HOCHSCHULE FÜR TECHNIK UND WIRTSCHAFT DRESDEN UNIVERSITY OF APPLIED SCIENCES

A Systematic Mapping Study on Blockchain Technology for Digital Protection of Communication in Manufacturing

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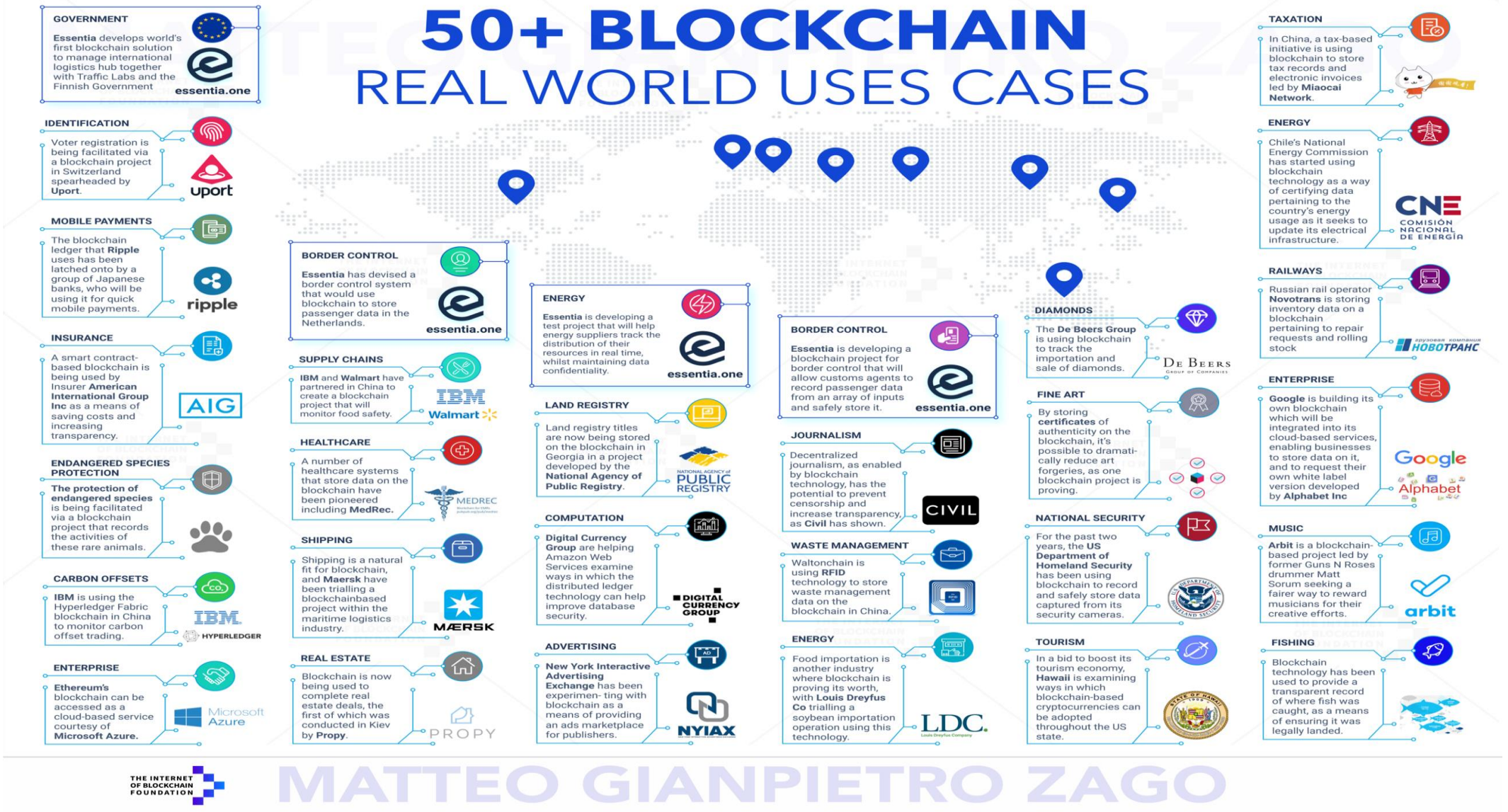
***Abstract*—In the next few years, Blockchain will play a central role in IoT as a technology. It enables the traceability of processes between multiple parties independent of a central instance.**

Motivation and Objective



source: https://medium.com/@matteozago/50-examples-of-how-blockchains-are-taking-over-the-world-4276bf488a4b

Motivation and Objective

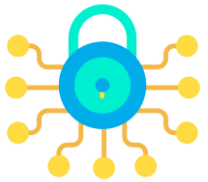
- Investigate the current state of the art and science
- use of block chain technologies
- digital protection of machine data

Blockchain is the combination of three technologies

P2P Networks	Cryptography	Consensus
Each participant in the network is both client and server	Ensures both transparency and privacy	A code of conduct between all parties involved

Features of the blockchain technology:

- **Decentralization**
- **Anonymity**
- **Resistance to manipulation**
- **Time recording**
- **Irreversibility**
- **Transparency**



Research Questions

RQ1:

What are the problems between stakeholders in manufacturing industry?

RQ2:

What are the data to secure in manufacturing process?

RQ3:

What are the use cases of Blockchain Technology for manufacturing industry?

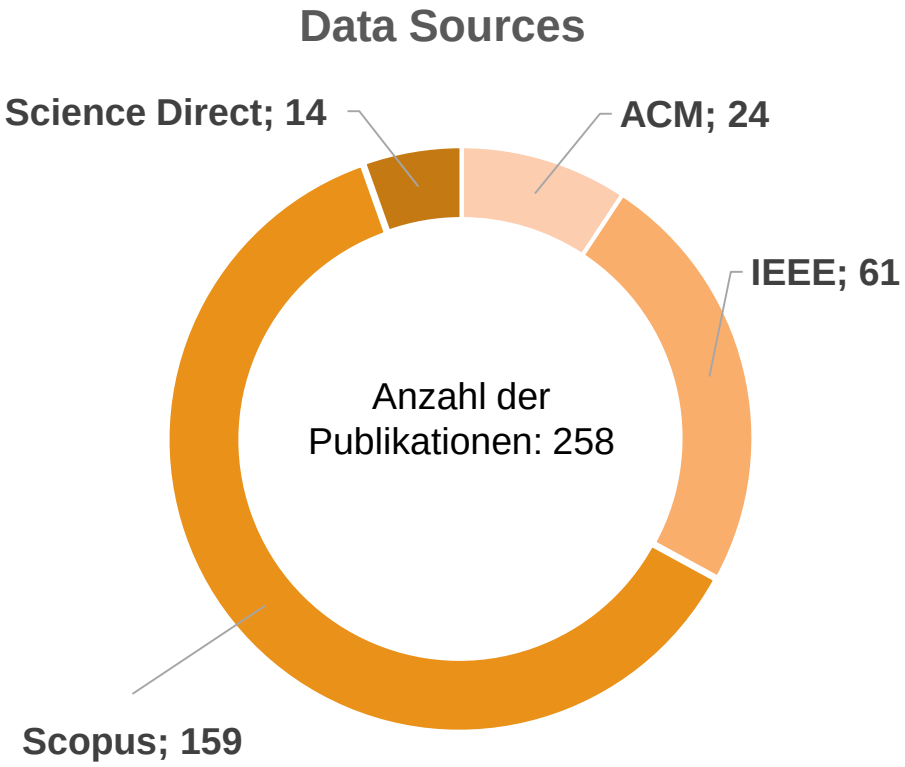
RQ4:

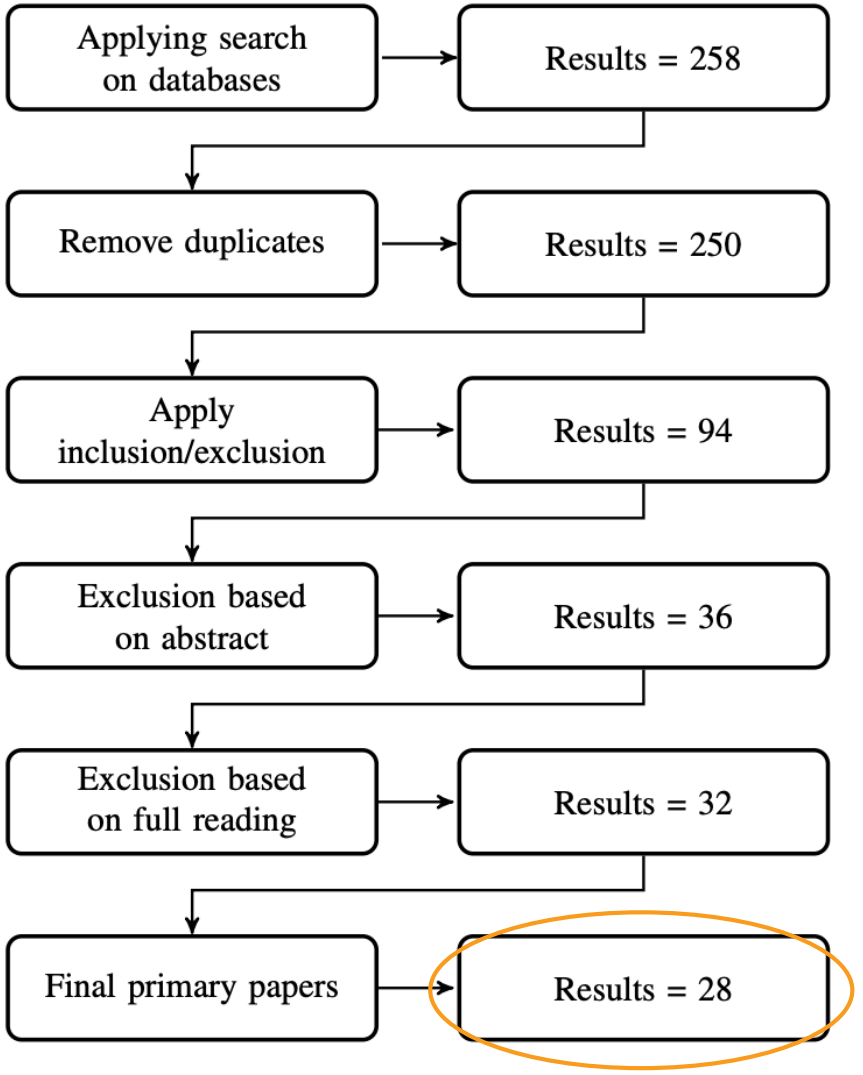
What Blockchain Frameworks are suitable for the scenario "Assignment of production orders to an external manufacturer"?

Conducting the Mapping Study

Dataset	Search String
ACM	+(”Blockchain” ”Distibuted Ledger”) + (”Manufacturing Execution” ”Programmable Logic Controller” ”Manufacturing” ”Distributed manufacturing”)
IEEE	’Blockchain’ OR ’Distributed Ledger’) AND (’Industrial Control’ OR ’Manufacturing Execution’ OR ’Programmable Logic Controller’ OR ’Manufacturing industry’ OR ’Distributed manufacturing’)
Scopus	ALL ((”Blockchain” OR ”Distributed Ledger”) AND (”Industrial Control” OR ”Manufacturing Execution” OR ”Programmable Logic Controller”) OR (”Manufacturing industry” OR ”Distributed manufacturing”))
Science Direct	(”Blockchain” OR ”Distributed Ledger”) AND (”Industrial Control” OR ”Manufacturing Execution” OR ”Programmable Logic Controller” OR ”Manufacturing” OR ”Distributed manufacturing”)

Search Results

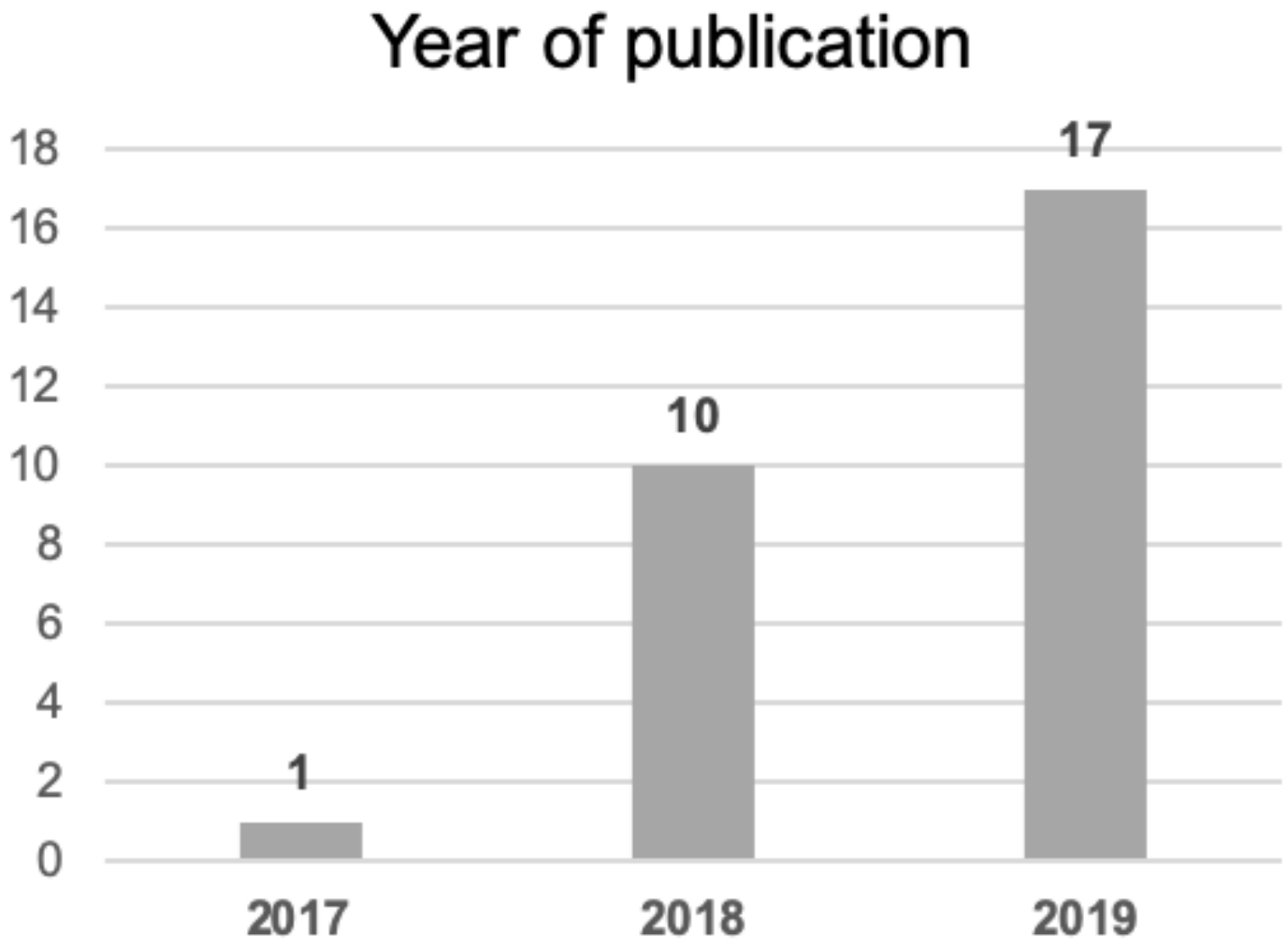




Inclusion:
- Title: Blockchain

Exclusion:
- Bitcoin
- Cryptocurrency

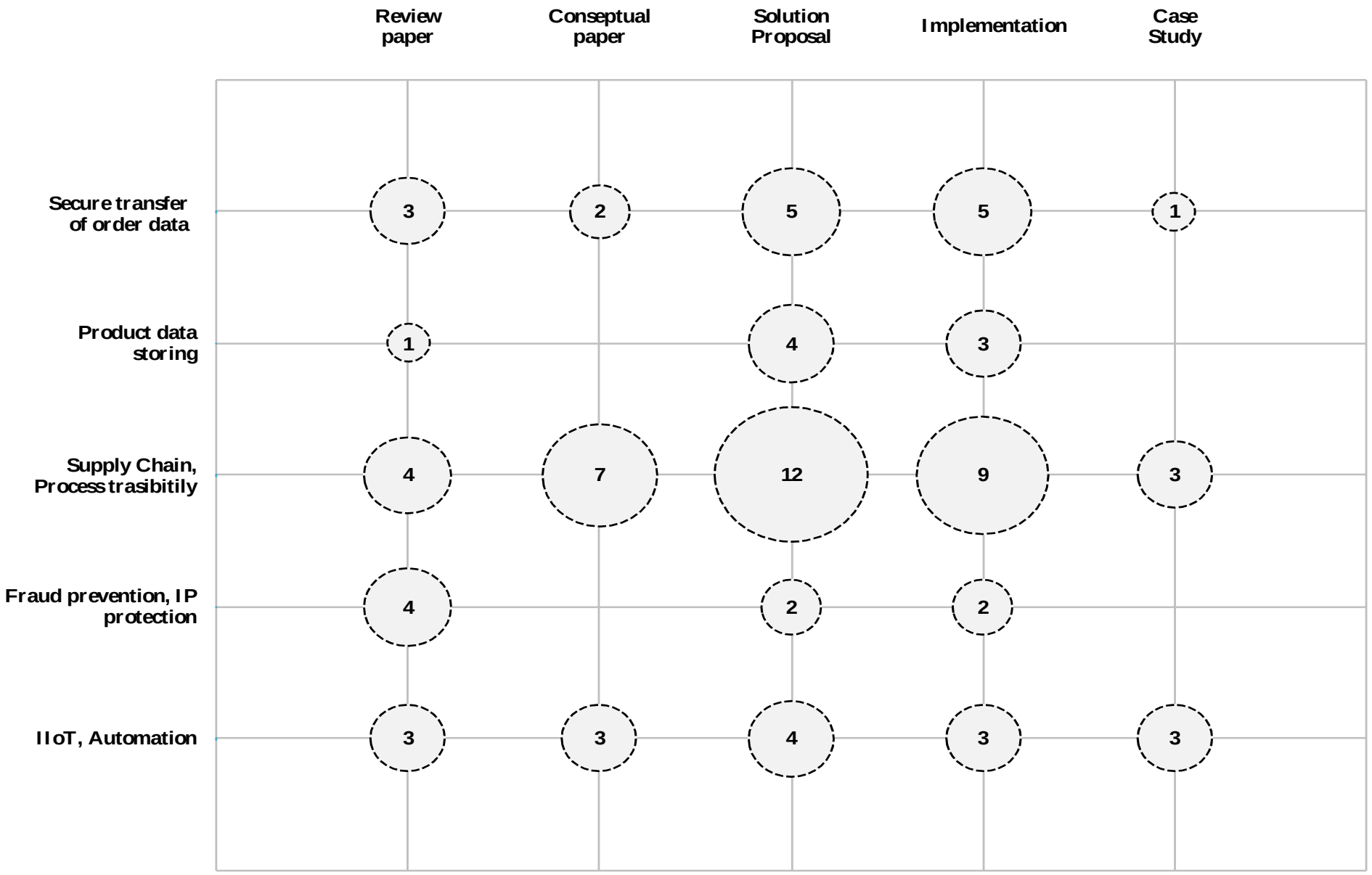
Some Statistical Results



Classification of Results

- Use case of Blockchain,
- Research facet,
- Blockchain facet.

Mappings


Review paper
Conseptual paper
Solution Proposal
Implementation
Case Study
Secure transfer of order data
Product data storing
Supply Chain, Process trasibitily
Fraud prevention, IP protection
IIoT, Automation
3
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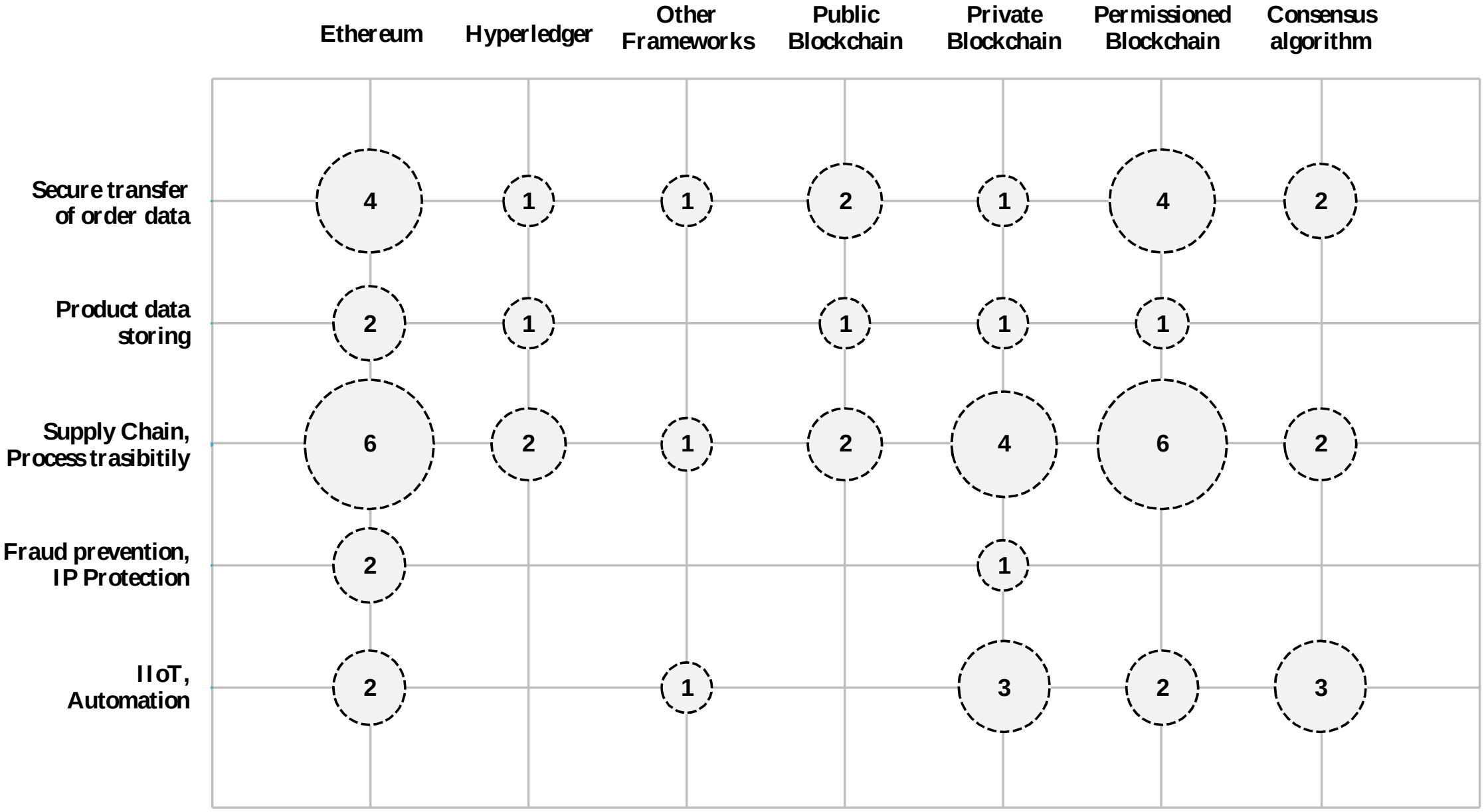
Mappings


Ethereum
Hyperledger
Other Frameworks
Public Blockchain
Private Blockchain
Permissioned Blockchain
Consensus algorithm
Secure transfer of order data
Product data storing
Supply Chain, Process trasibitily
Fraud prevention, IP Protection
IIoT, Automation
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3

Analysis

- **RQ1:** What are the problems between stakeholders in manufacturing industry?
  - Dependence on a Trusted Third Party (TTP)
  - Communication of the information to a TTP
  - Insufficient confidentiality

- **RQ2:** What are the data to secure in manufacturing process?
  - Computer-Aided Design (CAD file)
  - Material specifications
  - Order details
  - Machine data (characteristics and configurations)
  - Process values and process status

- **RQ3:** What are the use cases of Blockchain Technology for manufacturing industry?
  - Secured transmission of order data
  - Storage of the product data
  - Supply Chain, traceability of the process
  - Fraud prevention, securing intellectual property
  - Industrial Internet of things, automation

- **RQ4:** What Blockchain Frameworks are suitable for the scenario "Assignment of production orders to an external manufacturer"?
  - Ethereum, Hyperledger, MultiChain
  - Public, Permissoned

Conclusion

- Mapping Studies on 28 papers
- Five use cases of Blockchain
- Majority of papers describe the case ”supply chain and process traceability” as solution proposal.
- Less findings regarding assignment of production orders to an external manufacturer
- More detailed surveys and studies are required

Links

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- Link to the Slides
  - **https://tinyurl.com/indin2020bc**

- Link to Smart Production Systems at HTW Dresden
  - https://www.htw-dresden.de/industrie40

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