GOVERNMENT OF MALTA

FONDI.eu

INTERESTED IN WINE?
OR BLOCKCHAIN? OR BOTH?

VINOVERITAS

... when wine meets blockchain

Co-funded by the European Union

L-Università ta' Malta

Everything is fine with wine…

vinovest.co/blog/fake-wine

vinovest

WHY WINE WHY WHISKEY HOW IT WORKS BLOG

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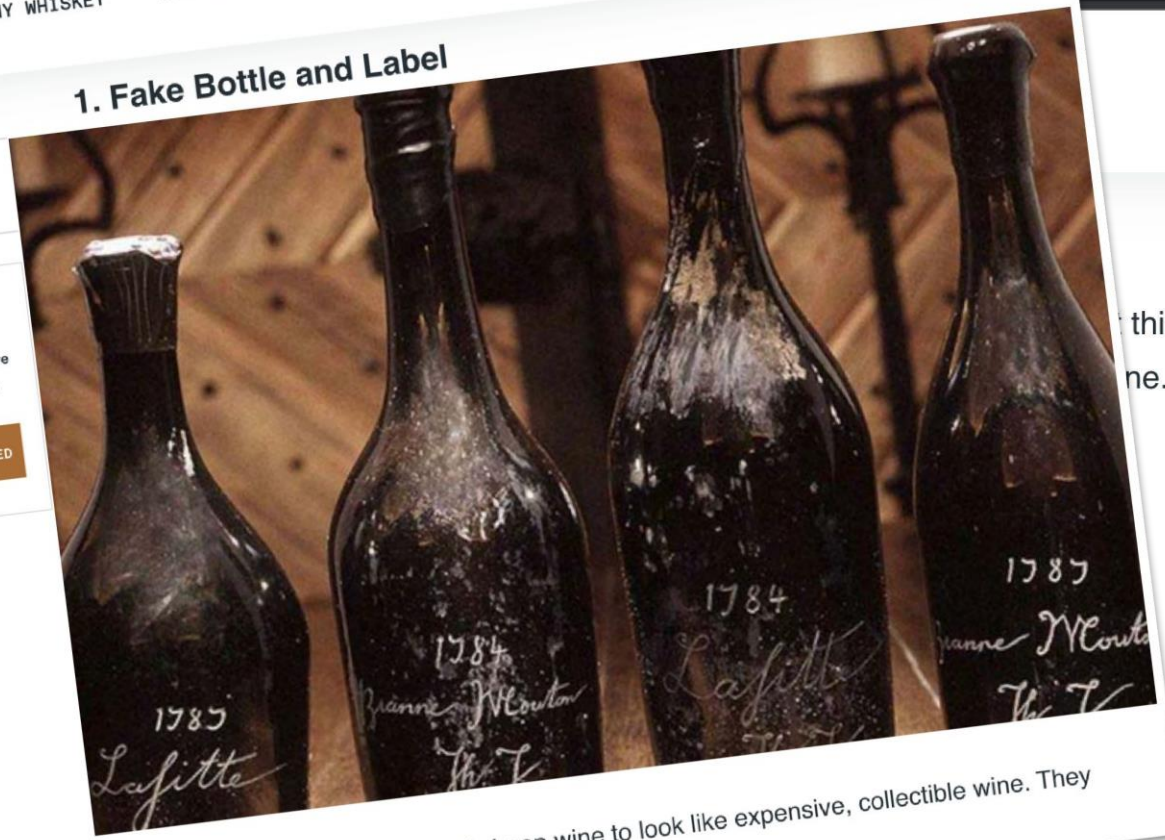
Simple modern wine investing

Wine consistently outperforms other alternative assets. Vinovest makes wine investment easy.

Enter your email GET STARTED

1. Fake Bottle and Label



Some counterfeiters relabel cheap wine to look like expensive, collectible wine. They even falsify the wines' origins to ensure high selling prices.

thing you want is to
ne.

vinovest.co/blog/fake-wine

vino vest

WHY WINE WHY WHISKEY HOW IT WORKS BLOG

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2. Wine Adulteration

Wine adulteration is when the wine is weakened or thinned, often with the inclusion of ingredients like juices. Sometimes counterfeiters also add sweeteners and additives to improve flavor or color.

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WHY WINE WHY WHISKEY HOW IT WORKS BLOG

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3. Fraud Wine Investment Firms

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Simple modern wine investing

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If you're an investor, do your due diligence about wine investment firms.

christianseiler.com/geschichten/the-scandal-that-changed-everything

Christian Seiler

Ve

The Scandal that changed everything

Zur Person
Bücher
Geschichten
Kolumnen
Corporate
Kontakt

teilen

Weinskandal (wine scandal) is a potent word, much like blitzkrieg or wanderlust. The German language has such a talent for words like this, it even exports them into English. Anyone whose interest in wine isn't limited to asking where the corkscrew is knows the story of the Austrian wine scandal. It's a good story, especially because it has a happy ending.

For anyone who doesn't have the facts to hand right now: in the summer of 1985, anonymous reports revealed that Austrian winemakers, as well as large German bottlers, had laced their wines with diethylene glycol. Added in the form

dose. Just one small glass of a wine like this, gulped thirstily down, could be fatal.

Zur Person
Bücher
Geschichten
Kolumnen
Corporate
Kontakt

Methyl alcohol (CH4O), has a strong toxic effect on the human organism. Once it has entered the system, it leads to hyperacidity of the blood, and of the whole body, within six to 30 hours. The symptoms are headaches, vomiting, dizziness and breathlessness. If treatment (usually administration of the antidote, fomepizole) is not started in time, it causes nerve damage, in particular damage to the optic nerve, followed by blindness, and eventually respiratory failure and death.

When reports of the victims of this methanol poisoning became public, consumption of wine sank dramatically.

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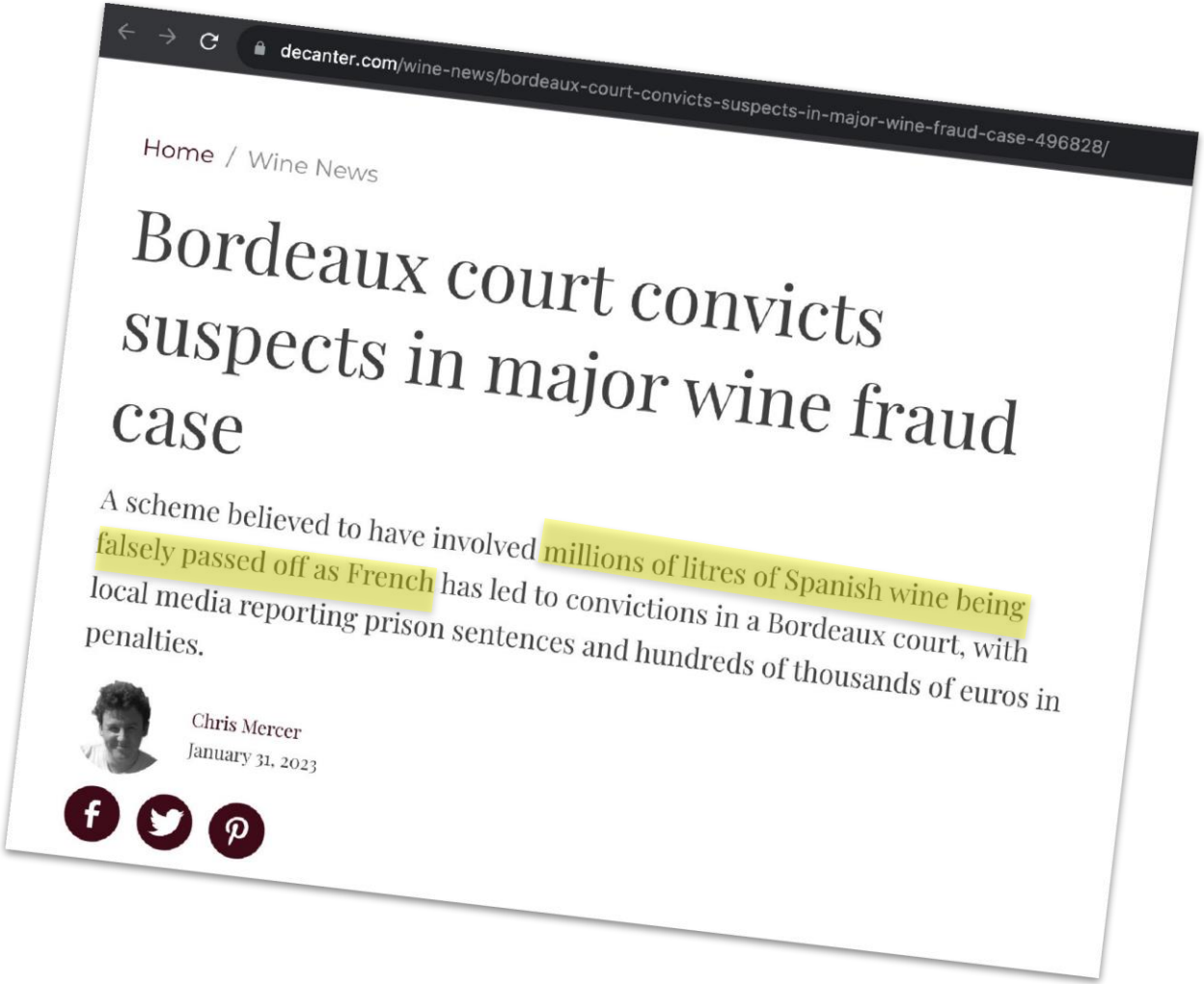
decanter.com/wine-news/bordeaux-court-convicts-suspects-in-major-wine-fraud-case-496828/
Home / Wine News
Bordeaux court convicts suspects in major wine fraud case
A scheme believed to have involved millions of litres of Spanish wine being falsely passed off as French has led to convictions in a Bordeaux court, with local media reporting prison sentences and hundreds of thousands of euros in penalties.
Chris Mercer
January 31, 2023

Châteauneuf-du-Pape Wine Scandal

It is France who is the undisputed historical motherland of premium wine and the birthplace of wine law. Here fraudsters face **serious jail time** and very public disgrace when mucking about with French wine.

As was the case recently when bulk wine merchant Raphaël Michel fell from grace. Raphaël Michel buys wine from 100's of producers to blend and bottle wine all over the world. In 2017, the Rhône Valley arm of the compan was at the center of a massive wine scandal.

Authorities found that **48 million litres** of simple, inexpensive Côtes du Rhône wine was mislabelled and sold as the more prestigious Châteauneuf-du-Pape wine over a 4-year period.

Originally, the organizations chairman, Guillaume Ryckwaert, "was charged with fraud, deception and violations of the consumer and tax codes." He fa… …il, a US $370 000 fine and a $600 000 bail.

decanter.com/wine-news/british-fraudster-faces-jail-after-admitting-13m-wine-...

Decanter

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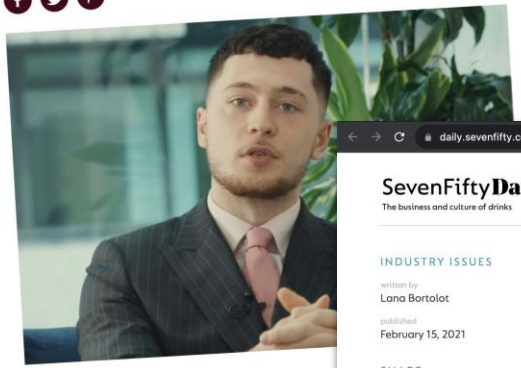
British fraudster faces jail after admitting $13m wine and whisky investment scam

Casey Alexander preyed upon more than 150 elderly American investors before he was finally rumbled in an FBI sting.

Martin Green
April 11, 2023



Casey Alexander

daily.sevenfifty.com/beyond-high-profile-scandals-wine-fraud-is-rampant/

SevenFiftyDaily
The business and culture of drinks

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INDUSTRY ISSUES

Beyond High-Profile Scandals, Wine Fraud Is Rampant

written by
Lana Bortolot

published
February 15, 2021

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How the pandemic-fueled increase in online sales and decrease in vetting has led to more counterfeit bottles—and how wine professionals can spot them

brazilreports.com/brazilian-wineries-involved-in-a-slave-labor-scandal/4129/

BRAZIL REPORTS

Peru Reports Aztec Reports Argentina Reports Latin America

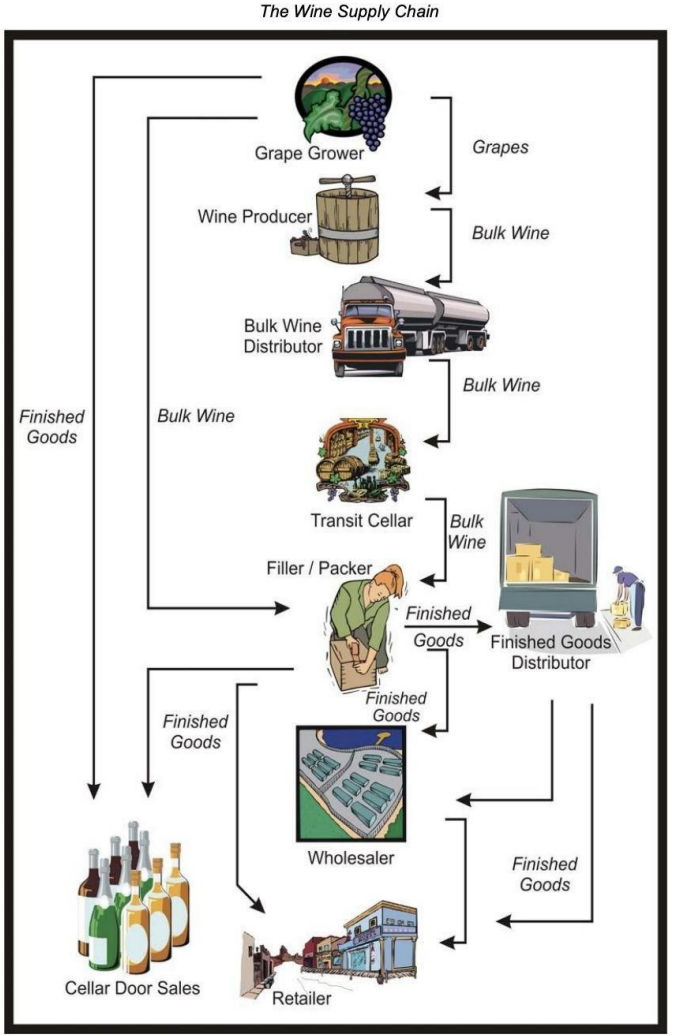
Brasil News News

Brazilian wineries involved in a slave labor scandal

By Thiago Alves March 7, 2023

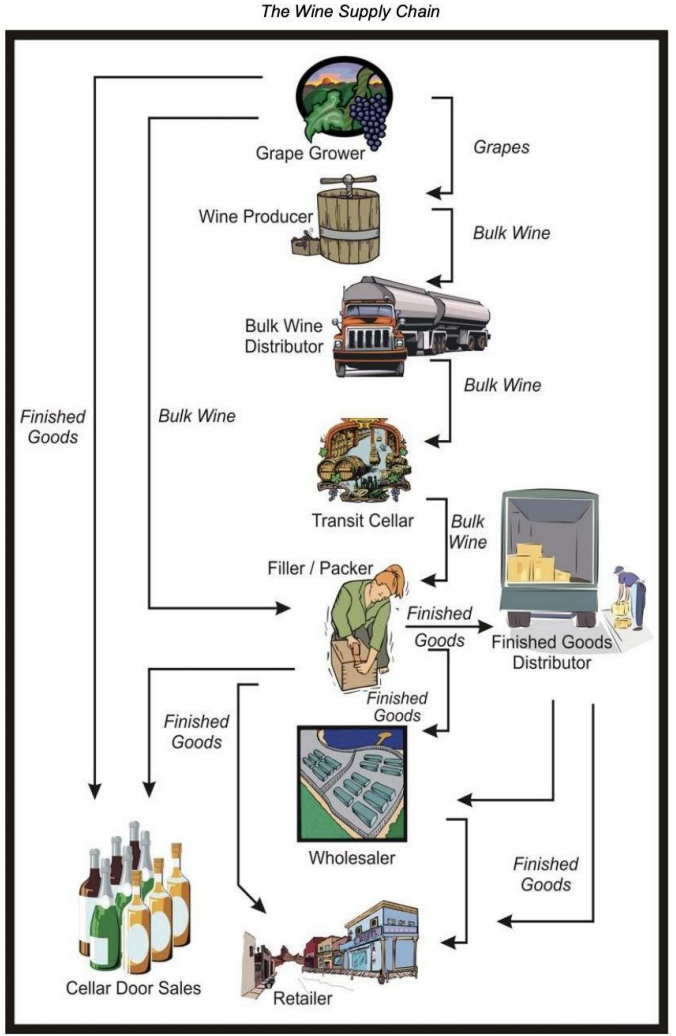
More and more…

We often thinfi about the Consumer risfis…



Wine Supply Chain Traceability: GS1 Application Guideline
GS1

Consumer risfis…
…and <u>risfis borne by other stafieholders</u>



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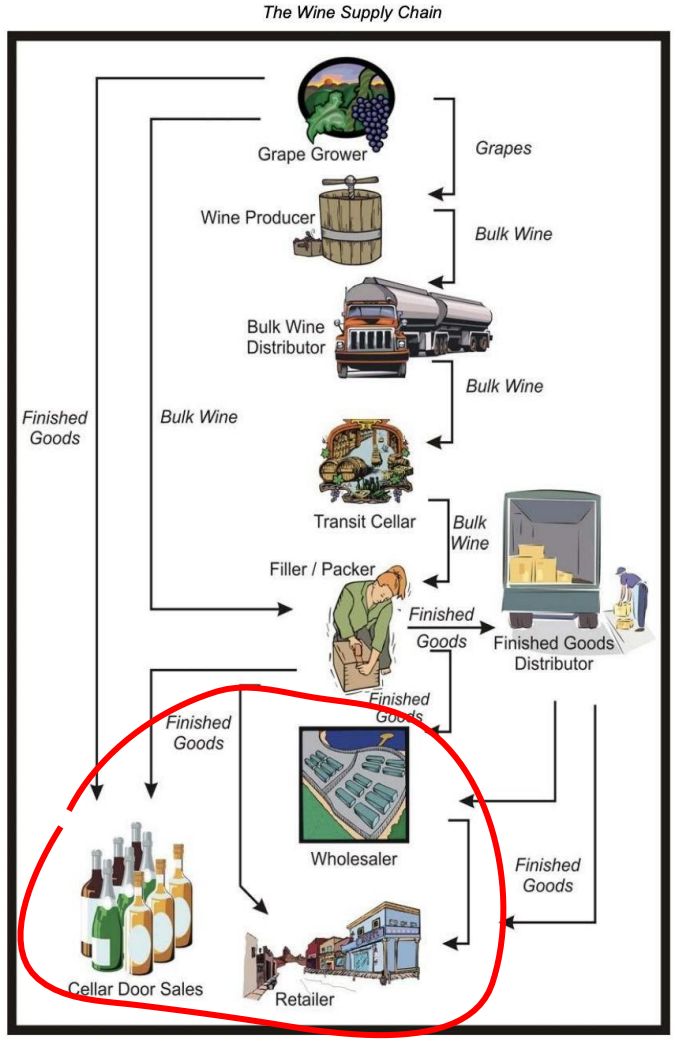

Sales related risks

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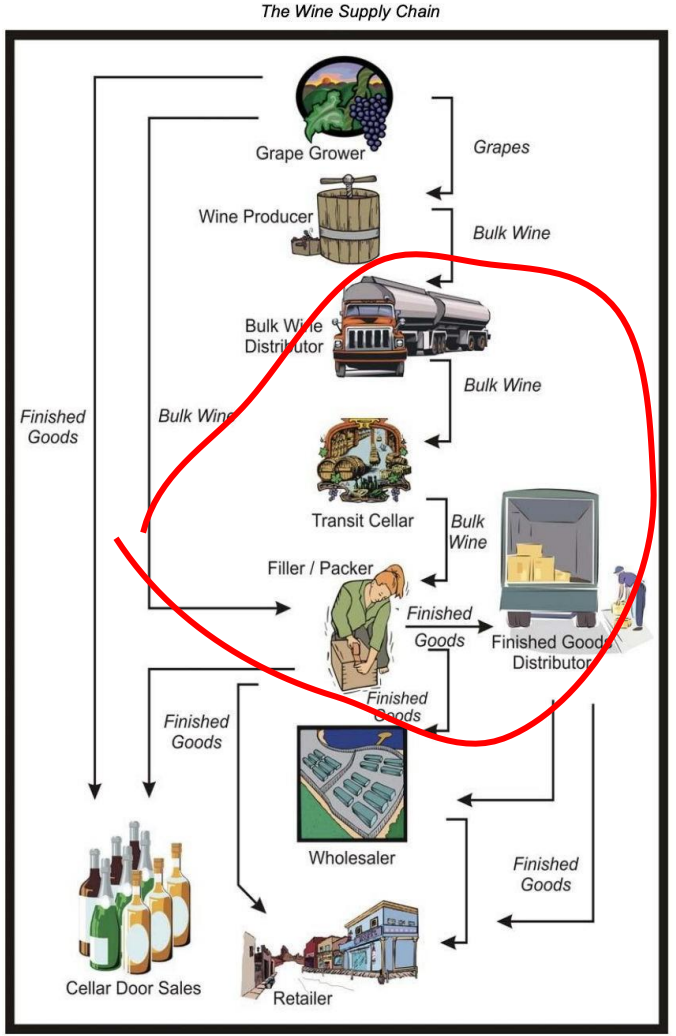
Logistics related risks

Sales related risks



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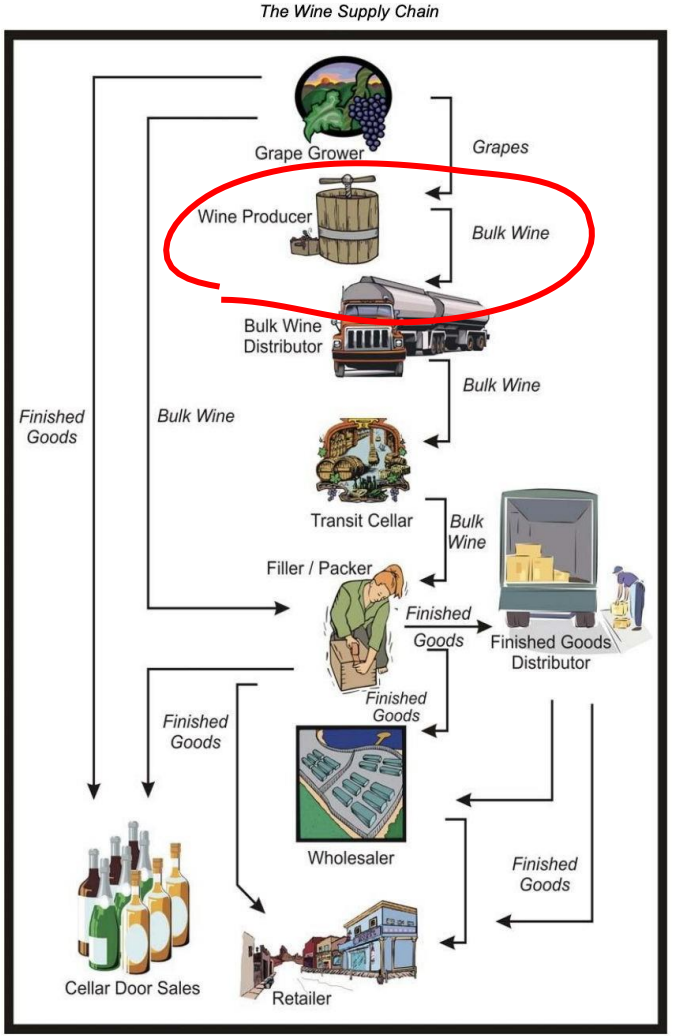
Wine producer risks

Logistics related risks

Sales related risks



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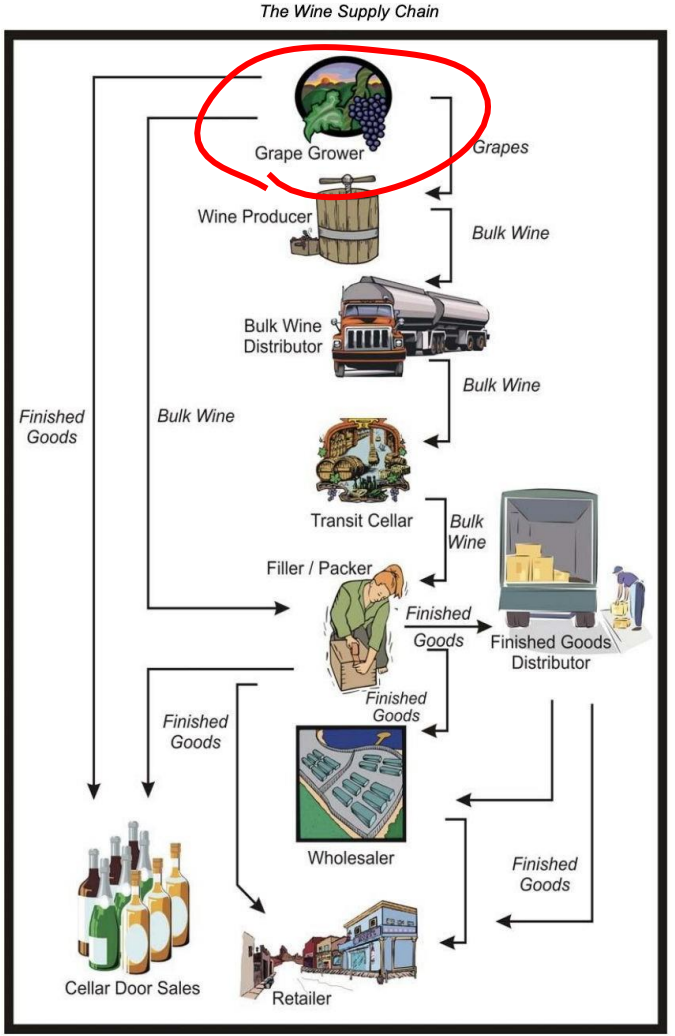
Grape grower risks

Wine producer risks

Logistics related risks

Sales related risks



Wine Supply Chain Traceability: GS1 Application Guideline
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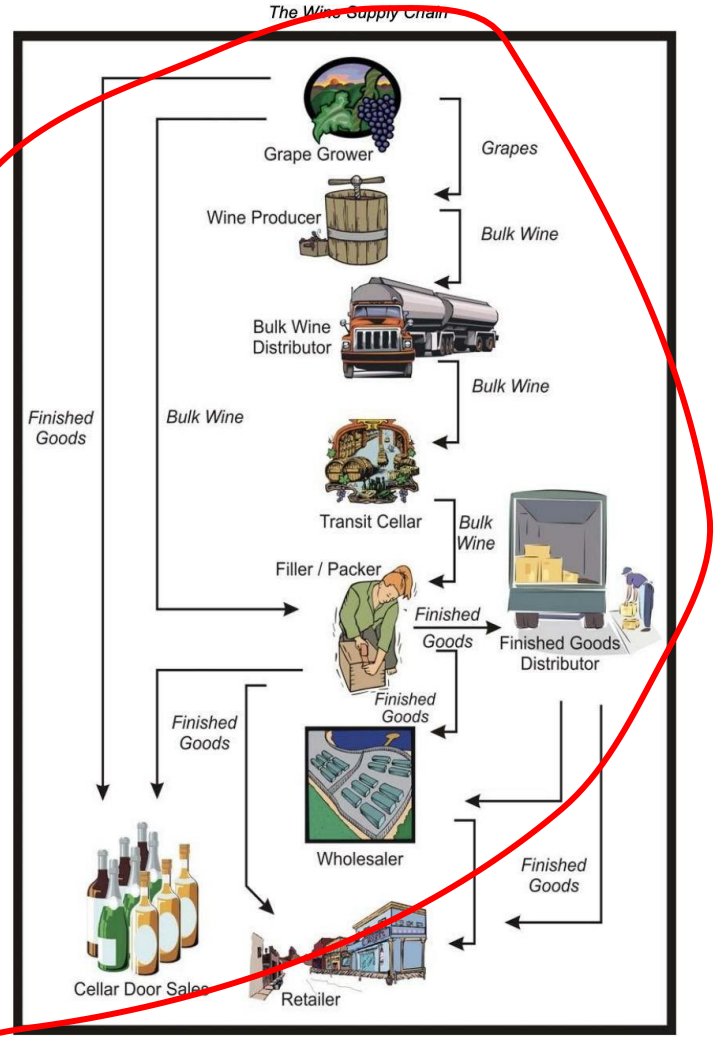
Grape grower risks

Wine producer risks

Regional / National / Authority risks

Logistics related risks

Sales related risks



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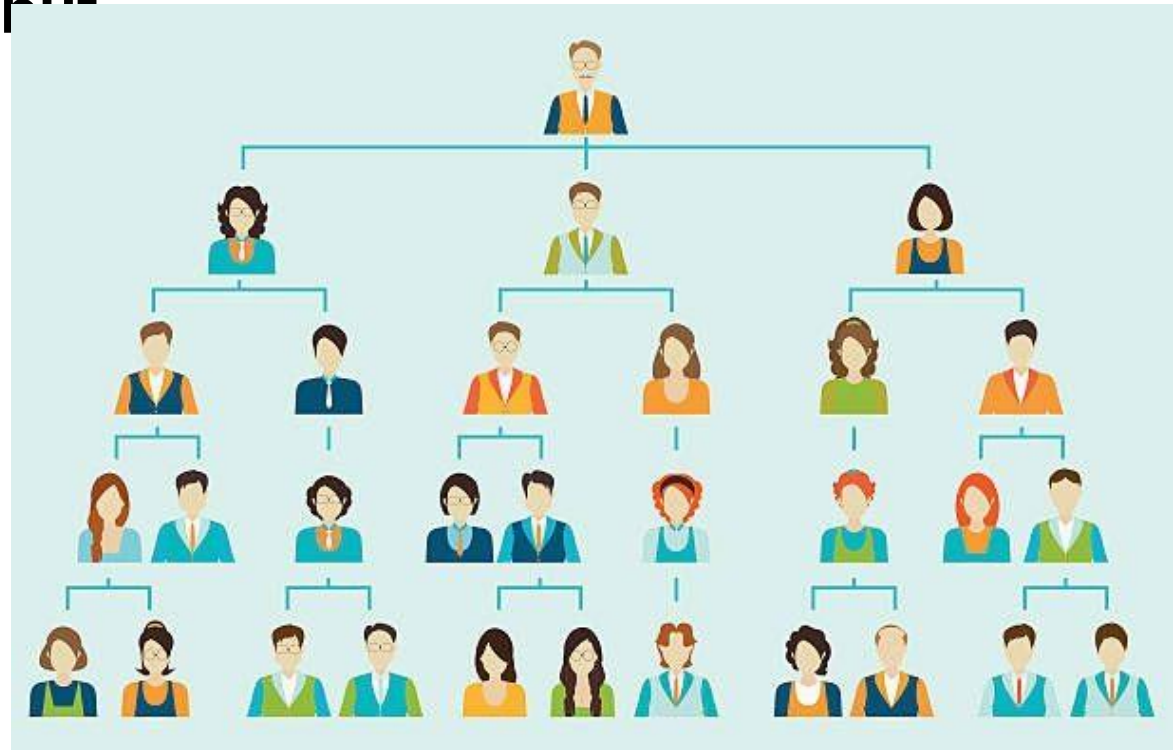
Organisational structures and risfis… We may trust the entity… but



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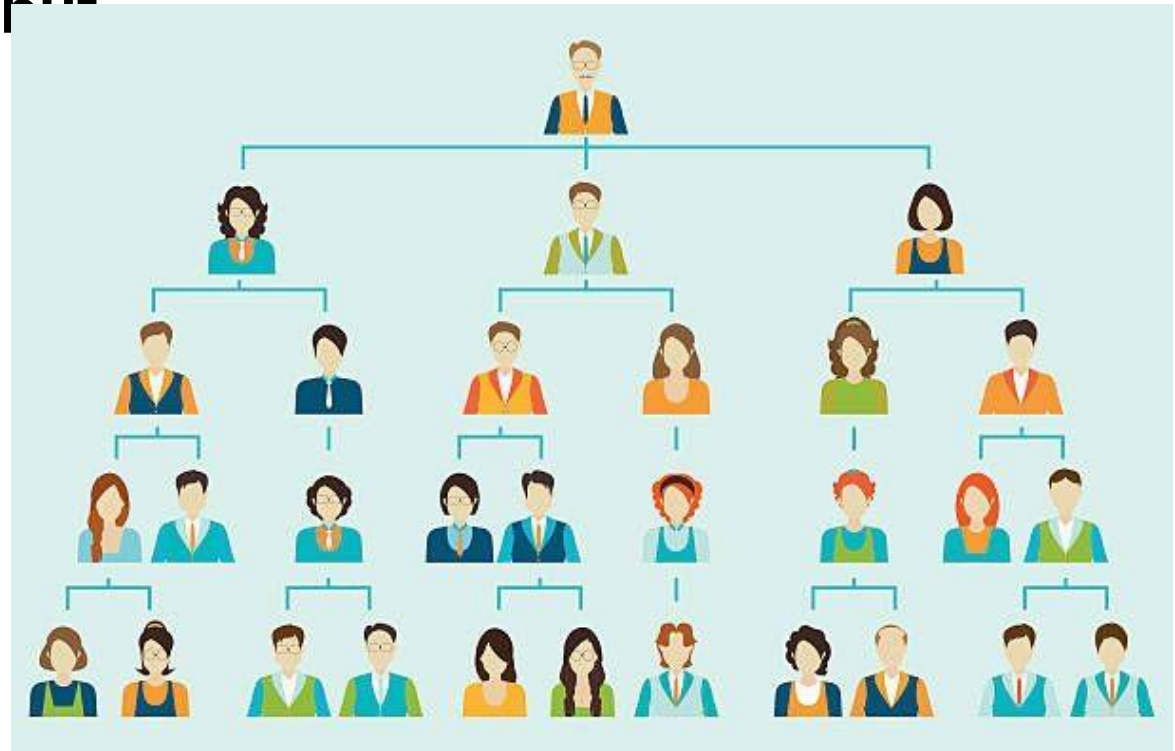

National wine certification programmes

Some of the risks mentioned can be covered via national/regional certification programmes.

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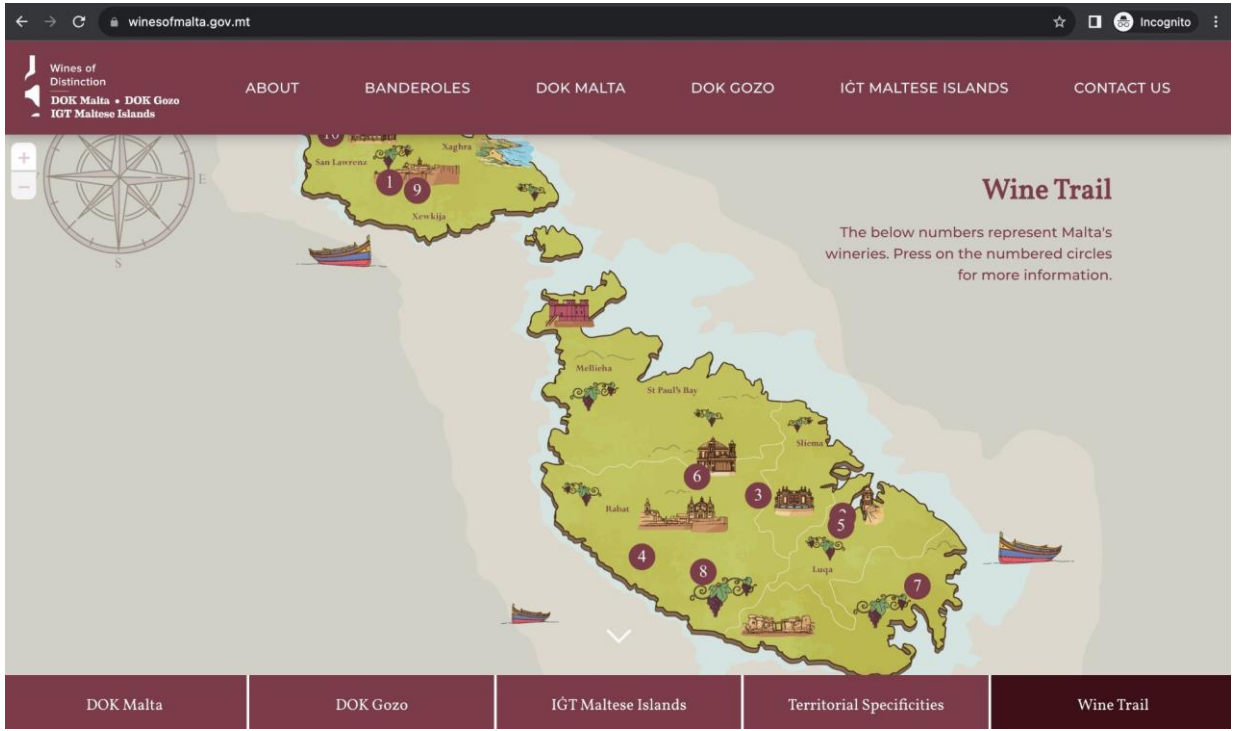

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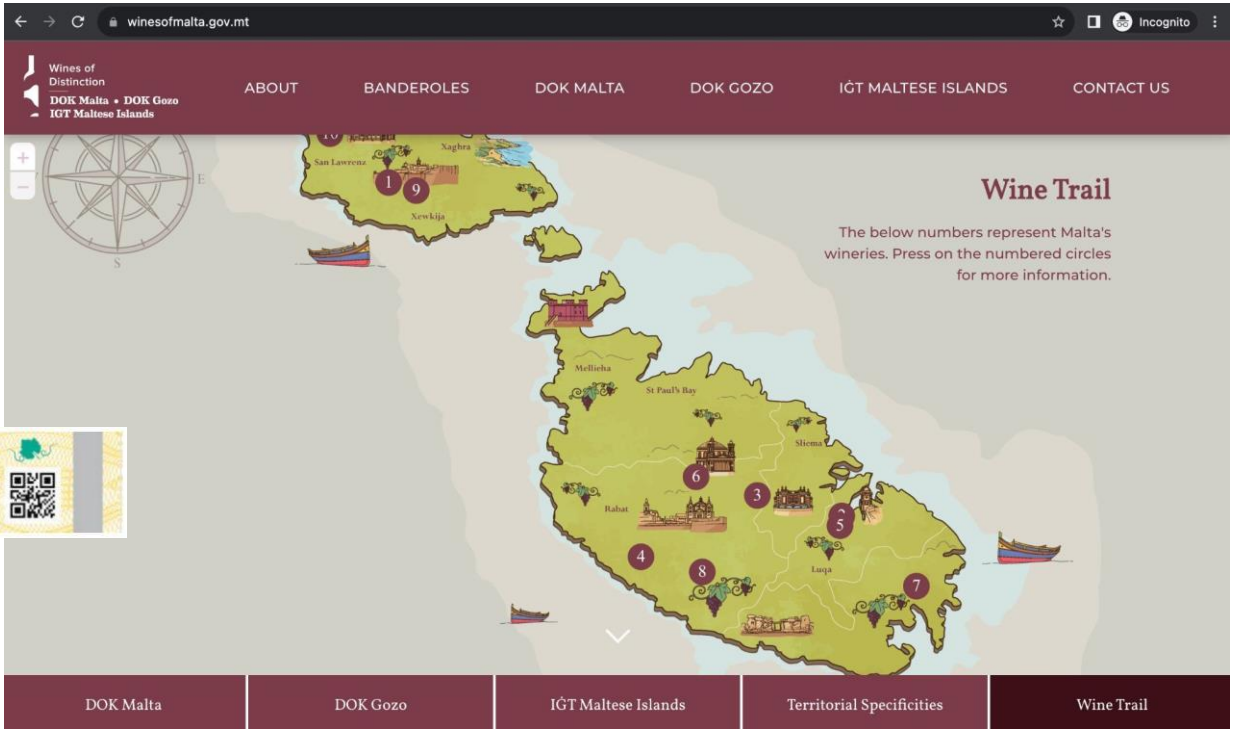

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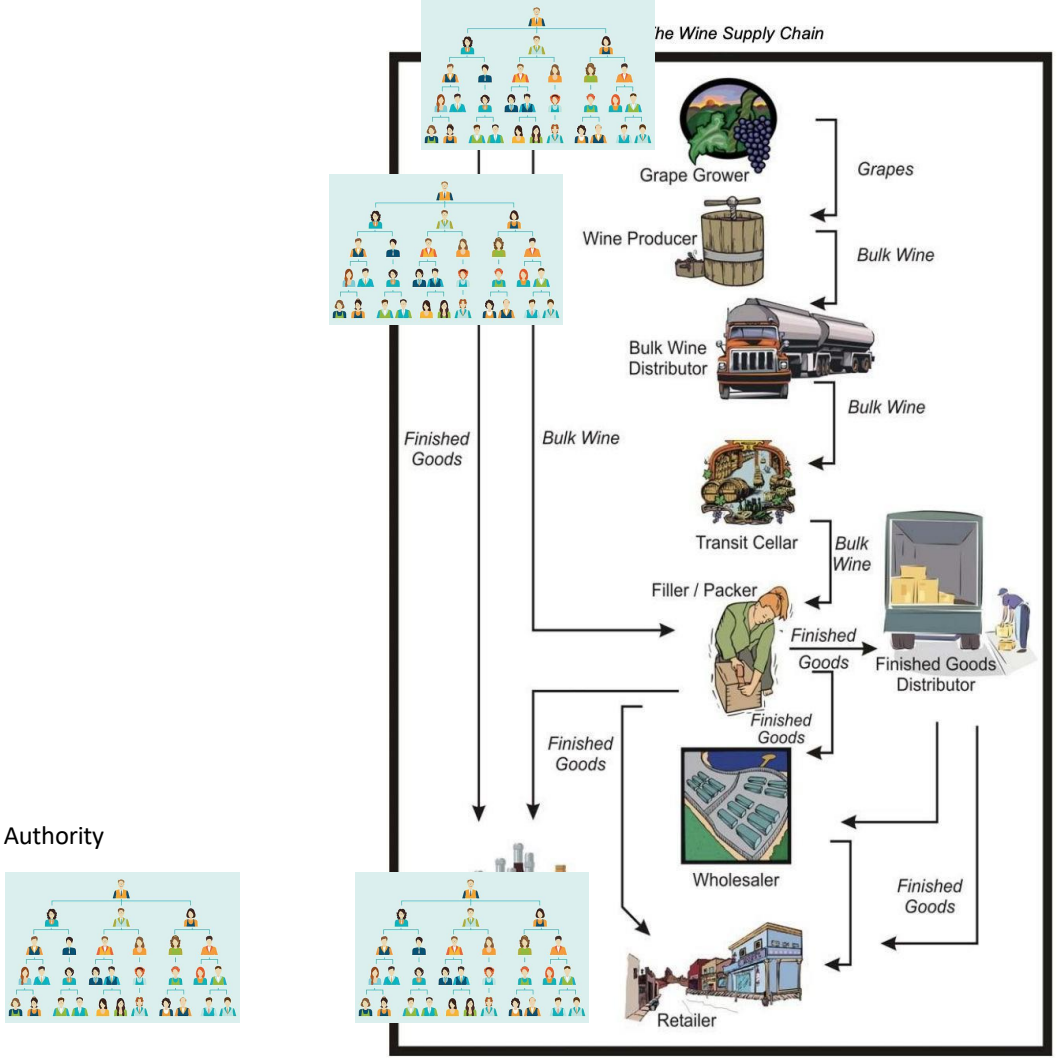
Staff/third-party risfis



Authority

Wine Supply Chain Traceability: GS1 Application Guideline
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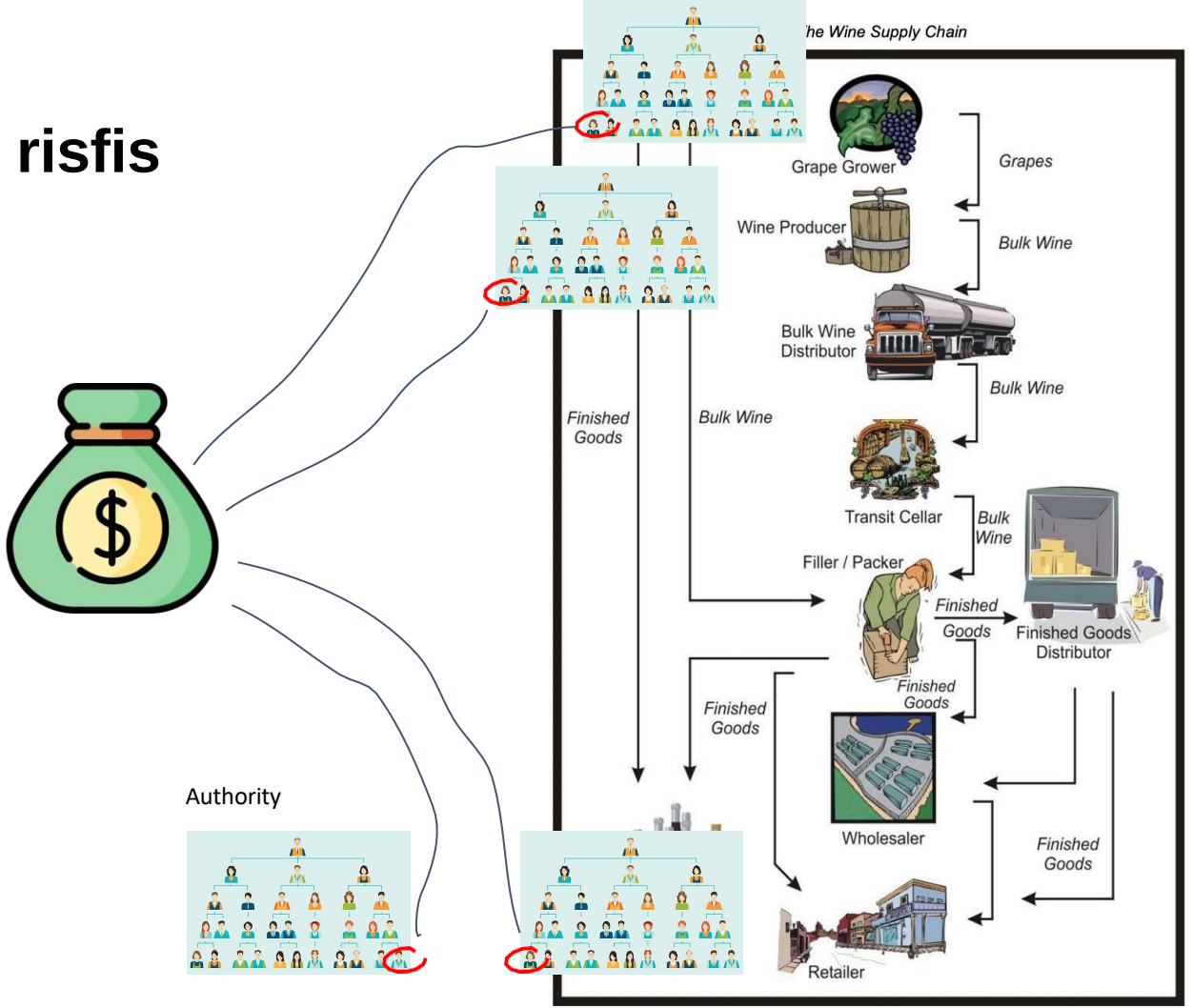
Staff/third-party risfis



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Can we fill some remnant 'trust gaps'?

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Can we fill some remnant 'trust gaps'?

One "trust gap" that is often just accepted is the trust we have in our digital systems…

We need to trust our digital systems too…
…consider Payment Systems as an example

Centralised Payments/Accounting Systems

AccountID	Name	<Balance>	…

Centralised Payments/Accounting Systems

AccountID	Name	<Balance>	…
…			
1392	Me	EUR 0.01	…
1393	You	EUR 1,234,567.89	…
…			

Centralised Payments/Accounting Systems

TransactionID	FromAccount	ToAccount	Amount

Centralised Payments/Accounting Systems

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1234	1392	1393	0.01

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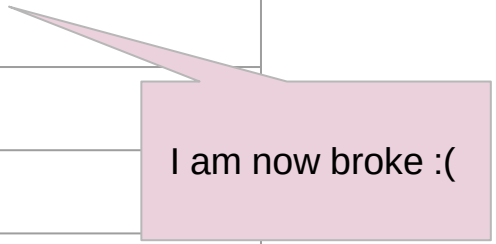

Centralised Payments/Accounting Systems

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1234	1392	1393	0.01

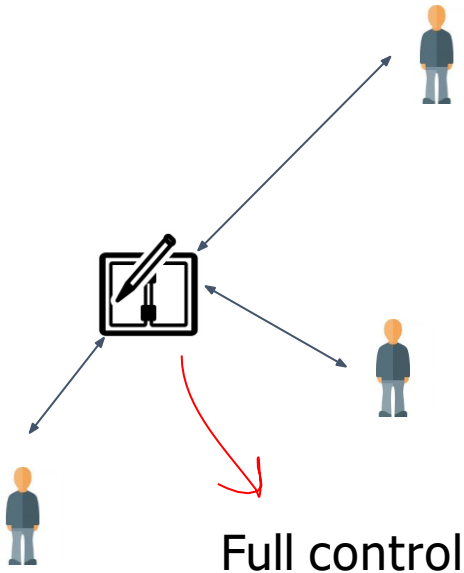
I am now broke :(

Can I somehow “hack” the system,
steal money,
or bribe someone?

Centralised Payments/Accounting Systems

TransactionID	FromAccount	ToAccount	Amount
1234	1392	1393	0.01
1235	1393	1392	100,000

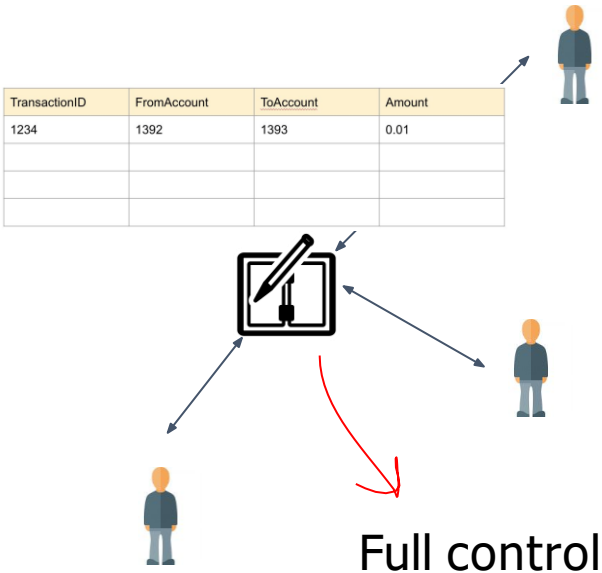
Centralised Systems



Full control over:

* Code / Processes / Rules / Logic
* Data

Centralised Systems



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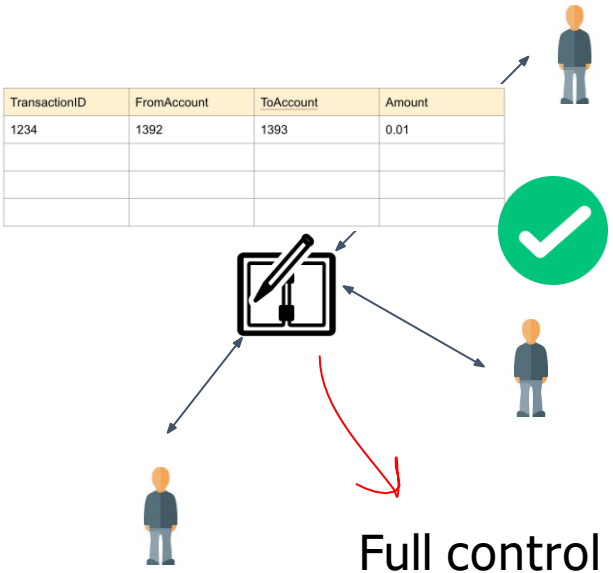

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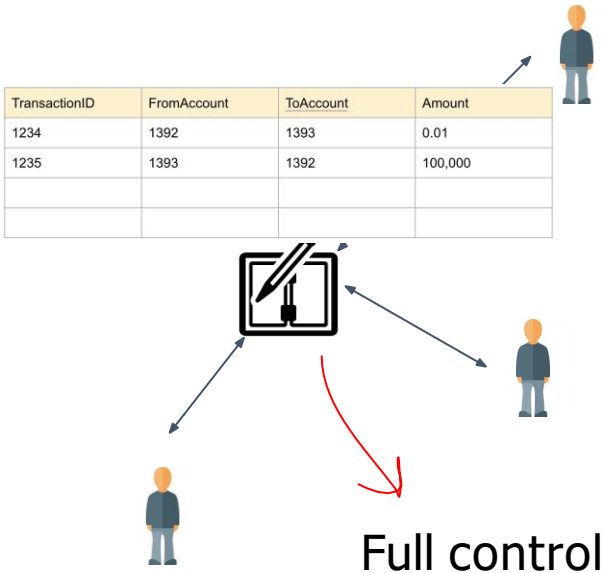

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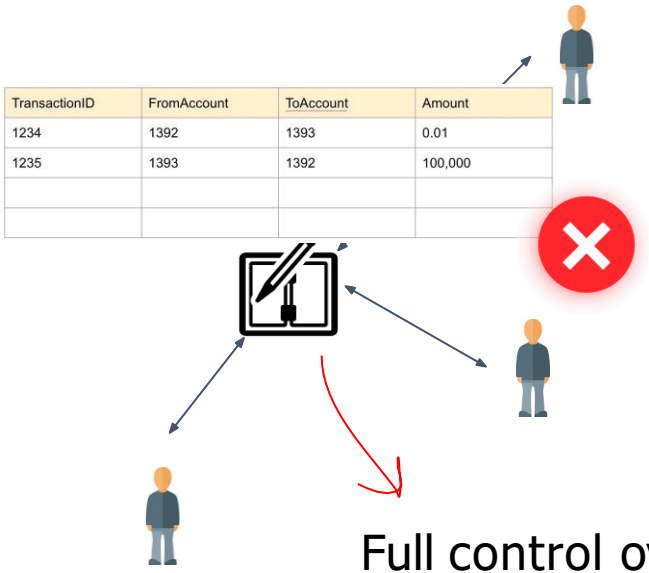

Though a transaction should not be allowed…

Full control over:

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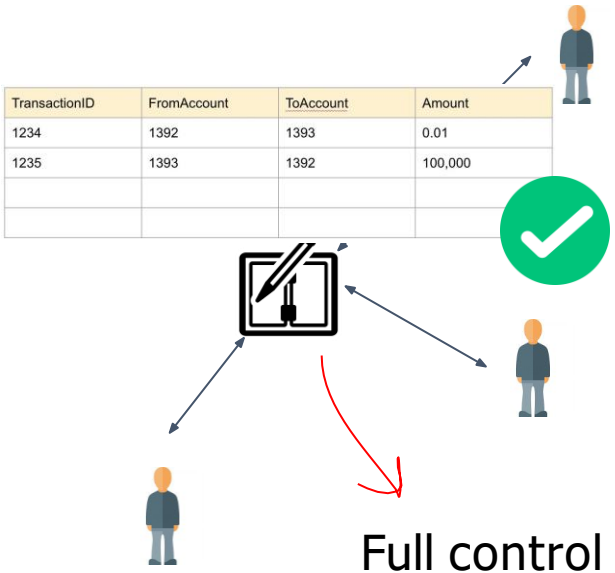
Centralised Systems



Because of the centralised nature of the system… rules can be broken.

Full control over:

* Code / Processes / Rules / Logic
* Data

NS just in Payment Systems...

... Consider Agri-Quality Assurance Systems

NS just in Payment Systems...
... Consider Agri-Quality Assurance Systems

Date & Time	Lab Tester	Verified Batch	Details
1st Jan 2024 13:01	JE	Yes	…
1st Mar 2024 12:34	JE	Yes	…
1st Jul 2024 14:11	JE	Yes	…

NS just in Payment Systems...
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Imagine we had to test a minimum of once every two months…
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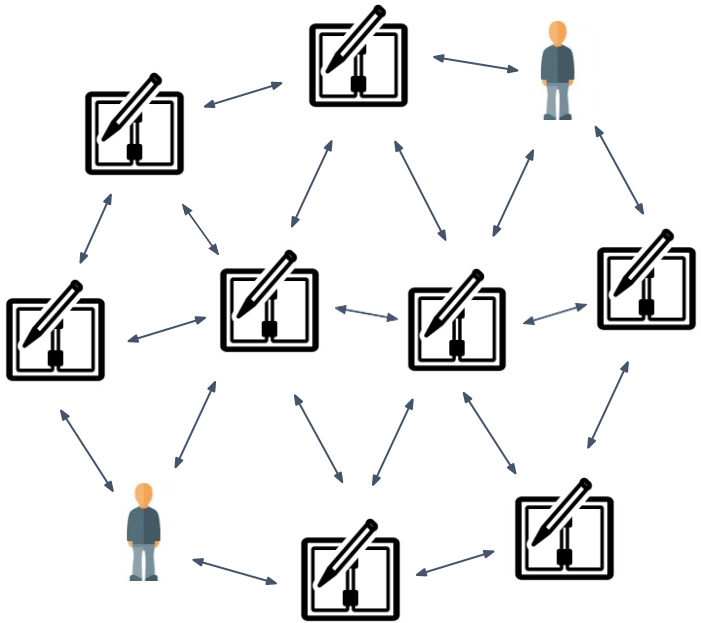
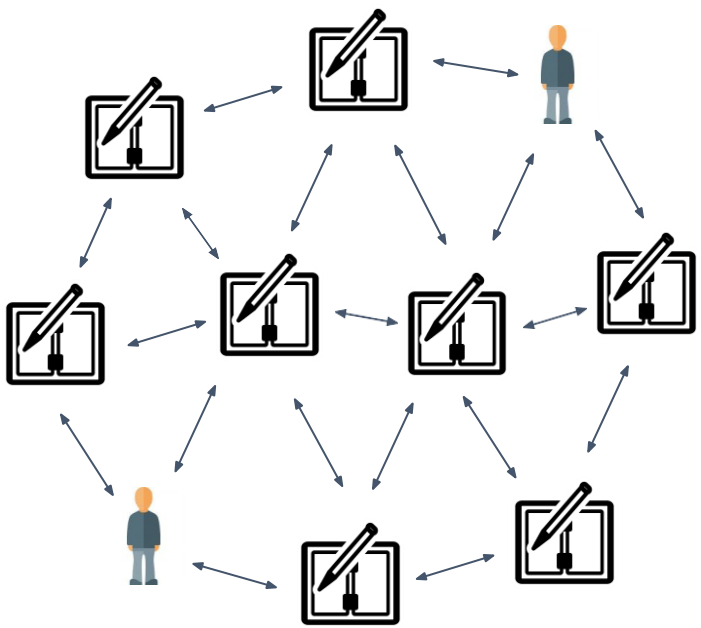
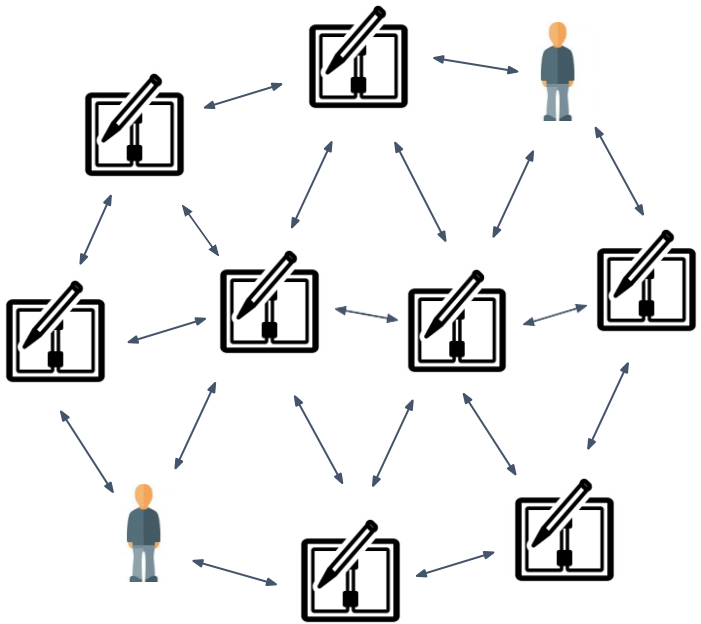




Decentralised Systems

- The code will do exactly what is written in the code.
- No one can change or cheat the code.



Decentralised Systems

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- We did not know how to create systems like this
  - Till Bitcoin proposed “Blockchain”

TransactionID	FromAccount	ToAccount	Amount
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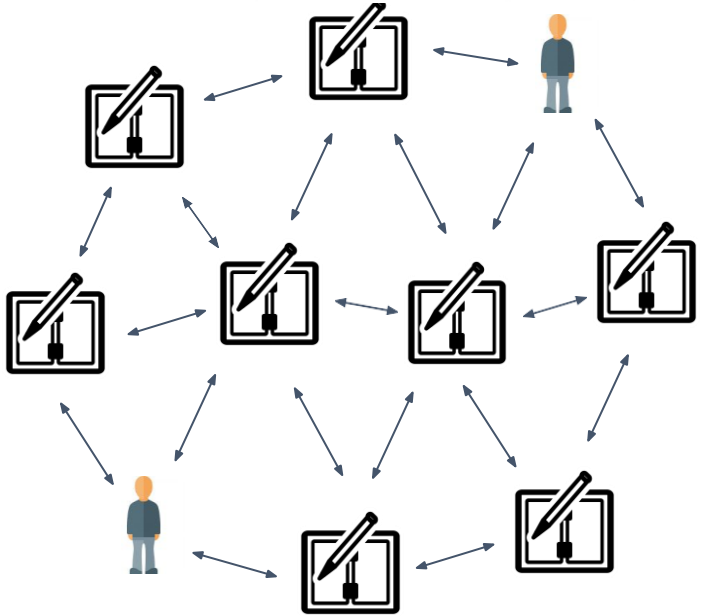
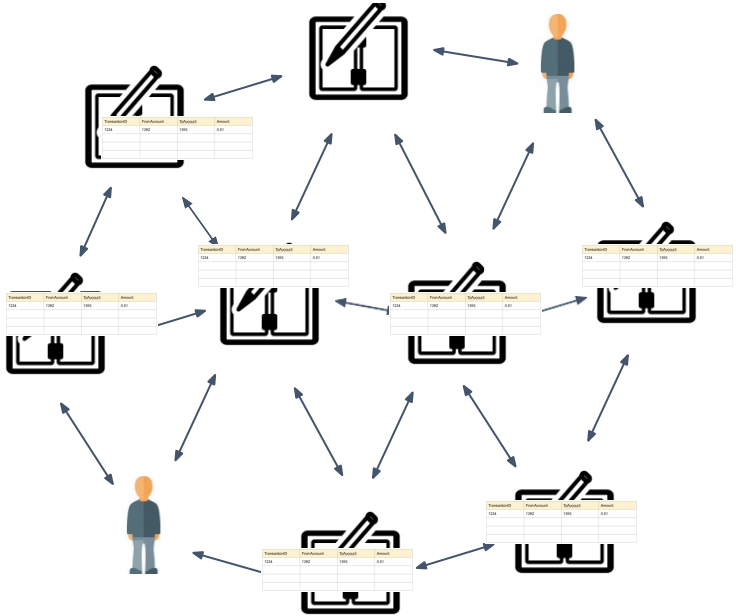


Decentralised Digital Money

TransactionID	FromAccount	ToAccount	Amount
1234	1392	1393	0.01



Decentralised Digital Money

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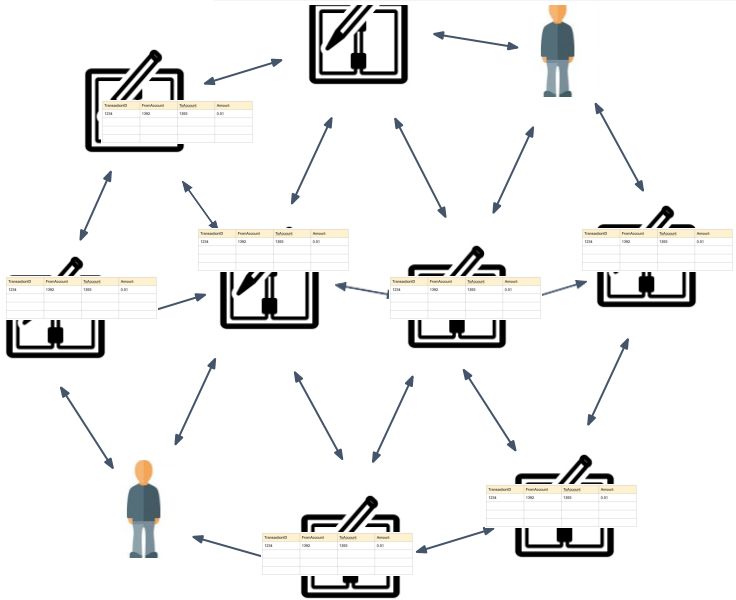
1235	1393	1392	100,000



Decentralised Digital Money

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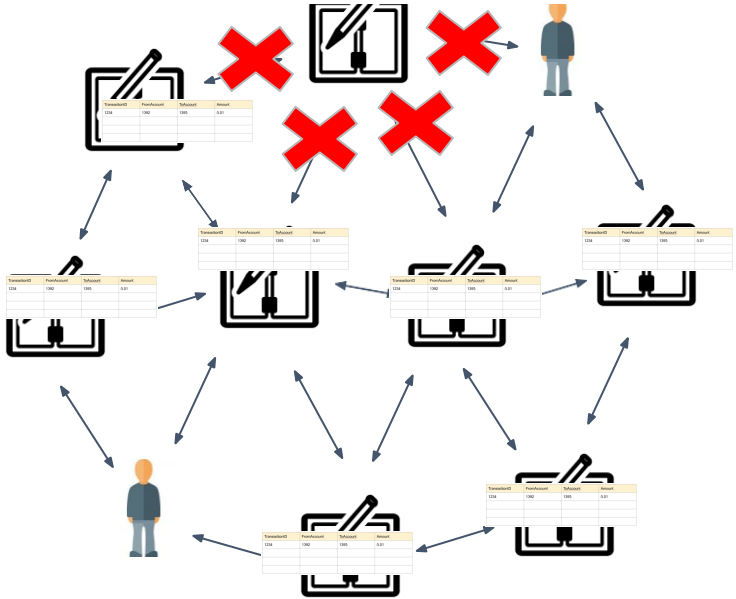
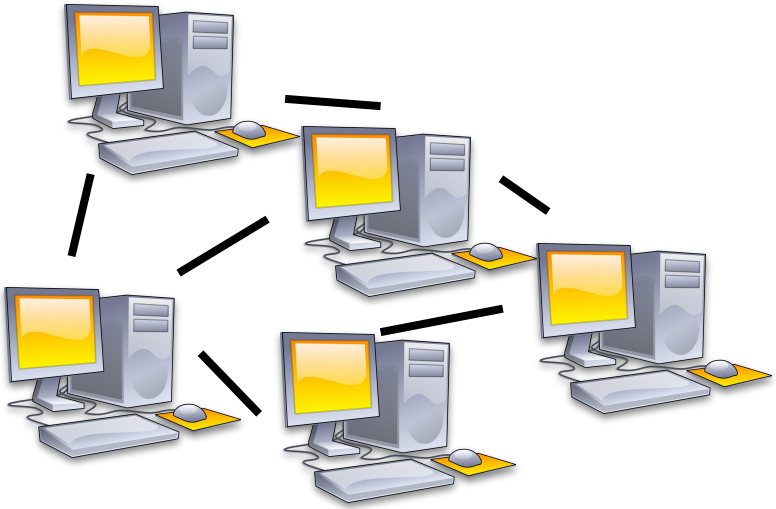
1234	1392	1393	0.01
1235	1393	1392	100,000

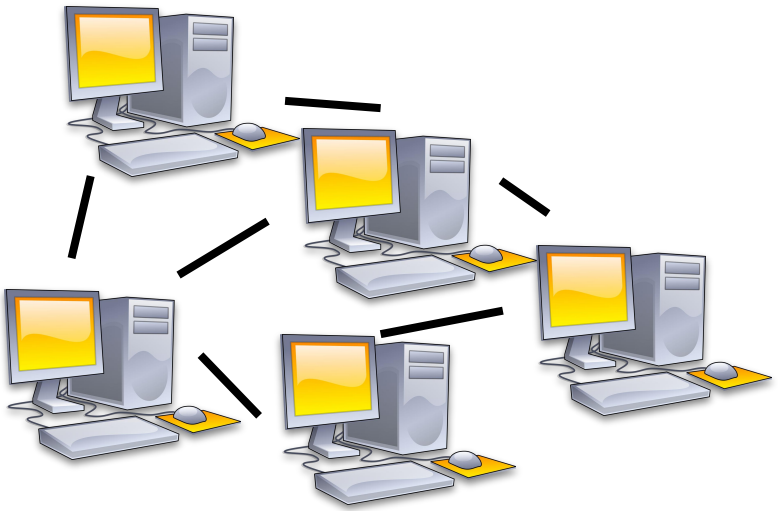


Blocfichain: uses algorithms to mafie sure the rules are not brofien



Blocfichain: uses algorithms to mafie sure the rules are not brofien

With the introduction of smart contracts: can be used for much more than just a cryptocurrency



With the introduction of smart contracts: can be used for much more than just a cryptocurrency

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With the introduction of smart contracts: can be used for much more than just a cryptocurrency

With the introduction of smart contracts: can be used for much more than just a cryptocurrency

Blocfichain: can be used for much more than just a ledger

We can encode rules into the blockchain:

E.g. A certification QR code is only issued if:
* Forms have been fully completed by producer & validated by blockchain

* Verified and approved by delegated Authority Official

Can Blocfichain help minimise remnant ‘trust gaps’?

* Full trust is required in authorities’ processes and maintenance of data

Can Blocfichain help minimise remnant ‘trust gaps’?

* Full trust is required in authorities’ processes and maintenance of data

Certification process can be encoded into blockchain, and certification issued if all rules are followed.

Can Blocfichain help minimise remnant ‘trust gaps’?

* ~~Full trust is required in authorities’ processes and maintenance of data~~

Can Blocfichain help minimise remnant ‘trust gaps’?

~~* Full trust is required in authorities’ processes and maintenance of data~~

* Authority only gets access to stakeholder data once requested/submitted
    > Has the data been changed since it was originally recorded?
    > Has the data been recorded retrospectively?

Can Blocfichain help minimise remnant ‘trust gaps’?

~~* Full trust is required in authorities’ processes and maintenance of data~~

Various stakeholders can immutably log data on blockchain.

Can Blocfichain help minimise remnant ‘trust gaps’?

~~* Full trust is required in authorities’ processes and maintenance of data~~

~~* Authority only gets access to stakeholder data once requested/submitted~~

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Can Blocfichain help minimise remnant ‘trust gaps’?

~~* Full trust is required in authorities’ processes and maintenance of data~~

~~* Authority only gets access to stakeholder data once requested/submitted~~

~~> Has the data been changed since it was originally recorded?~~

~~> Has the data been recorded retrospectively?~~

* How can the producer be sure employee/third-party data has not changed?

Can Blocfichain help minimise remnant ‘trust gaps’?

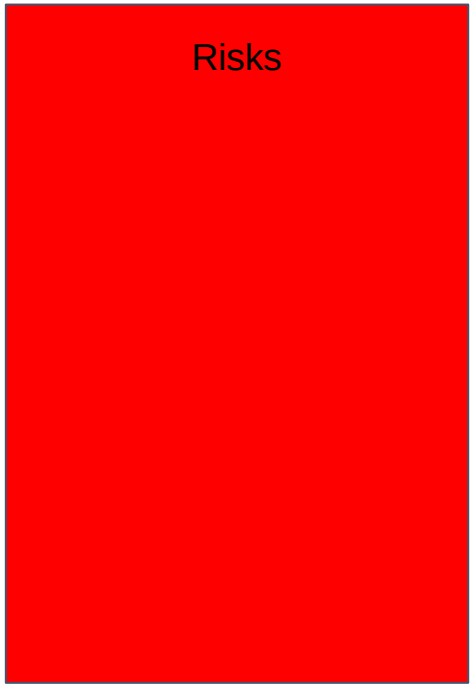
~~* Full trust is required in authorities’ processes and maintenance of data~~

Again,
Various stakeholders can immutably log data on blockchain.

Do Blocfichains solve all issues?

No, other remnant ‘trust gaps’ will remain.

But we should remove as many risfis as possible…



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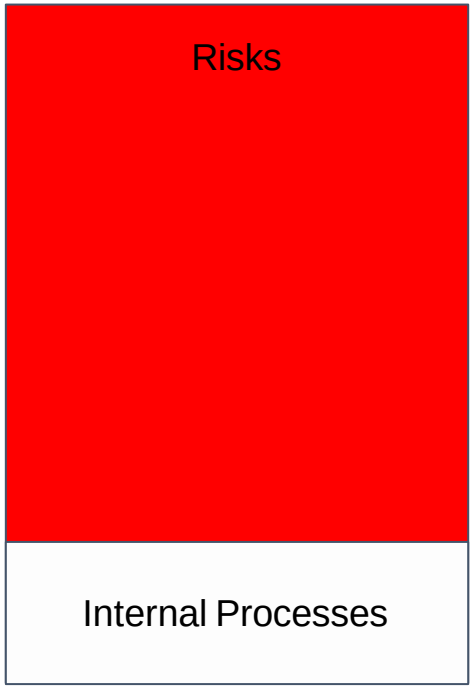

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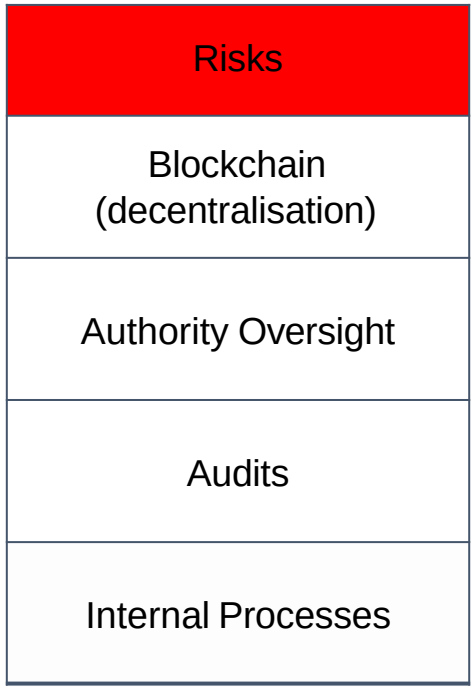
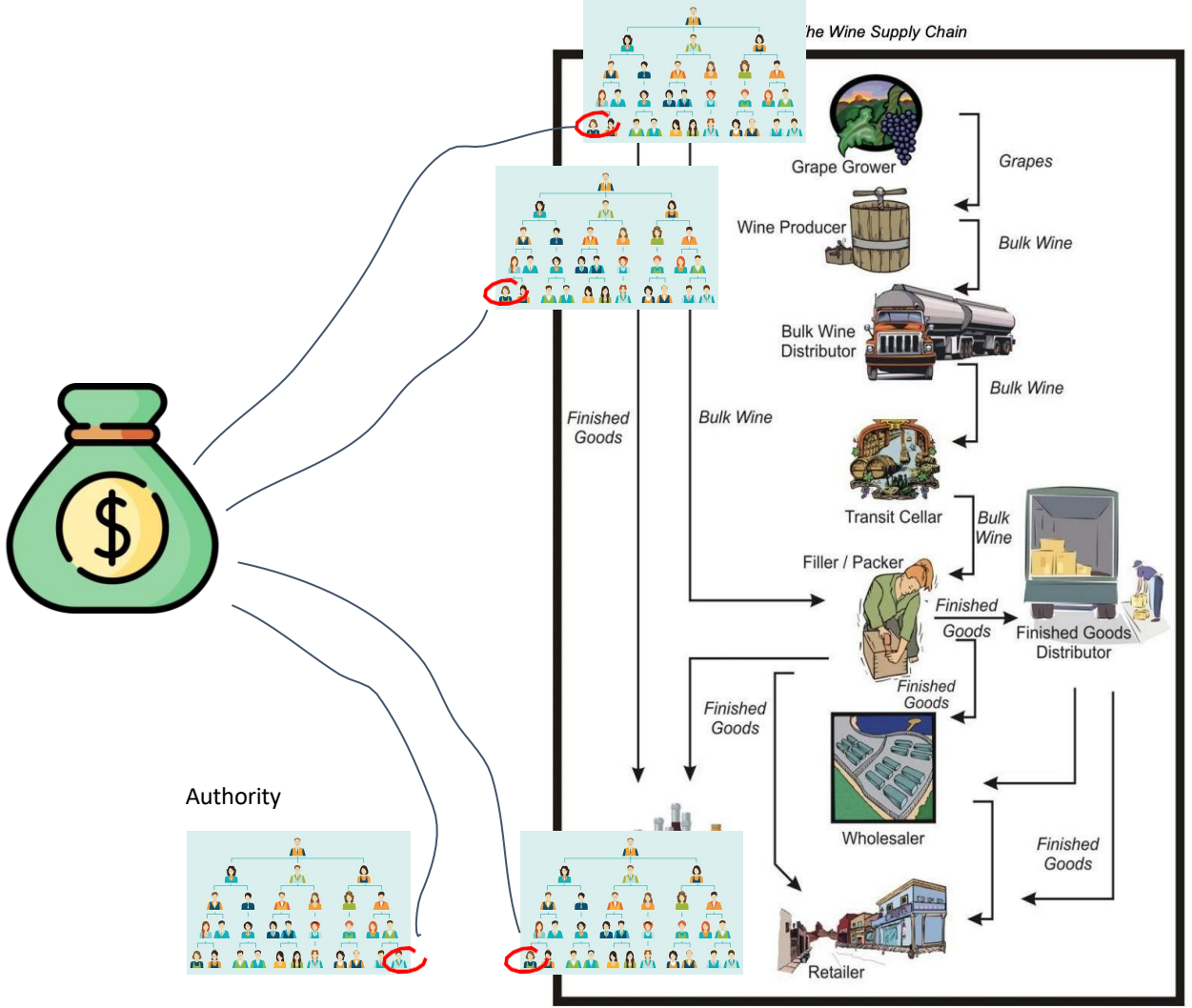
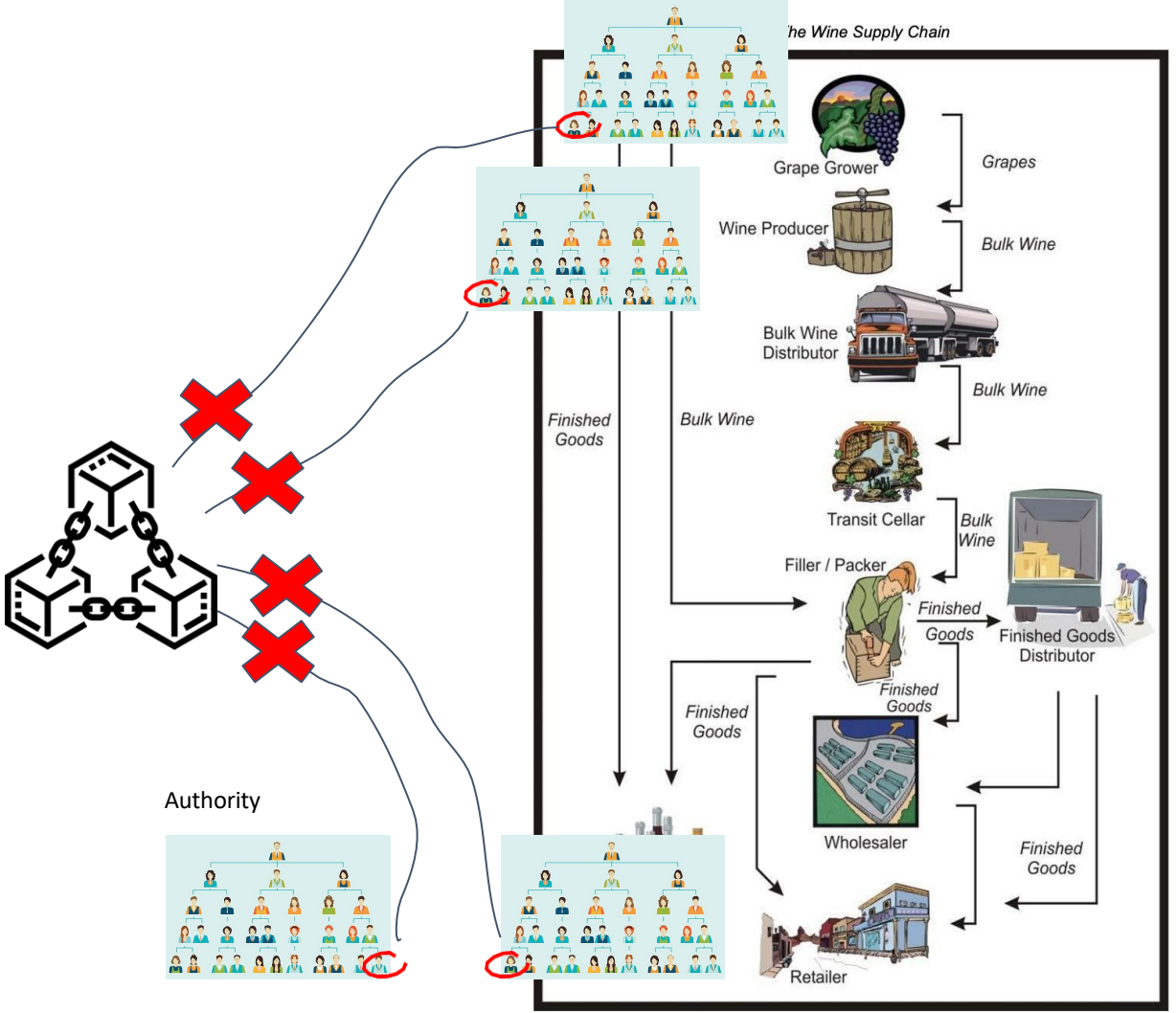


From…



Wine Supply Chain Traceability: GS1 Application Guideline
GS1

…To.



Wine Supply Chain Traceability: GS1 Application Guideline
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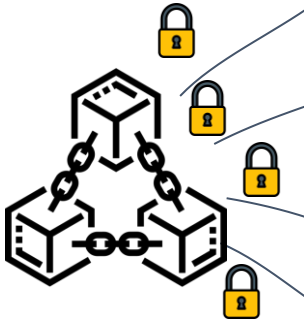

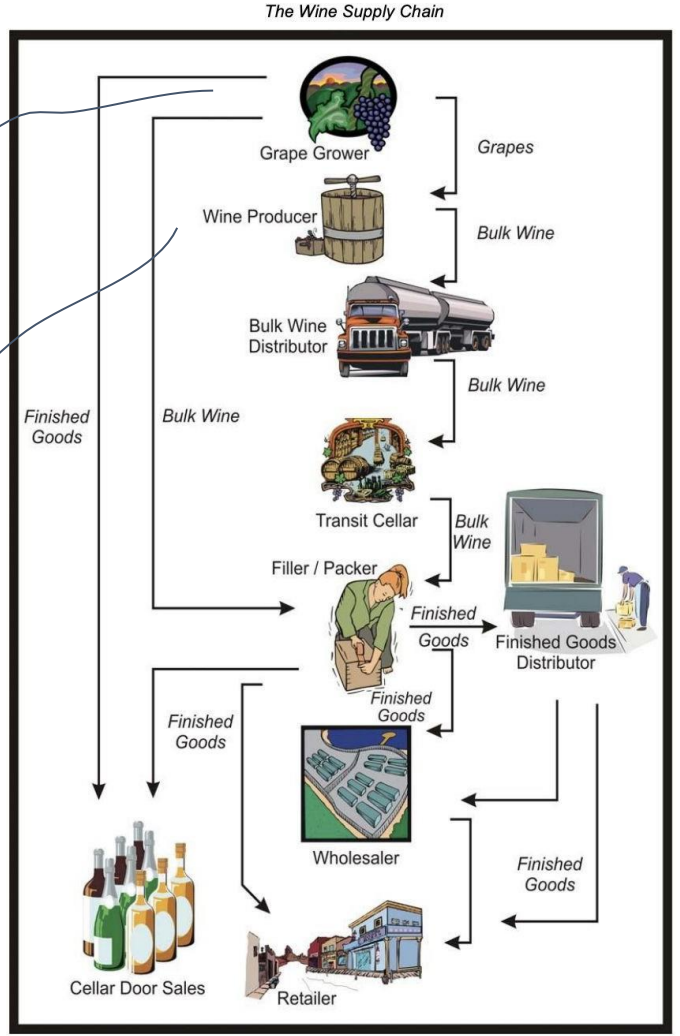

Authority

Wine Supply Chain Traceability: GS1 Application Guideline
GS1

VinoVeritas

... when wine
meets blockchain

1st Step: Survey

IEEE Access
Multidisciplinary | Rapid Review | Open Access Journal

Date of publication xxxx 00, 0000, date of current version xxxx 00, 0000.

Digital Object Identifier 10.1109/ACCESS.2023.0322000

Bottling Up Trust: A Review of Blockchain Adoption in Wine Supply Chain Traceability

GOWHER MAJEED PARRY[1], IOANNIS REVOLIDIS[1], JOSHUA ELLUL[1], and GORDON PACE[1]
[1]Centre for DLT, University of Malta, Malta
Corresponding author: Gowher Majeed Parry (gowher.parry@um.edu.mt).

The project, VinoVeritas, is part-financed by the European Union, EAFRD 1153 2014-2020.

Over 209 papers across:
* challenges of wine supply chains
* proposed blockchain solutions

Findings:
* Solutions tend to be focused on a specific stakeholder
* Solutions often non-intuitive (blockchain UI)
* Need for more: process flexibility, ease-of-use, technology-independence

VINOVERITAS

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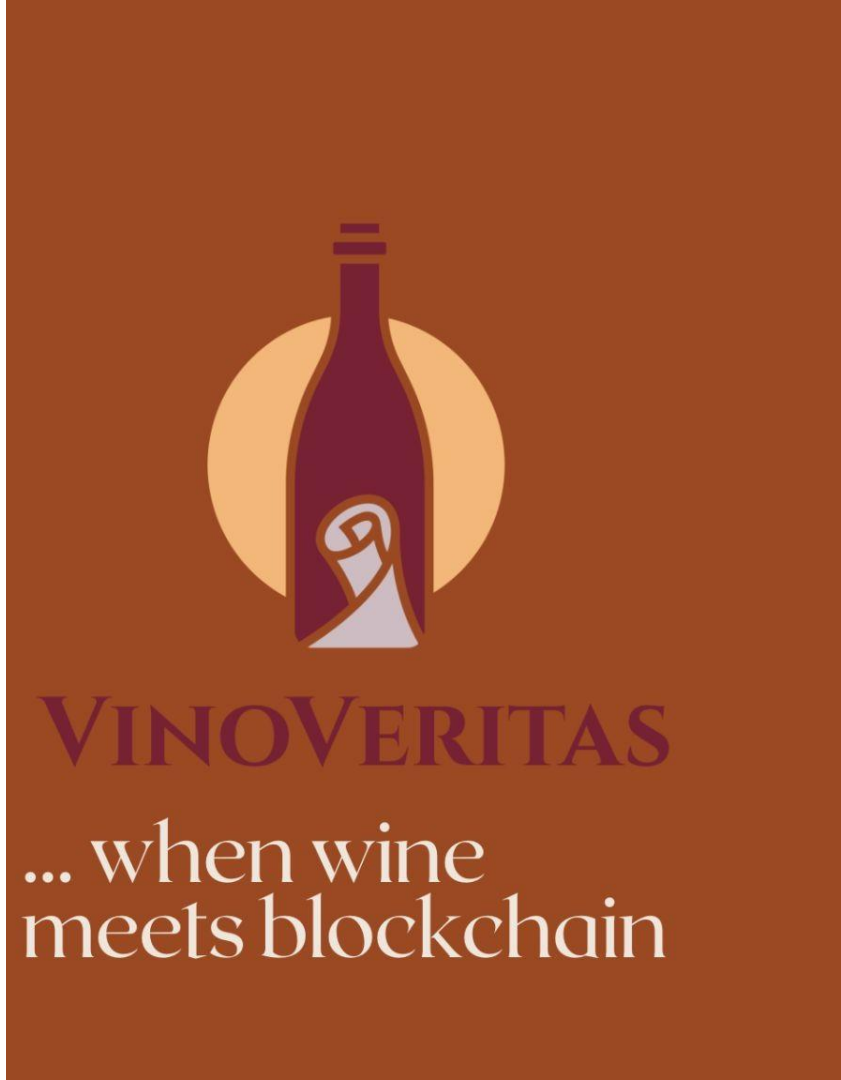
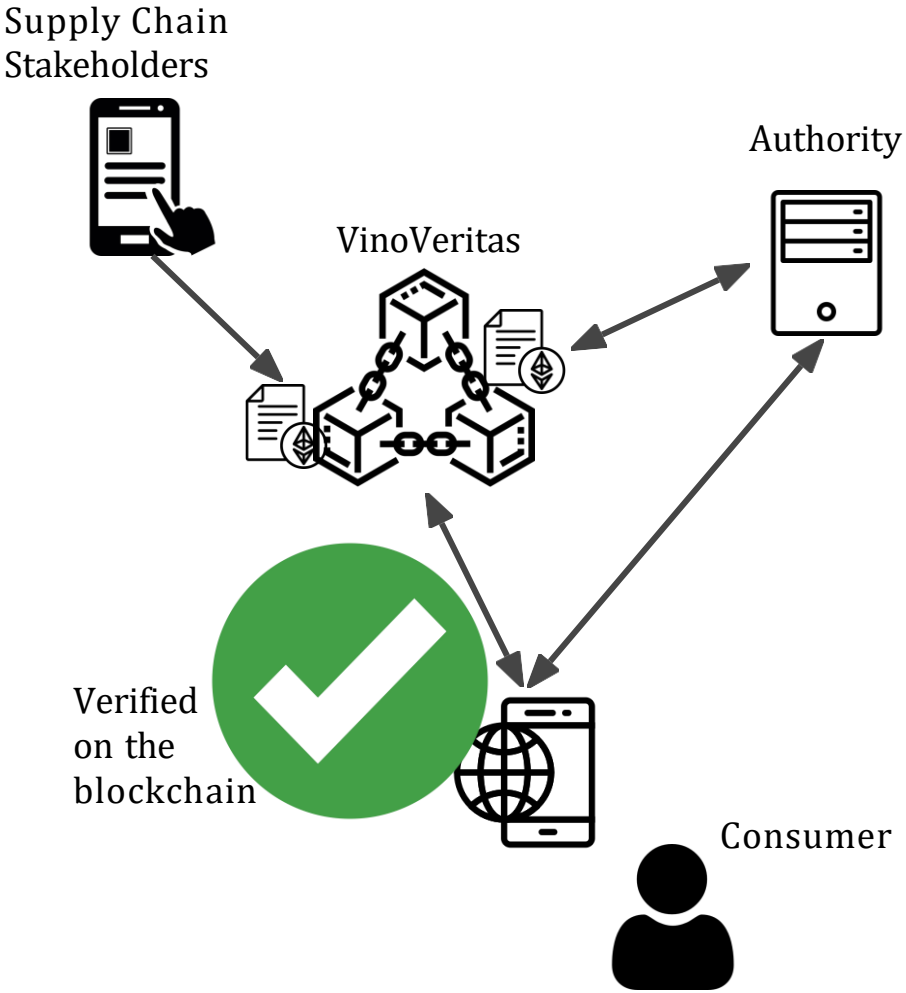
Aim of project:

Focus on infrastructure development to support ease of:

1. Process definition
2. Attestation
3. Verifiability





VINOVERITAS

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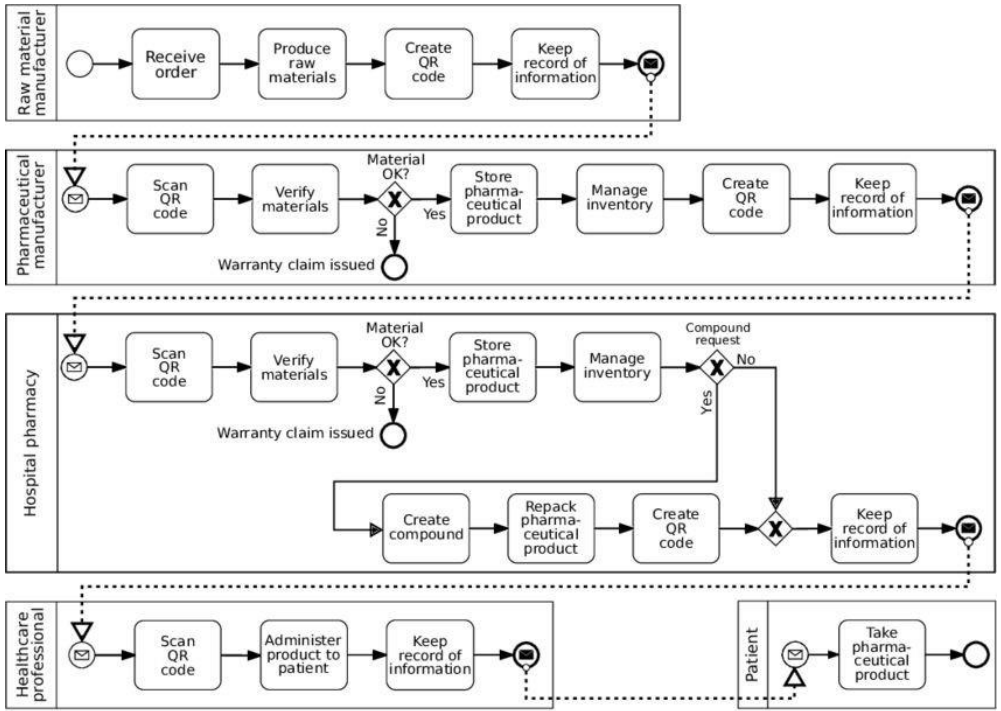
Need for an Attestation Flow Model Framework

Why not use something existing like BPMN?

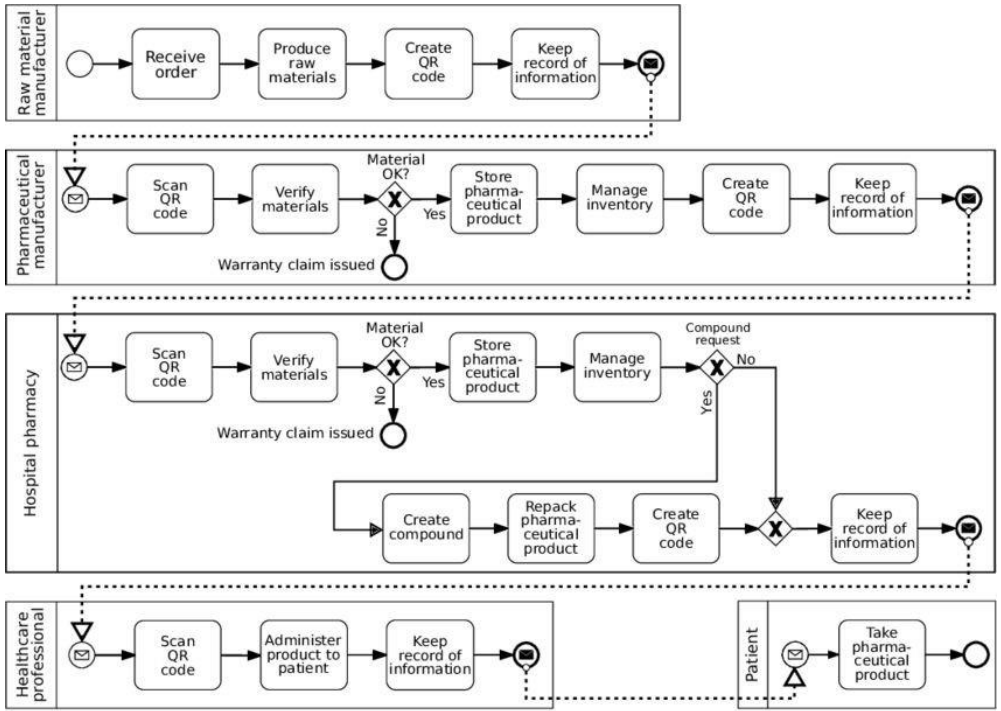


Complexity: BPMN is designed for comprehensive business process modelling.

We need something that is simple.

Need for an Attestation Flow Model Framework

Why not use something existing like BPMN?

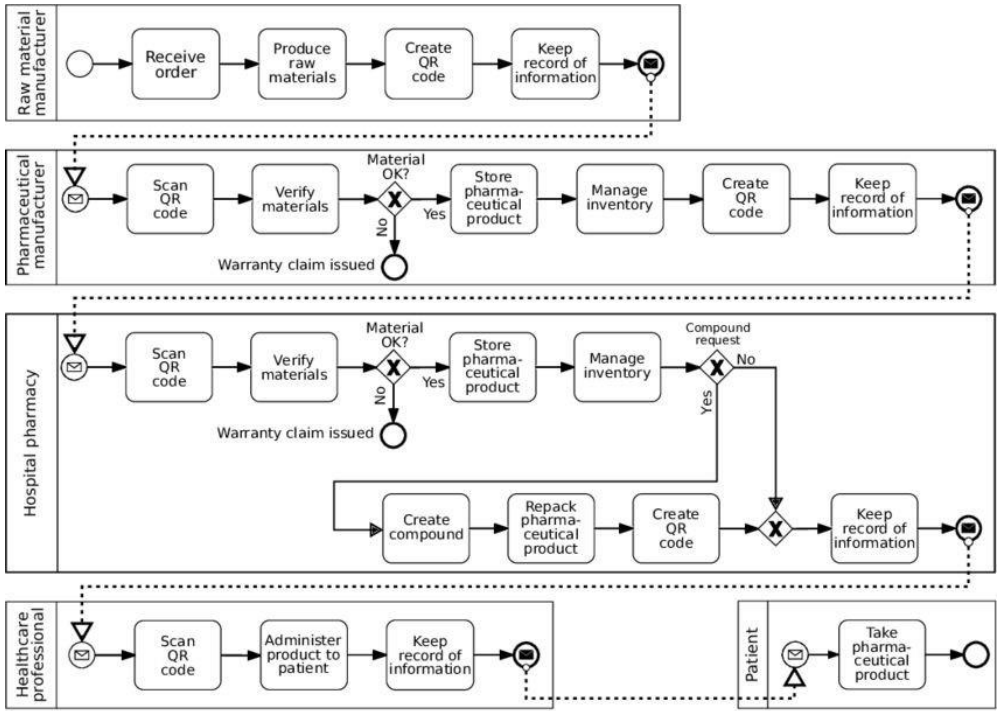


Specificity: BPMN is designed for general purpose process modelling.

We need something that is specific for attestation verification.

Need for an Attestation Flow Model Framework

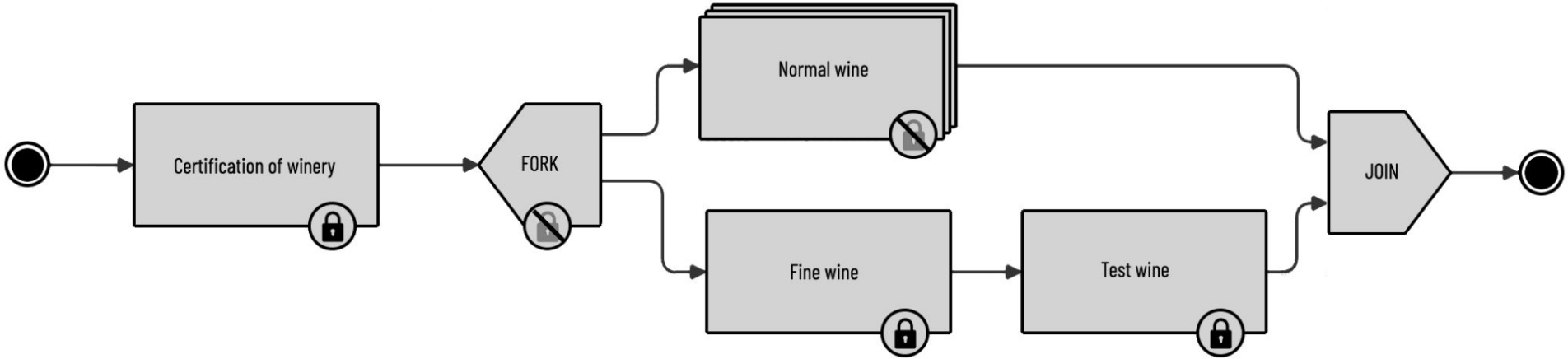
Why not use something existing like BPMN?



<u>Data Location Specificity</u>: While BPMN can support where tasks/data can be stored to some degree, it isn't ideal for specific node-related data locations.

We need something that allows for ease of data location specification.

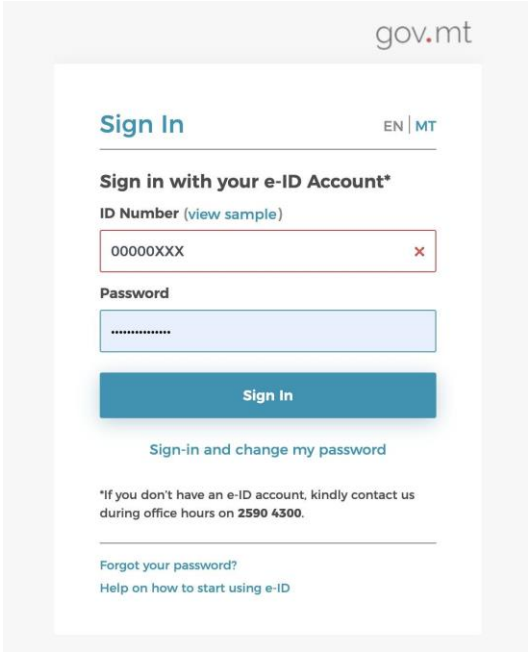
Design of General Attestation Model Flow

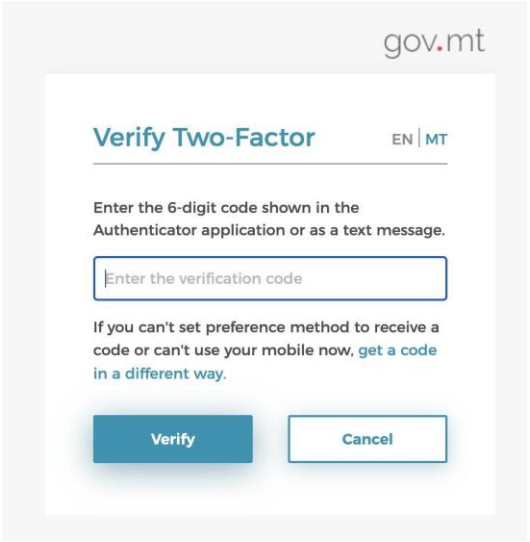


VINOVERITAS

... when wine meets blockchain

Extension of National Declaration Platform





VINOVERITAS

... when wine meets blockchain

Extension of National Declaration Platform

Declaration

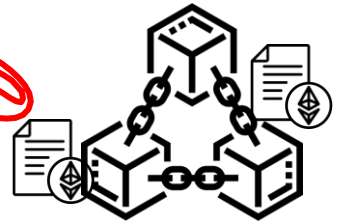
Policy on Data Protection

The Directorate of Agriculture carries out its functions in accordance with all relevant European Commission and local regulations. This application together with the documents attached will be kept confidential and will be processed with compliance with the General Data Protection Regulation (EU) 2016/679. Personal information maybe given to the Ministry of Environment, Sustainable Development and the Climate Change, as well as departments under this Ministry, to manage the agricultural policy. You are entitled to ask regarding personal data being processed about you as provided by the Privacy Policy of the Agency, if and when you want you can request a copy.

I agree

SAVE AS DRAFT PRINT SUBMIT VinoVeritas: Notarise Declaration

VinoVeritas



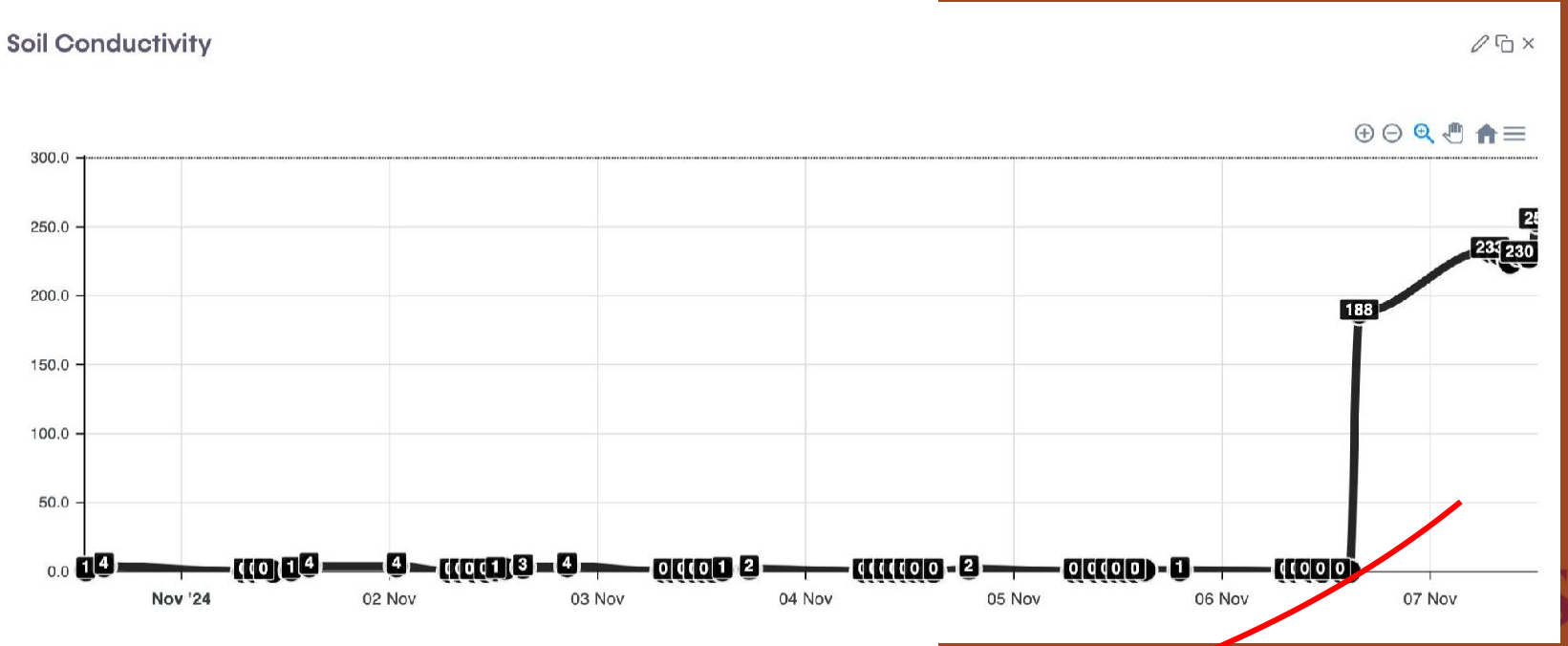
IoT Deployment

Installation underway
(any day now)

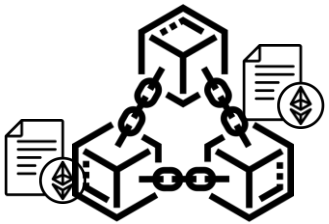
VINOVERITAS

... when wine meets blockchain

IoT Data Collection



VinoVeritas



... when wine meets blockchain

Supply-chain stakeholder Attestation

Click on step to go back: Prototype Wine > Vineyard owner > Barreling

Attest

Barreling

Select the related Grape Testing preceding Barreling

Grape Testing - 01-Jun-2024 12:33:11

+ Add more

Provide details to be included in attestation:

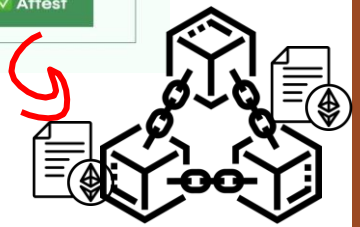
Witnessed by JA

Upload a file to be included in attestation:

Choose File CERT_202406_11.pdf

Attest

VinoVeritas



VINOVERITAS

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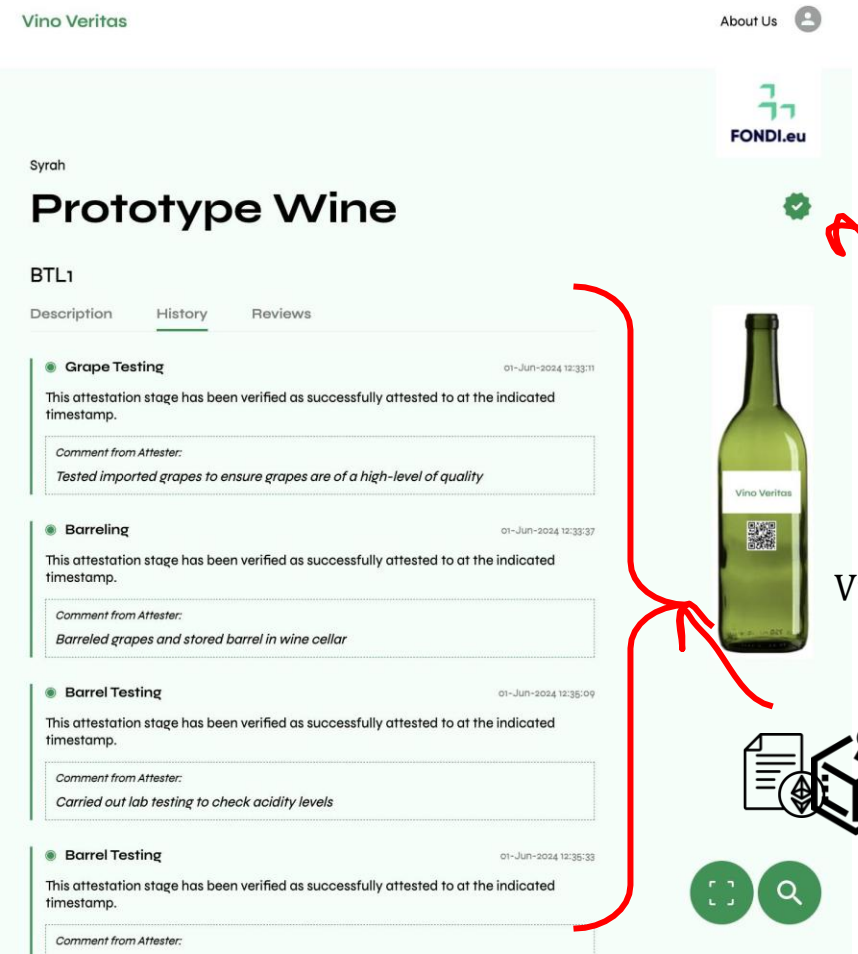
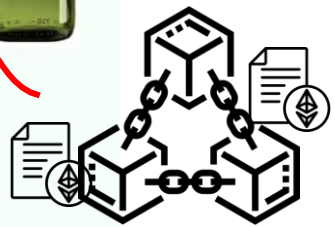
Consumer Verification



VinoVeritas



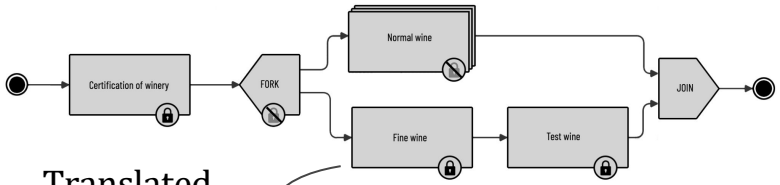
VINOVERITAS

... when wine meets blockchain

What should Smart Contract code look like?

V1:

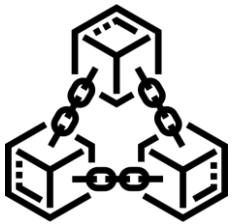
User-defined process



Translated into intermediate representation

Compiled to Smart Contract code

Deployed to blockchain



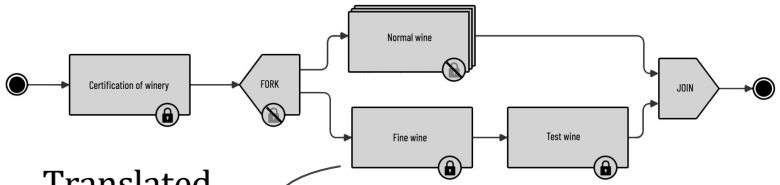
Disadvantages:

- **Deployment of smart contract code to blockchain consumes costs**
- **For attestations that are relevant to different processes/flows, attestation needs to be sent individually to each associated smart contract…**
  …more costs

What should Smart Contract code look like?

V2:

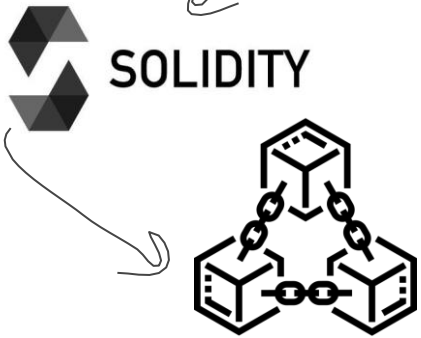
User-defined process



Translated into intermediate representation

IR uploaded to SC.
IR interpreted on-chain

Static general verification code uploaded once, and used by all processes



Advantage:

+ **Single smart contract uploaded and used for all processes.**
+ **A single attestation can be uploaded and used across different processes.**

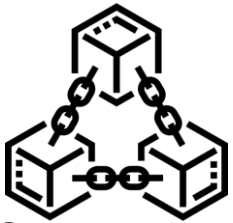
Disadvantages:

- **Interpretation of processes on-chain introduces interpretation execution costs.**

Where should verification code live?

Solutions proposed execute verification code “on-chain” (in smart contracts)

Whilst this provides guarantees wrt processes followed, involves cost for “on-chain” execution



Computation

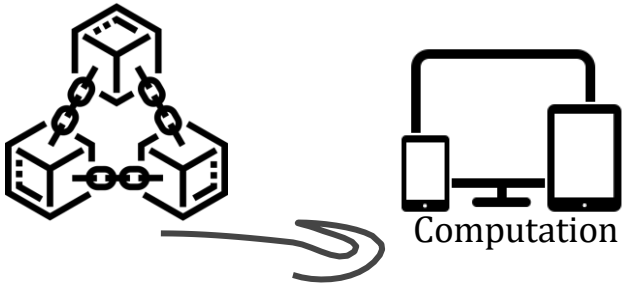
VINOVERITAS

... when wine meets blockchain

Where should verification code live?

Solutions proposed execute verification code “on-chain” (in smart contracts)

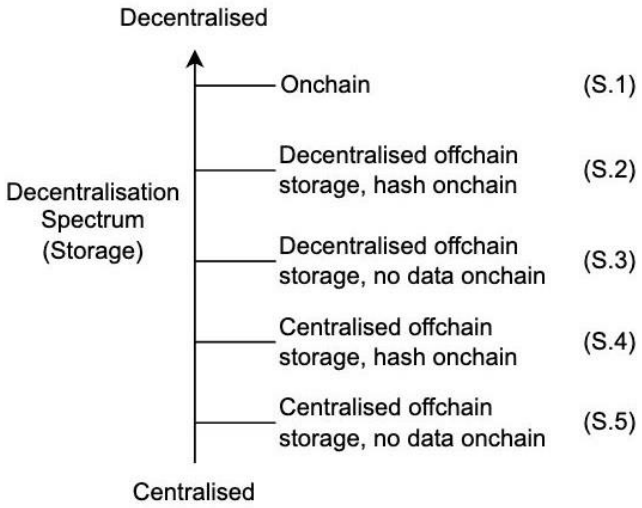
Whilst this provides guarantees wrt processes followed, involves cost for “on-chain” execution

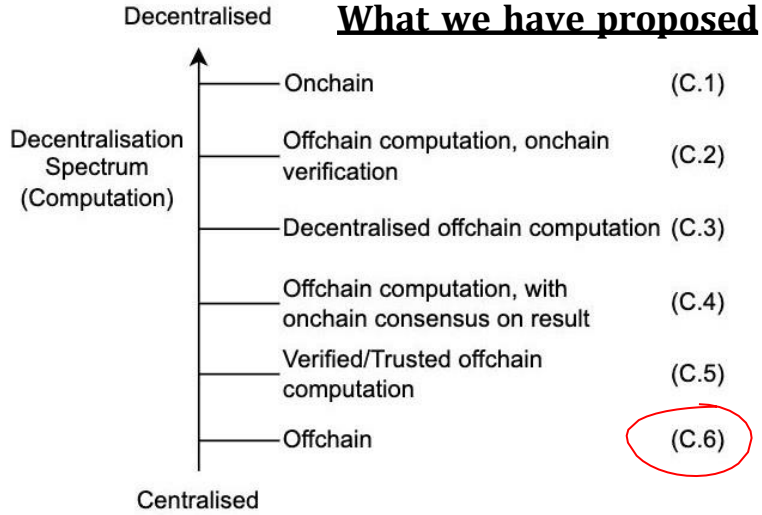


We proposed execution verification off-chain, on users’ devices — to minimise costs without sacrificing guarantees.

VINOVERITAS

... when wine meets blockchain





Low storage requirements (less than a hash) might as well store on-chain

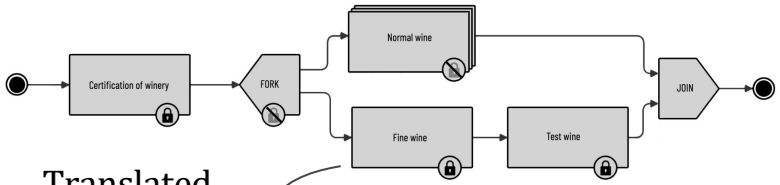
For verification, each user can verify the process off-chain. Same levels of guarantees, since data is stored on-chain.

Approach	S.1	S.2	S.3	S.4	S.5	C.1	C.2	C.3	C.4	C.5	C.6
[Farokhnia and Kafshdar Goharshady 2023]									×		
[Körbel et al. 2021]							×				
Bulletproof [Bünz et al. 2018]							×				
Ekiden [Cheng et al. 2018]										×	
ZoKrates [Eberhardt and Tai 2018]							×				
TrueBit [Teutsch and Reitwießner 2019]									×		
SlimChain [Xu et al. 2021]		×						×			
[Zheng et al. 2018]		×									
[Chou et al. 2020]		×									
[Jayabalan and Jeyanthi 2022]		×									
[López-Pimentel et al. 2020]				×							
[Sutton and Samavi 2017]			×								

What should Smart Contract code look like?

V3:

User-defined process



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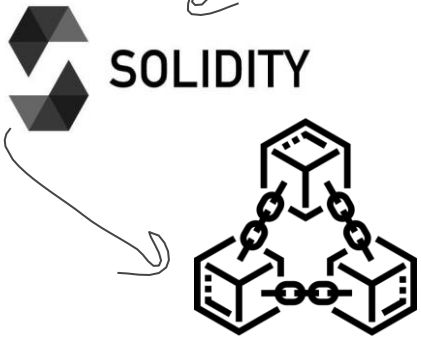
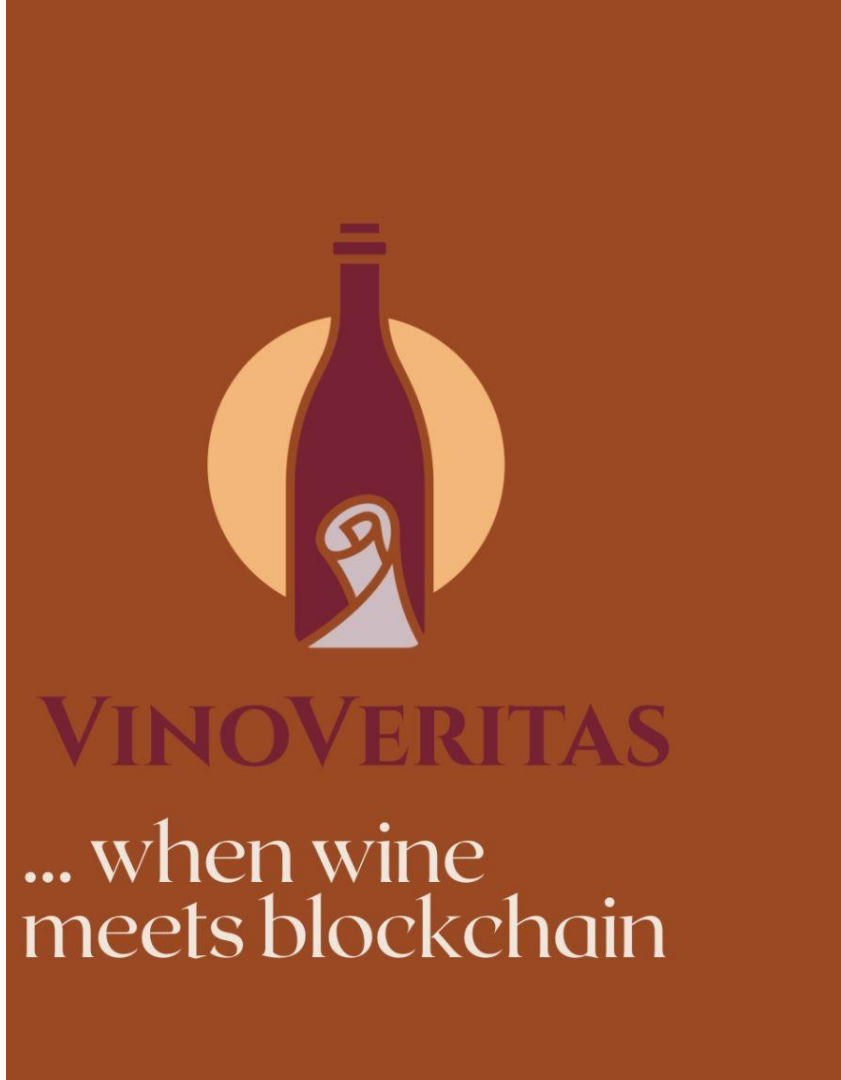


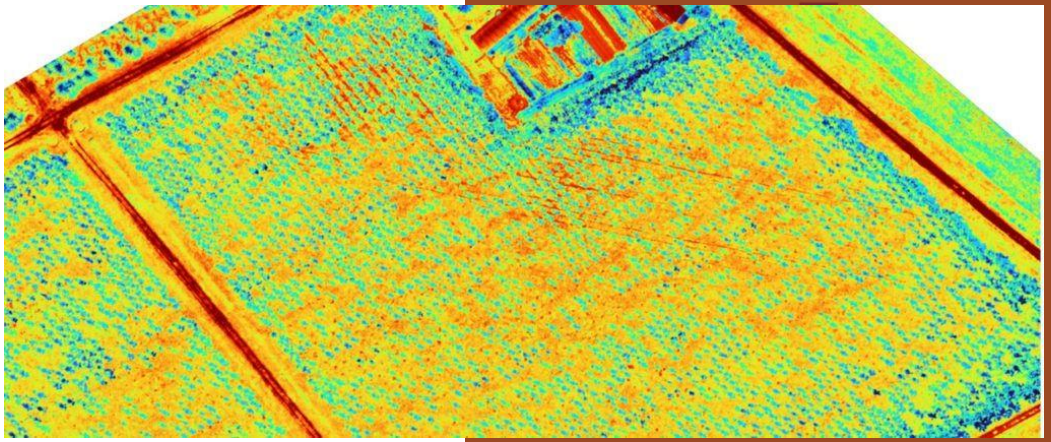
Best of both worlds:

+ **Single smart contract deployed and used for all processes.**
+ **A single attestation can be uploaded and used across different processes.**
+ **No on-chain interpretation costs (as this can be done off-chain on users' devices)**

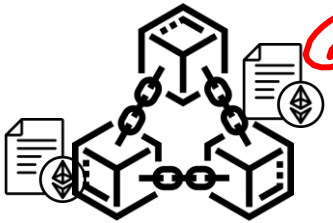
Final Steps



Drone Data Integration



VinoVeritas



VINOVERITAS

... when wine meets blockchain

General Attestation Framework Paper

- Model Semantics

Finally, the example below shows a single-shot attestation node with branching. One of the conditions (checking whether the attestation is for a fine wine with acidity level less than 0.5 and not from a sample barrel) is shown in the callout.

Enable through non-blocking nodes: Non-blocking nodes that become enabled, enable their successors:

$\forall q, q'.\ q \in E' \cap nonblocking \wedge q \rightarrow q' \Longrightarrow q' \in E'.$

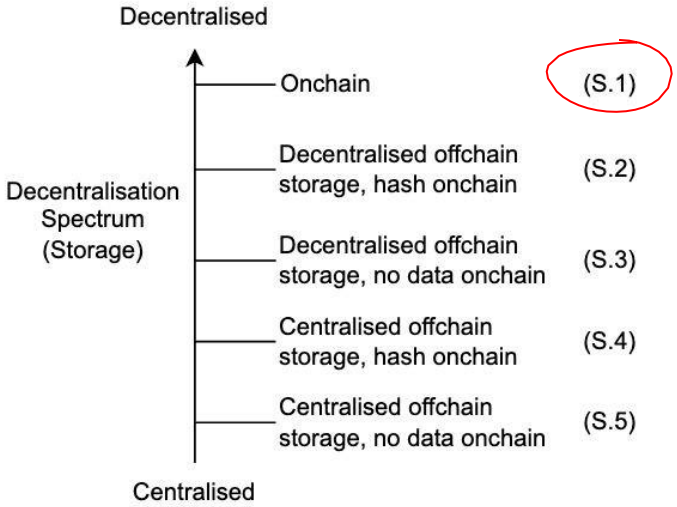
- **Blocking vs. non-blocking**: The node must be specified to be a blocking or non-blocking. This affects whether the successor node is enabled, but not the completion status.
- **Completion-constraint**: The node contains a condition which may refer to attestations already received from attestation nodes and objects to which they refer to.

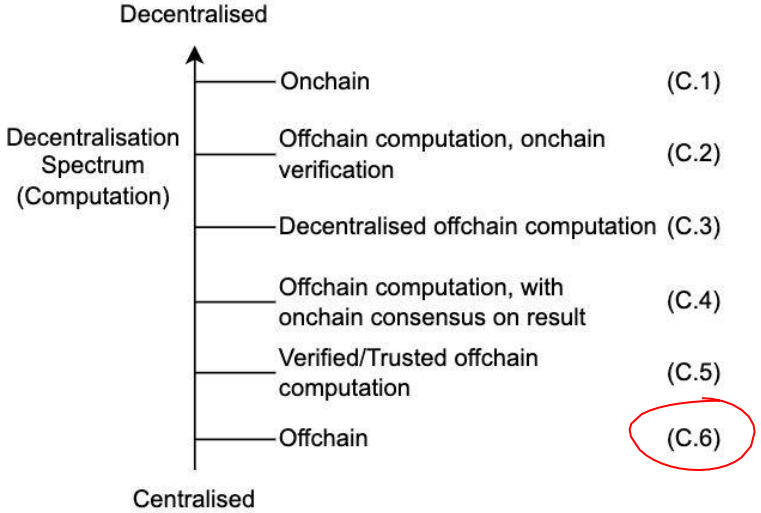
VINOVERITAS

... when wine meets blockchain

General Attestation Framework Paper

- Model Semantics
- Smart contract design options and overhead evaluation

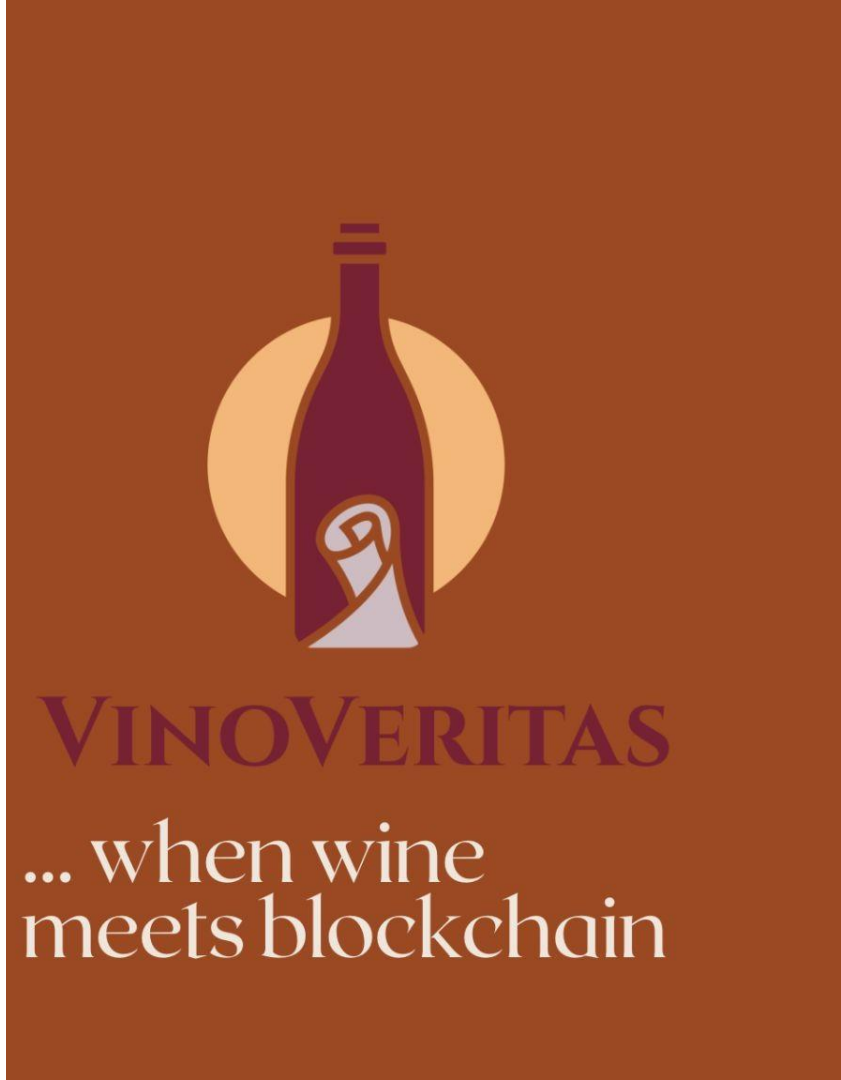




Approach	S.1	S.2	S.3	S.4	S.5	C.1	C.2	C.3	C.4	C.5	C.6
Ellul and Pace, 2024	×										×

User Acceptance Testing

- Winery training and feedback
- Authority demo and feedback
- Adapt software to better support user needs



Future:

- Increasing temperatures is literally changing the Maltese landscape and will likely impact quality of future produce (and wines)
- Helping winerys to make sense of the data
  - Continual Data Collection
  - Prediction/Intelligence
- Application to other Agri-supply chains and sectors.

VINOVERITAS

... when wine meets blockchain

Thank you for listening!

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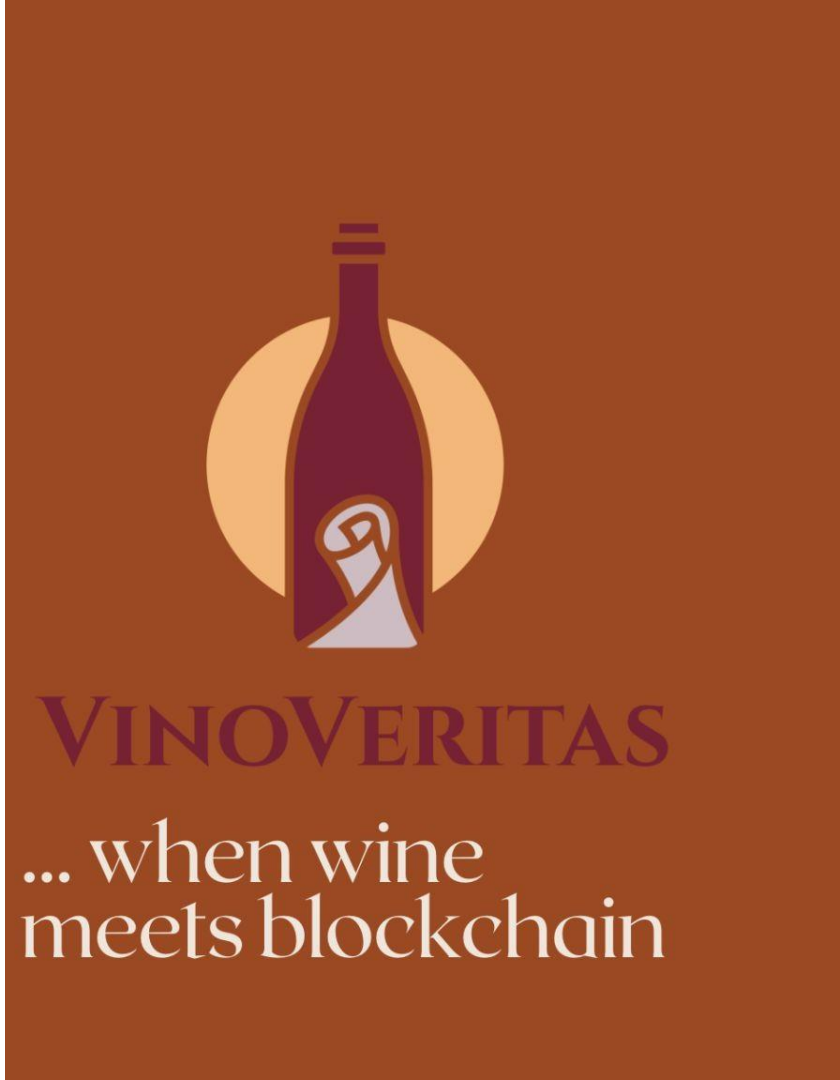

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