can be admitted or not. These agro-food companies have already the necessary IT means to support their business processes. It's also a rather mid-long term time-frame so it's worth implementing and managing a private blockchain deployed in a Cloud.

3. Product information associated to the transformation process must be stored in the blocks. This is a public information: clients must get access to it. There are no payment function so the system will use only utility token. This means that there are no need to integrate financial regulation constraints.
4. Usage perimeter: the blocks are provided only by supply-chain members and clients can only read it.
5. Regulation challenges are associated to the food product trackability. Depending on the type of product, extra production information (such as controlled temperature) can be added. These regulations may vary depending on the "client" location (local rules may apply)



## 4 CASE STUDIES

### NFT-based loyalty program or free case study

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 such a collaborative organisation and the requirements regarding governance and regulation.

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:** What is the meaning of “governance”?

**A:** Governance addresses decisions and processes used to control interactions between members of an organisation. Regulation refers to the legal control of the different activities and on the interaction with the environment.

#### Question and Answer No.2

**Q:** What is the difference between regulation and governance?

**A:** Governance addresses decisions and processes used to control interactions between members/components of an organisation/system. Regulation refers to the legal control of the different activities and on the control of the system's interaction with the environment.

#### Question and Answer No.3

**Q:** What is a transaction?

**A:** In a business context, a transaction means the execution of a deal / contract. In an IT context, transactions have been introduced to manage data integrity and consistency.

#### Question and Answer No.4

**Q:** how is organised a contract-based collaboration?

**A:** in a contract-based collaboration, a common business process is defined to coordinate the activities of the different participants. Contracts define precisely the different participants interactions.

#### Question and Answer No.5

**Q:** Is there a unique regulation framework for blockchain systems?

**A:** As a technology, blockchain are not directly regulated BUT the usages based on blockchains are regulated. These regulations depend on the business field and on the location of the system.

## 6 MULTIPLE-CHOICE QUESTIONS

### Multiple Choice question No. 1

**Q:** Blockchain users are

**A:** Identified thanks to a key so that's a pseudo-anonymity

- Totally anonymous
- Identified thanks to a key so that's a pseudo-anonymity
- Clearly identified and their identity is proven

### Multiple Choice question No. 2

**Q:** Blockchain governance controls

**A:** Both technologic interaction and interactions in the distributed organisation

- Only technologic interactions
- Only P2P interactions between blockchain participants
- Both technologic interaction and interactions in the distributed organisation

### Multiple Choice question No. 3

**Q:** Blockchain regulation

**A:** is related to usages

- Is related to the technology
- Is related to usages

### Multiple Choice question No. 4

**Q:** Regarding approved transactions stored in a blockchain, the associated transaction double spending challenge

**A:** Does not require any log on parties' side

- Leads to track and log the processes on each party side
- Does not require any log on parties' side

### Multiple Choice question No. 5

**Q:** Crypto-currencies managed by blockchain systems

**A:** have a pure speculative value



- Are associated to physical guarantees
- Are managed by states
- Have a pure speculative value

### Multiple Choice question No. 6

**Q:** In traditional transaction processing system

**A:** There's a rollback mechanism to support transaction reversal process

- Once launched, a transaction cannot be cancelled
- Transaction cancellation requires a dispute process involving participants
- There's a rollback mechanism to support transaction reversal process

### Multiple Choice question No. 7

**Q:** Public blockchain system governance rules

**A:** may be implicitly approved when a participant joins the distributed organisation

- Requires explicit agreements between all parties
- May be implicitly approved when a participant joins the distributed organisation

### Multiple Choice question No. 8

**Q:** Blockchain participants

**A:** Have different status depending on their role

- Have different status depending on their role
- Have a same status

### Multiple Choice question No. 9

**Q:** Smart contracts

**A:** Have no legal value

- Have a legal value
- Have no legal value

### Multiple Choice question No. 10

**Q:** Blockchain governance integrates

**A:** Both on-chain and On-chain governance rules

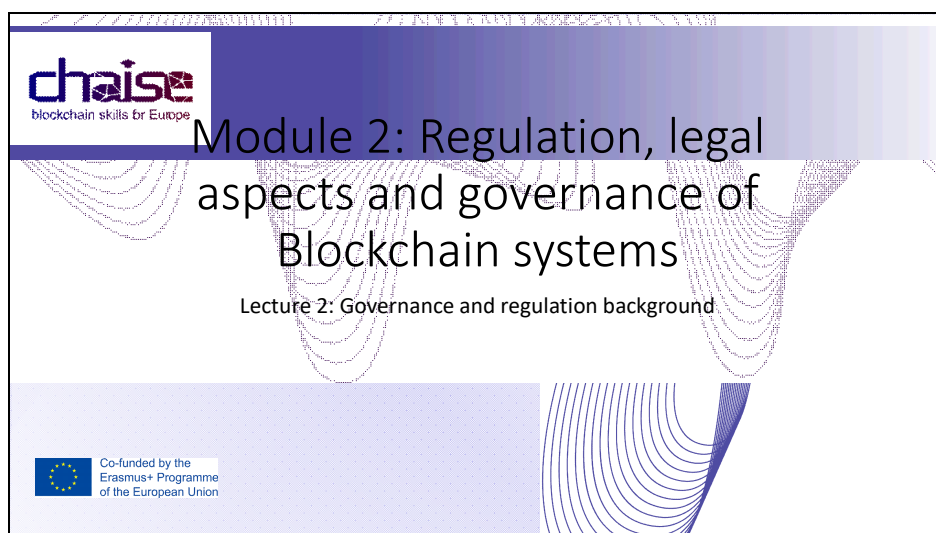


- 
- Only On-chain governance rules
  - Only Off-chain governance rules
  - Both On-chain and Off-chain governance rules

## 7 REFERENCES

- Keating, Charles B., and Joseph M. Bradley. "Complex system governance reference model." *International Journal of System of Systems Engineering* 6.1-2 (2015): 33-52.
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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.		
Knowledge	Skills	Responsibility and Autonomy
<b>Knows / Aware of:</b> <ul style="list-style-type: none"> <li>- Legal status of the decentralized autonomous organizations.</li> <li>- Implications of blockchain technology for society, regulators, policy makers, governments, law professionals.</li> </ul>	<b>Able to:</b>	<b>Capable to:</b> <ul style="list-style-type: none"> <li>- Practice critical thinking of the blockchain legal environment and regulations.</li> </ul>
EQF level	EQF Level 5	

## How can you define governance and regulation for blockchain systems?

- How do you define governance and regulation? Are these concepts similar?
- Which kind of interaction do stakeholders have? How are they managed?
- How do the blockchain interact with its environment? Are there particular rules that must be fulfilled?





## How can you define governance and regulation for blockchain systems?

- In this lecture you will
  - Learn differences between governance and regulation
  - Identify key elements related to transaction based models and organisations
  - Learn how responsibility and decision are managed in distributed organization



## Learning objectives

### Governance vs regulation

Key concepts  
Blockchain context

### Transaction based models and organisations

Transaction based models  
Contract management

### Collaborative distributed organisations

Main organisations  
Key requirements

## Table of Content



- ▶ Governance vs regulation
  - ❑ Key definitions
  - ❑ Blockchain context
- ▶ Collaborative distributed organisation
  - ❑ Distributed organisation
  - ❑ Key governance and legal requirements
- ▶ Transaction based models
  - ❑ Key definitions
  - ❑ Blockchain Agreements
- ▶ To conclude

## Governance ...

- Basic definition
  - from Collins dictionary
    - government, control, or authority
    - the action, manner, or system of governing
  - From Cambridge dictionary:
    - The way in which an organization is managed at the highest level and the system for doing this
- System governance
  - Approved set of rules and processes
  - Regulate system component interaction
- Enterprise governance
  - *Enterprise governance is the structure and relationships that control, direct, or regulate the performance of an enterprise (and its) projects, portfolios, infrastructure, and processes (Wilson, W. L., 2009, Conceptual Model for Enterprise Governance, Ground System Architectures Workshop)*
  - Necessary mechanisms to align stakeholders' interests





## Regulation

- Basic definition
  - From Collins dictionary
    - a rule, principle, or condition that governs procedure or behaviour
    - a governmental or ministerial order having the force of law
  - Cambridge dictionary:
    - An official rule or the act of controlling something
- From system theory
  - Set of rules to manage complex systems
  - For industrial systems: self-regulation = set and enforce rules with less government involvement
- Commonly
  - Set of rules and laws organizing interactions between entities



## Blockchain context

- Complex and distributed system
  - Multiple stakeholders
  - Common decision rules
    - Block validation
    - Blockchain system organisation
- Interactions with the environment
  - Financial
  - Energy
  - Legal constraints depending on the usages
- Transaction management between parties
  - Distributed trusted interactions
  - Parties identification

## Blockchain Governance & regulation

- Basic definitions
  - Blockchain governance
    - Similar to enterprise governance
    - Define the decision process rules
      - On-chain decision to manage consensus
      - Off-chain decision for more complex situations
  - Blockchain regulation
    - Legal
    - Refer to the usage context
    - Different applicable laws depending on the countries and on the usage field.

## Interaction with socio-economic regulators (1)

- Identifying requirements due to technology
  - Cryptography
    - Used to “sign transactions”
    - Used to identify parties
    - Has different regulations depending on the countries
  - P2P transaction support
    - Solve and prove the double-spending problem
      - Previous interchange contracts manages logs on each system
      - Blockchain integrate the double spending process as its core service
    - Immutability management and trackable processes must be deployed
  - Distributed architecture
    - Identifying / proving responsibilities limits
    - Token exchanges are trackable but not the way blocks are validated (means involved)
    - Threats can focus on different entry points





## Interaction with socio-economic regulators (2)

- Identifying requirements due to economic environment
  - Token economy
    - Token status:
      - Transnational and unregulated crypto-currencies
      - Technical value
    - Different legal constraints depending on the countries
  - Environmental impact
    - Authorizations to set data centers
    - Require estimating the energy consumption
  - Complexity of blockchain governance
    - Different blockchains used for different purpose
    - No transfer between blockchains

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## Distributed organisation: collaboration strategy

- **Informal collaboration**
  - Based on trust
  - P2P co-operation
  - No common processes
- **Contract-based collaboration**
  - Activities are coordinated thanks to a common process but Information Systems (ISs) are not integrated
  - Contracts support partners interaction
  - Trust is enforced by the contractual relationship
- **Fully integrated cooperation**
  - Cooperating legacy IS requiring interoperability
  - Common process with strong interactions between partners own processes
  - Multiple contracts management

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## Distributed and Collaborative organisations

- **Partner centered collaborative organization**
  - Main stakeholder and its related business partners
  - Mid-term to long-term collaboration
  - Centralized vision
- **Centralized business network**
  - Main stakeholder with its business partners
  - Networked value chain thanks to transversal relationships between partners
  - Take advantage of trust developed using the partner centered collaborative organization
  - Semi-decentralized vision
- **Fully decentralized**
  - Based on the business development and on the client own value chain
  - Require developing trust
  - Need to interconnect trusted Business Process (BP) in a short-term / mid-term vision

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## Governance in collaborative business

- Trust management
  - Cornerstone of collaborative organizations
  - Depends on various criteria
    - Subjective ones such as social relationships
    - Objective ones related to Non functional properties (cost, delay, quality...)
- Supervision and governance
  - Monitor agreements (SLA and business agreements)
  - Transaction-guided agreement composition
- Common process enactment
  - Interoperability
  - Global supervision and governance
  - Activity accountability

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## Collaborative Business: legal constraints

- Value-added process management involves paying attention to
  - Responsibility limits
  - Financial flows
- Main requirements
  - Transaction specification
    - Standard interoperable documents
    - Transaction log management
  - Trusted parties certification
    - Legal accreditation
    - Certification process
  - Different legal contexts for international collaboration

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## Back to basis: contract definition

- Basic definition
  - From Collins dictionary
    - An agreement between two or more parties for the doing or not doing of something specified
    - An agreement enforceable by law
    - The written form of such an agreement
    - The division of law dealing with contracts
  - From Cambridge dictionary
    - A legal document that states and explains a formal agreement between two different people or groups or the agreement itself
- A contract needs to define
  - The parties
  - The purpose
  - Execution conditions





## Back to basis: transaction definition

- Definition from Cambridge Dictionary
  - From commerce field:
    - An occasion when someone buys or sells something
    - The process of doing business
  - From IT field
    - A single action which changes data in a computer database
- Definition from Collins dictionary
  - 1. something that is transacted: a business deal or negotiation
  - 2. the act of transacting or the state of being transacted
  - 3. In business computing : the act of obtaining and paying for an item or service
  - 5. IT: the transmission and processing of an item of data
- Basically:
  - Requires an agreement between parties
  - Has an object
  - Particular IT properties



## Business transactions

- Key characteristics
  - P2P or multiple stakeholders
  - Business entity
  - Logged for accounting purpose
  - Execution condition
  - Supported by a source document
  - Monetary measured
- Business transaction in distributed organisation
  - Basic coordination between BP
  - On the fly cooperation?
  - Tracks interactions between stakeholders



## Transaction Processing

- Key IT transaction properties
  - P2P
  - Atomicity
  - Consistency
  - Isolation
  - Durability
- Parties authentication
  - Certified by a trusted authority
  - May require identity proof “deposit” linking physical and virtual worlds
- Rely formally on accounting
  - Double spending problem
  - Separate logs on both sides to prove its validity (Debit = Credit!)
- Transaction has a cost
  - Related to the specific development, consumed resources
  - price allow paying the authority

## Agreements in Blockchain context

- Private blockchain organization
  - Participant identification
  - Provided services
  - Blockchain organisation
  - Contractual relationships
- Public blockchain agreements
  - Implicit agreement
    - Use it => agree to its rules
    - Stakeholder status?
  - Public rules
    - Transaction validation
    - Dedicated market for the token





## Blockchain 2.0 Smart contracts

- Smart contract
  - Code is law
  - Public storage
  - « Firing » conditions
- Contract vs transaction?
  - Contractual terms stored in the code
    - Execution conditions
    - Basic actions
    - Peers identification?
  - Automated business transaction execution
  - Legal status?



## Blockchain as a business transaction support system

- Immutable ledger
  - Robust certified storage of contracts
  - Trusted log management
- Business transaction control
  - « Code-based » contracts
  - Event driven execution
- BUT
  - Real identity management?
  - Limited to P2P business transactions
  - Regulation challenges



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## To conclude

- Governance vs regulation
  - Governance devoted to internal decision
  - Regulation refers to law
- Distributed organisation
  - Different collaboration strategies
  - Common governance and regulation challenges
- Support for Business Transaction
  - Limited to P2P transaction
  - Legal status of Smart Contracts







## Resources

- Keating, Charles B., and Joseph M. Bradley. "Complex system governance reference model." *International Journal of System of Systems Engineering* 6.1-2 (2015): 33-52.
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