Traceability of agricultural products: digital and genetic technologies

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Traceability

- Traceability is the ability to identify the origin of food and feed ingredients and food sources.
- In the agricultural sector, the accurate and timely traceability of products and activities plays a vital role in the supply chain.
- Traceability within food control systems is applied as a tool to control food hazards because it enables food removal from the market at any stage of the food chain, should a problem be identified.
- Traceability can provide reliable product information also to consumers, it guarantees product authenticity, and it might provide information of the production process.

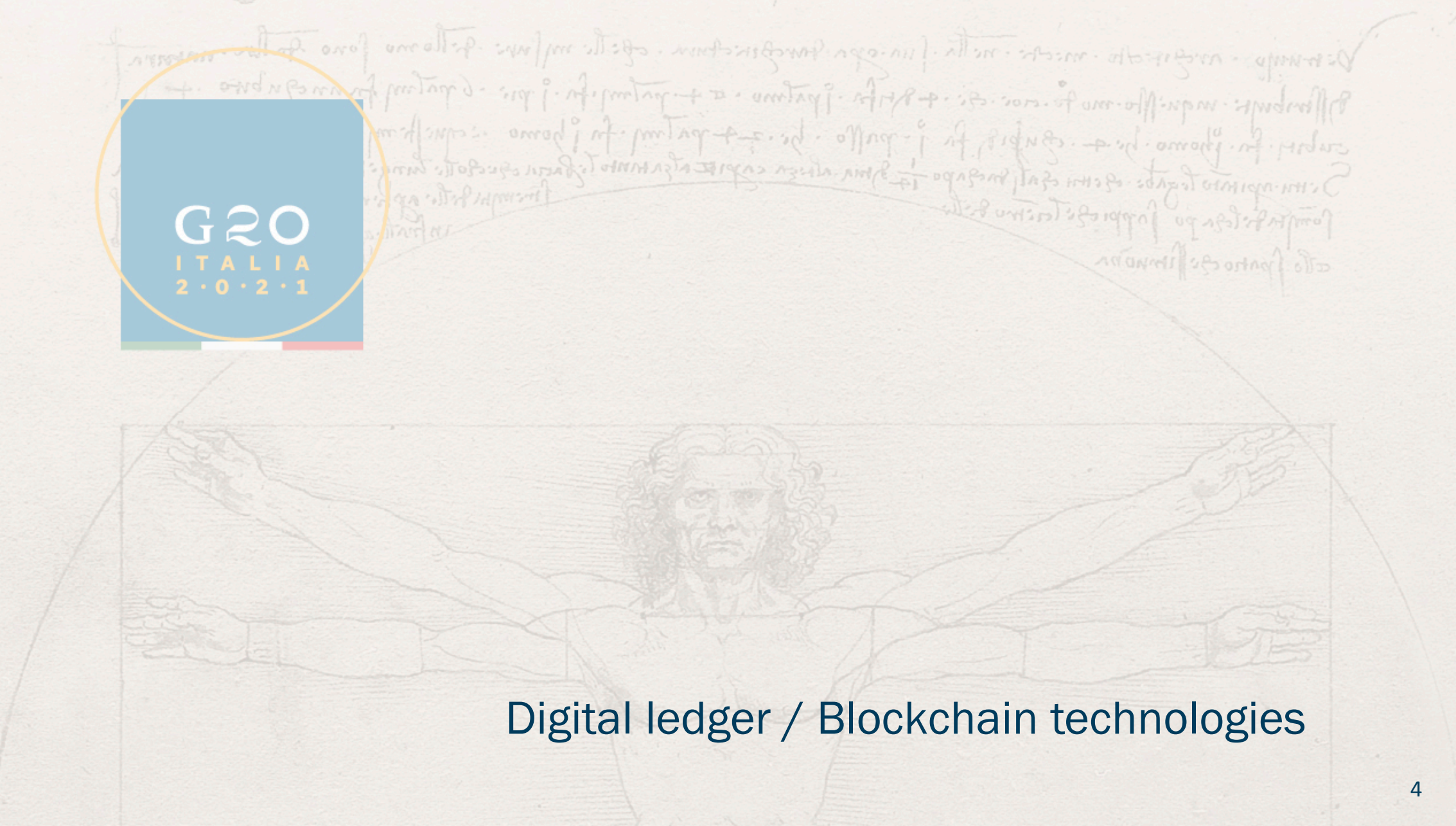
Reliability of a traceability system

Key aspects:

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

Some of these features can be implemented via a Blockchain-type application to develop the digital part of a traceability system, and genetic technologies can support tests on products.

The Blockchain technology has interesting features with respect to traceability, but agricultural products require many operations from production to final consumers, where the life cycle of the product ends. Also, different actors are involved with a wide range of expertise and resources.



Digital ledger / Blockchain technologies

Problems of the Blockchain technology for application in agribusiness

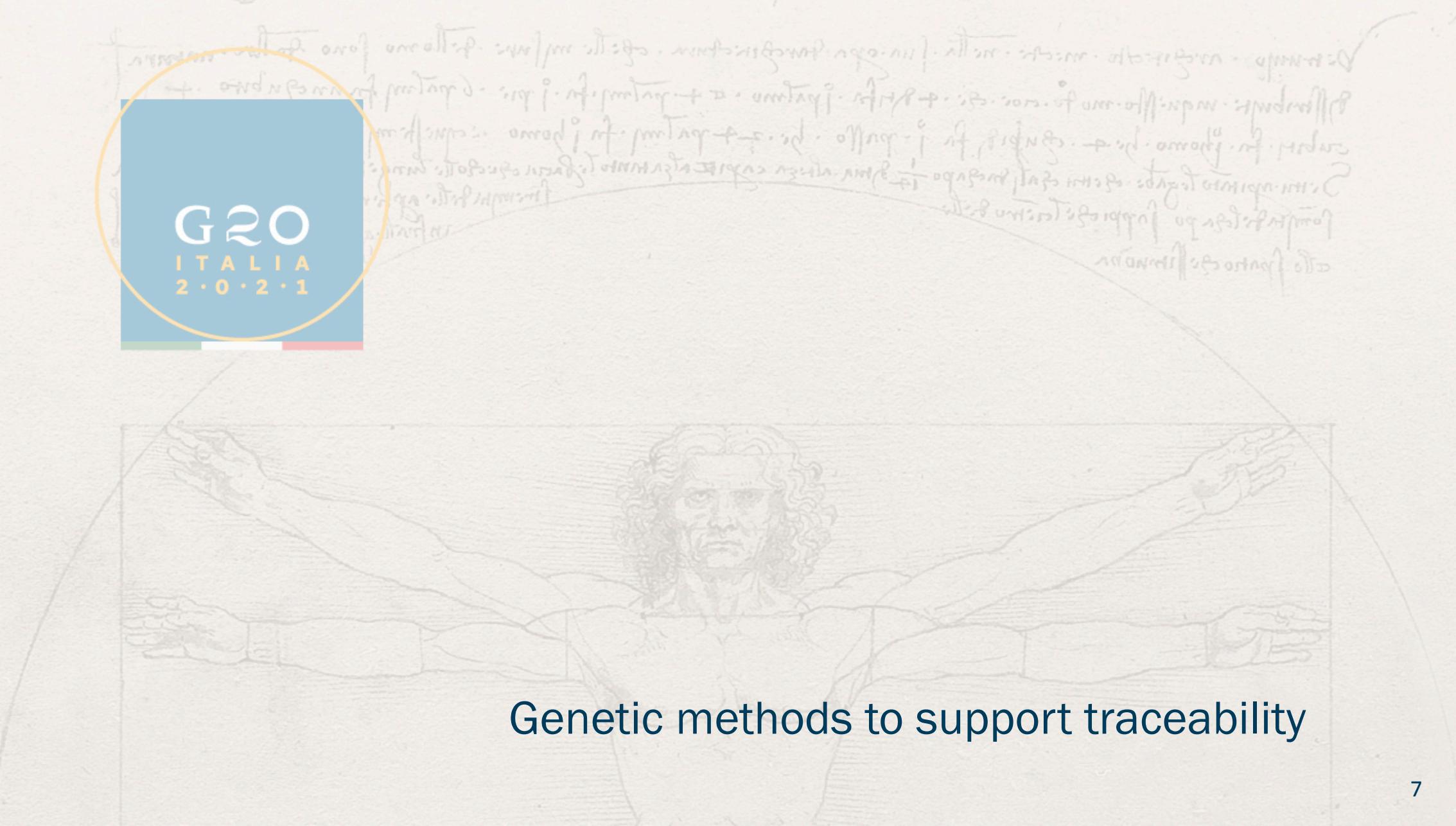
Key aspects of the blockchain make it an overkill in agribusiness, while still missing features of interest. The challenge is given by:

- Decentralization requires all parties to host nodes on the network to participate consensus
- Governance rules must be established, deployed, and managed
- Latency associated with network consensus can impact transaction throughput
- Development and management is challenging

Ledger capability comparison

			
Distributed architecture with decentralized consensus	X	X	V
Centralized architecture provìding tamper-evident proofs to users	V	V	X
Query ledger data in a performant manner without adding additional infra	V	V	X
Support for updates and deletes while maintaining forward integrity	V	V	X
Does not require new development, enable on existing systems	V	X	X
Support for on-prem, provisioned cloud and serverless	V	X	X
Ability to backup/restart ledger data while maintainlng data integrity	V	X	X
Support for customer managed keys tor encryption	V	X	X

slide courtesy of Microsoft



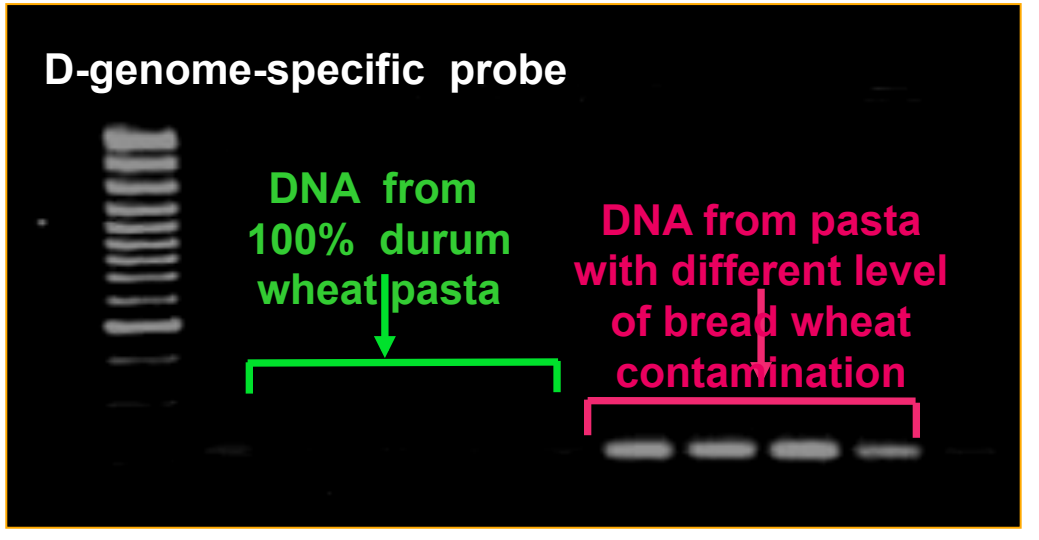
Genetic methods to support traceability

Genetic methods

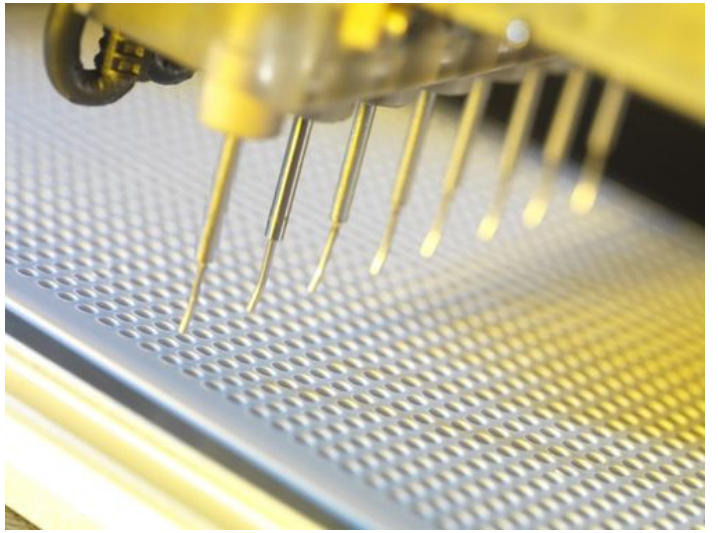
- Genetic methods are emerging as robust, reliable, sensitive and rapid control tools for verifying the authenticity of products and their origin.
- DNA can be considered a biological barcode

- DNA allows revealing the presence of undesired ingredients

(e.g. GMO, bread wheat in durum wheat pasta) and of pathogens with a high level of sensitivity (< 0.05%)



Ease for implementation and low cost



- Methods for DNA traceability can be run in high throughput platform that allow to reduce the cost/ datapoints
- Specific genomic assays can be implemented into Point-of-care analytical approaches, to be used directly on the production sites, with limited costs and even by unskilled personnel.

Conclusions

- Developing standards for transnational access to info related to food and feed products will increase safety control, limiting frauds by:
  - Providing independent access to immutable information
  - Allowing applications of AI to spot anomalies
- Agreeing internationally on probes for DNA analyses would increase standards and possibly provide a legal value to tests
- Technologies are mature and cost effective to track products in the steps of the production chain, and to run analyses to corroborate data provided by actors in the production and supply chains