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Session: Digital Agriculture and Traceability

Blockchain features to implement data management at national and international level

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ministero delle politiche
agricole alimentari e forestali

Traceability

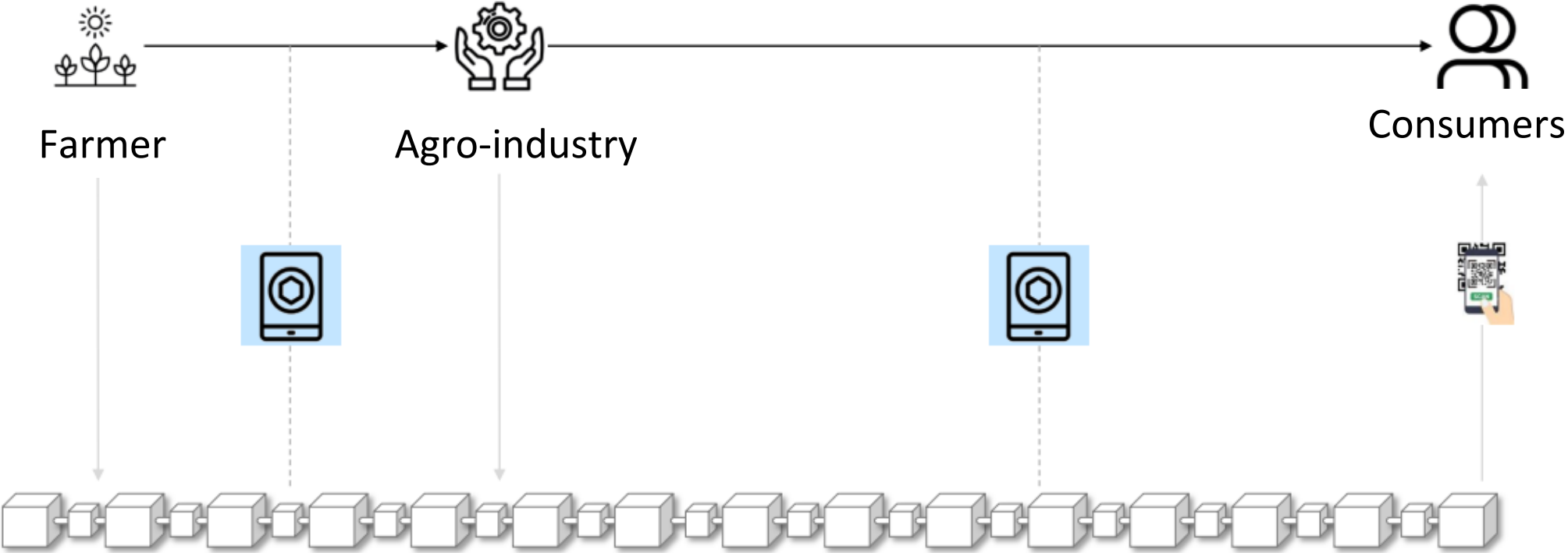
- Besides the primary use as a tool to control food hazard, traceability can provide reliable product information to consumers by making explicit both origin and the production process.
- Traceability can hence increase trust for the agri-food industry, and it can consequently add value to products.

Key aspects for traceability:

- Correctness of the information provided
- Accessibility to the information
- Immutability of the information

The life of an agricultural product

...and other actors: transporters, distributors, retailers...



Blockchain features

Some features of the blockchain have quickly risen interest for a potential application on agricultural products:

- The distributed ledger, mostly to increase flexibility and possibly to reduce costs
- The “smart contracts” to make transactions independent from the parties as fed by data from sensors, and to allow trusted interactions among parties.
- The immutability of data

There is an overlap with the key requirements for traceability, but the application to agricultural products has several implications which make very difficult, if possible, to adopt as such the blockchain procedures and tools.

Moreover, some functionalities needed for tracing agricultural products might be missing.

The Blockchain philosophy

Five defining concepts:

- **Transparent:** all processes and transactions can be verified ex post and it is always possible to measure the resources possessed by a given user at a given point in time.
- **Decentralized:** no such thing as a centralized control, the network outlives individual nodes, and there is no such thing as a hierarchy among nodes.
- **Accountability:** it is possible to track the origin of each and every operation, identifying who owned a resource at a certain point in time.
- **Tamper proof:** it is virtually impossible to forge transactions, and data cannot be altered.
- **Reward-driven:** people and/or organizations who participate in the system must receive value back

If one of these principles is not among our requirements, it is better to move to “traditional cloud computing”.

An example on wine



Questions:

1. Is the whole production chain considered?
2. Are data guaranteed as immutable?
3. Are all the actors included as independent nodes of the blockchain instance?
4. Can transaction data be accessed by external authorities?
5. Is the data intelligible to external authorities and other parties?



A secure data repository

What we really need is a secure repository.

What does “secure” mean, which features are needed?

- **Tamper proof:** transactions cannot be altered, and tampering attempts can be detected
- **Accountability:** it must be possible to track the origin of transactions, i.e. reading the value chain all the way up to the farmer.
- **Transparency:** it must be possible to know how much product is available and who holds it right now. External authorities must be able to verify transaction data.
- **High availability:** it must be available, be resilient to faults/disasters, and scale up.

The business model

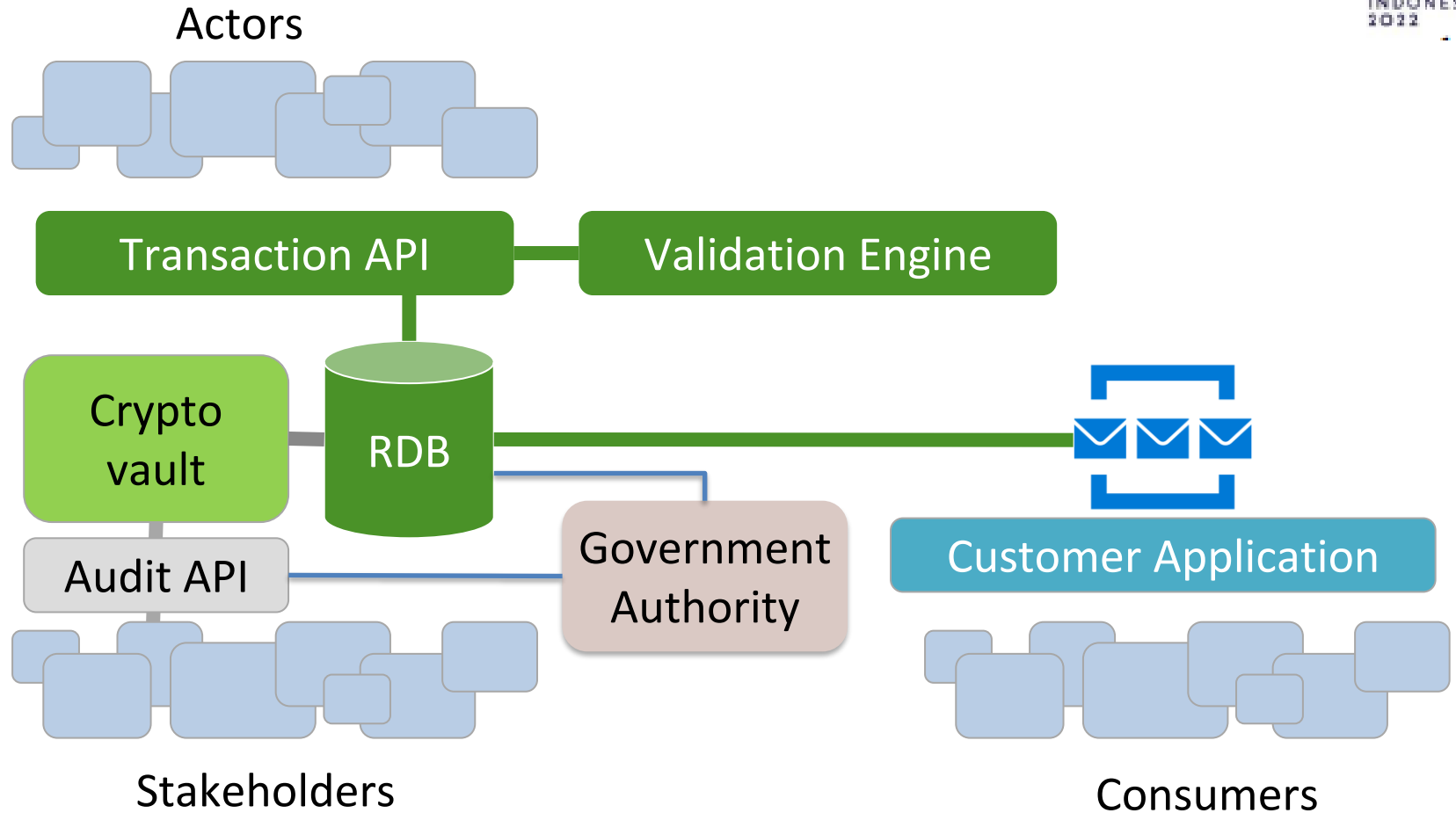
- A software framework to be customized for a specific product should be made available; not necessarily from a government agency but complying to specific communication capabilities.
- An instance of a data traceability system for a specific product should be developed by the agro-industry making the processing of the product, because:
 - The knowledge of relevant regulations;
 - The knowledge of the quality parameters of the product;
 - The direct connection with product providers, to transporters, and to the distribution/retail networks
- Retailers would be involved with two actions:
 - Contributing with transactions, which may include the rejection of either part or a complete transport lot
 - Feeding the database with data on storage

The business model (2)

- A government agency should validate the specific instance of the traceability system of the product in terms of data management; the correctness of production and processing procedures would be independent as they are now. The agency would provide a link accessible of a validation electronic stamp from the agency for a specific production chain.

Consumers, by finding such validation besides other and usual quality controls, would be guaranteed that the story-telling of the product is based on an immutable set of transactions which can be at any time subject to audit.

Putting it all together



What data, what impact

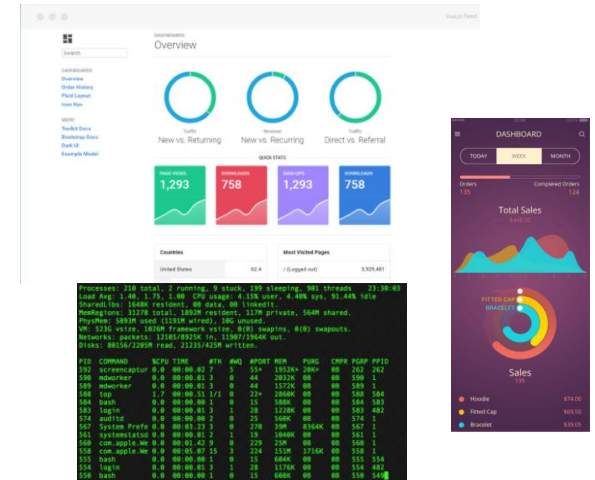
- Whether some of the data need to be made available to run traceability in the framework described (e.g. data from sensors), other are already collected, at times still on paper documents.
- Developing the software to run transactions in the life-cycle of a product (by validating according to «smart contracts») impacts on digitalizing data acquisition, also integrating information from various sources.
- Such digitalization will allow also to run analytics and applications of AI to monitor production systems and to improve quality controls on traceability.
- Importing and exporting agricultural products would benefit from data of traceability as described, also making frauds more difficult (food frauds are worth 100 B€/year for Italian products alone. a +70% growth trend over 10 years).

Technologies and knowledge transfer

- There are already technologies to implement data management for traceability of products which enable the actions described; different platforms can be developed, as far as they allow access as required, and maintain data integrity:
 - No centralized technology and no forcing to specific technologies;
 - Flexibility in development/customization.
- Different technologies can be used; if they share the same kind of access to data as web services it will be possible to use traceability chains also across different countries.
- Primary producers, starting from small farm holders, can benefit in various ways from being actors in production chains traced: better value of products, assistance on digitalization which would impact positively also on other technologies to manage production in a more resilient and cost-effective ways.

Multi-modality

- Not a single end-user system.
- Platform (s) to publish and to receive transactions.
- Producers can integrate it into their systems.
- Market operators can integrate it into their consumer applications.
- Anyone can engineer their own instance of a product chain.



Food Tracking
Platform

Conclusions

- Building immutable data sources with a government validation of the data procedures would certify products not only to consumers, but to also to agro-industry for import/export of products.
- The potentially high cost to implement a platform for traceability can be overcome:
 - In the short period, by developing software platforms which would require, for new products, configuration instead of new logic, and making it available to the agro-industry. Players as Microsoft and PwC are working with us on this.
 - In the medium term, by the higher price that products digitally traced would yield.
- International cooperation may have a role in co-development of requirements for such platforms, whereas technology would be a free-choice of each country and agro-industry player.