

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

Javad Ghofrani

Department of Informatics and Mathematics
HTW Dresden University of Applied Sciences, Germany
Dresden, Germany
javad.ghofrani@gmail.com

Kirill Loisha

Department of Informatics and Mathematics
HTW Berlin University of Applied Sciences, Germany
Berlin, Germany
kiril.loisha@hhtw-berlin.de

Dirk Reichelt

Department of Informatics and Mathematics
HTW Dresden University of Applied Sciences, Germany
Dresden, Germany
email address or ORCID

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.



50+ BLOCKCHAIN REAL WORLD USES CASES

GOVERNMENT
Essentia develops world's first blockchain solution to manage international logistics hub together with Traffic Labs and the Finnish Government
essentia.one

IDENTIFICATION
Voter registration is being facilitated via a blockchain project in Switzerland spearheaded by Uport.
uport

MOBILE PAYMENTS
The blockchain ledger that Ripple uses has been latched onto by a group of Japanese banks, who will be using it for quick mobile payments.
ripple

INSURANCE
A smart contract-based blockchain is being used by insurer American International Group Inc as a means of saving costs and increasing transparency.
AIG

ENDANGERED SPECIES PROTECTION
The protection of endangered species is being facilitated via a blockchain project that records the activities of these rare animals.

CARBON OFFSETS
IBM is using the Hyperledger Fabric blockchain in China to monitor carbon offset trading.
IBM
HYPERLEDGER

ENTERPRISE
Ethereum's blockchain can be accessed as a cloud-based service courtesy of Microsoft Azure.
Microsoft Azure

BORDER CONTROL
Essentia has devised a border control system that would use blockchain to store passenger data in the Netherlands.
essentia.one

SUPPLY CHAINS
IBM and Walmart have partnered in China to create a blockchain project that will monitor food safety.
IBM
Walmart

HEALTHCARE
A number of healthcare systems that store data on the blockchain have been pioneered including MedRec.
MEDREC

SHIPPING
Shipping is a natural fit for blockchain, and Maersk have been trialling a blockchain-based project within the maritime logistics industry.
MÆRSK

REAL ESTATE
Blockchain is now being used to complete real estate deals, the first of which was conducted in Kiev by Propy.
PROPY

ENERGY
Essentia is developing a test project that will help energy suppliers track the distribution of their resources in real time, whilst maintaining data confidentiality.
essentia.one

LAND REGISTRY
Land registry titles are now being stored on the blockchain in Georgia in a project developed by the National Agency of Public Registry.
NATIONAL AGENCY OF PUBLIC REGISTRY

COMPUTATION
Digital Currency Group are helping Amazon Web Services examine ways in which the distributed ledger technology can help improve database security.
DIGITAL CURRENCY GROUP

ADVERTISING
New York Interactive Advertising Exchange has been experimenting with blockchain as a means of providing an ads marketplace for publishers.
NYIAX

BORDER CONTROL
Essentia is developing a blockchain project for border control that will allow customs agents to record passenger data from an array of inputs and safely store it.
essentia.one

JOURNALISM
Decentralized journalism, as enabled by blockchain technology, has the potential to prevent censorship and increase transparency, as Civil has shown.
CIVIL

WASTE MANAGEMENT
Waltonchain is using RFID technology to store waste management data on the blockchain in China.

ENERGY
Food importation is another industry where blockchain is proving its worth, with Louis Dreyfus Co trialling a soybean importation operation using this technology.
LDC

DIAMONDS
The De Beers Group is using blockchain to track the importation and sale of diamonds.
DE BEERS
GROUP OF COMPANIES

FINE ART
By storing certificates of authenticity on the blockchain, it's possible to dramatically reduce art forgeries, as one blockchain project is proving.

NATIONAL SECURITY
For the past two years, the US Department of Homeland Security has been using blockchain to record and safely store data captured from its security cameras.

TOURISM
In a bid to boost its tourism economy, Hawaii is examining ways in which blockchain-based cryptocurrencies can be adopted throughout the US state.

TAXATION
In China, a tax-based initiative is using blockchain to store tax records and electronic invoices led by Miaocai Network.

ENERGY
Chile's National Energy Commission has started using blockchain technology as a way of certifying data pertaining to the country's energy usage as it seeks to update its electrical infrastructure.
CNE
COMISIÓN NACIONAL DE ENERGÍA

RAILWAYS
Russian rail operator Novotrans is storing inventory data on a blockchain pertaining to repair requests and rolling stock.
НОВОТРАНС

ENTERPRISE
Google is building its own blockchain which will be integrated into its cloud-based services, enabling businesses to store data on it, and to request their own white label version developed by Alphabet Inc.
Google
Alphabet

MUSIC
Arbit is a blockchain-based project led by former Guns N Roses drummer Matt Sorum seeking a fairer way to reward musicians for their creative efforts.
arbit

FISHING
Blockchain technology has been used to provide a transparent record of where fish was caught, as a means of ensuring it was legally landed.

- ▶ 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

Each participant in the network is both client and server

Cryptography

Ensures both transparency and privacy

Consensus

A code of conduct between all parties involved

Features of the blockchain technology:

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



RQ1:

What are the problems between stakeholders in manufacturing industry?

RQ2:

What are the data to secure in manufacturing process?

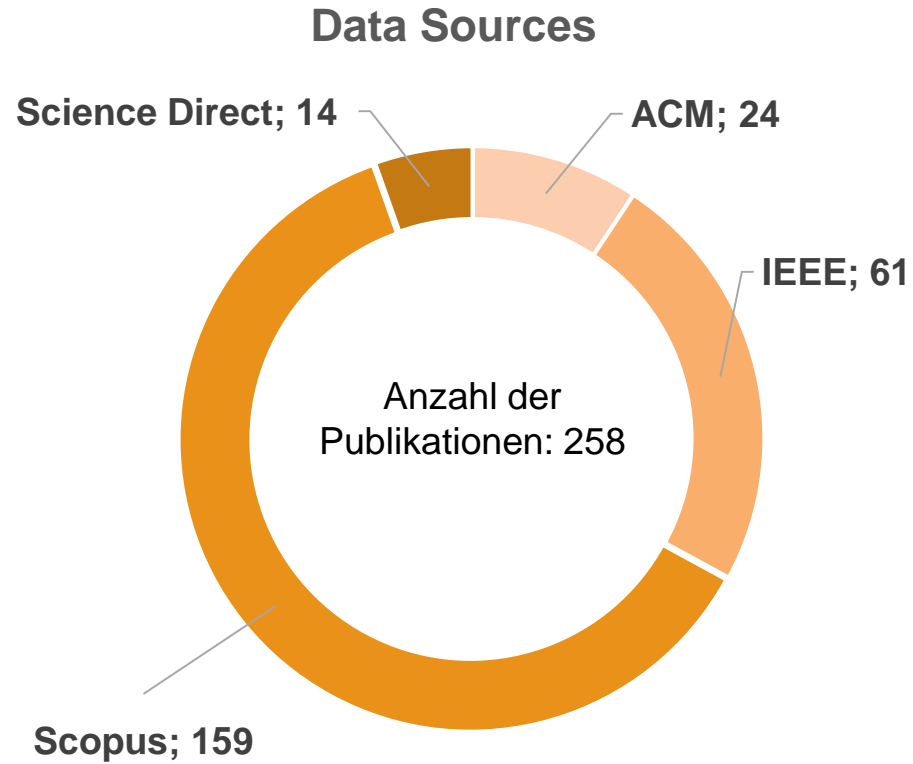
RQ3:

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"?

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")

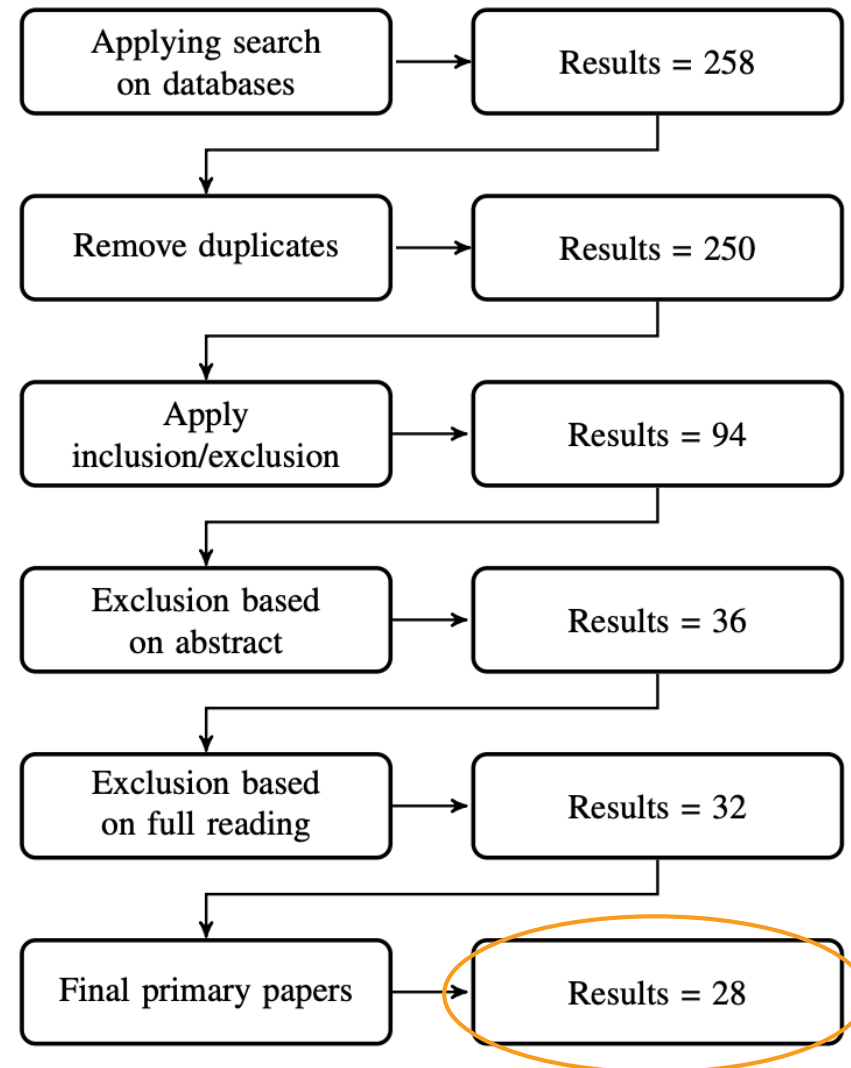


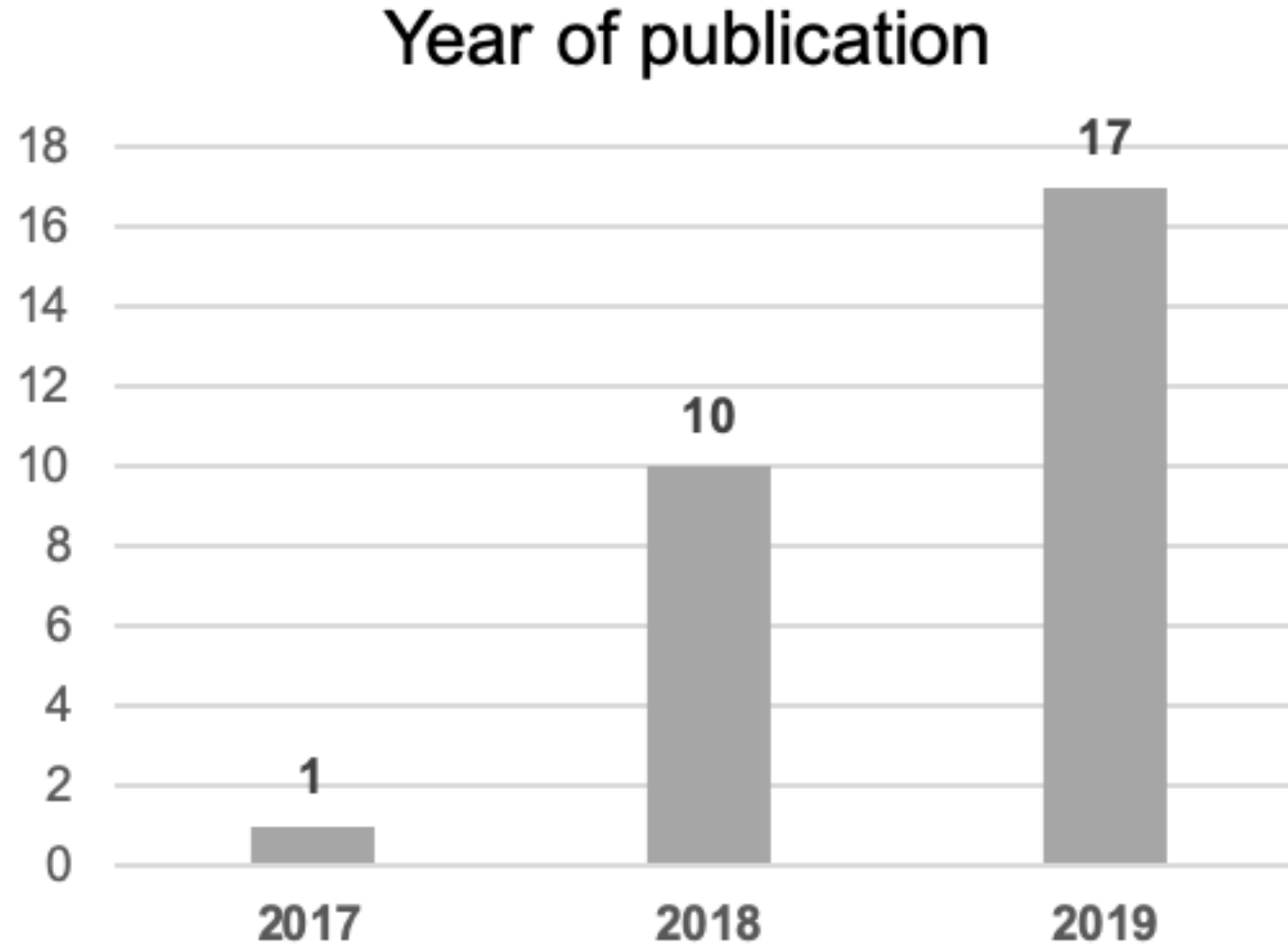
Inclusion:

- Title: Blockchain

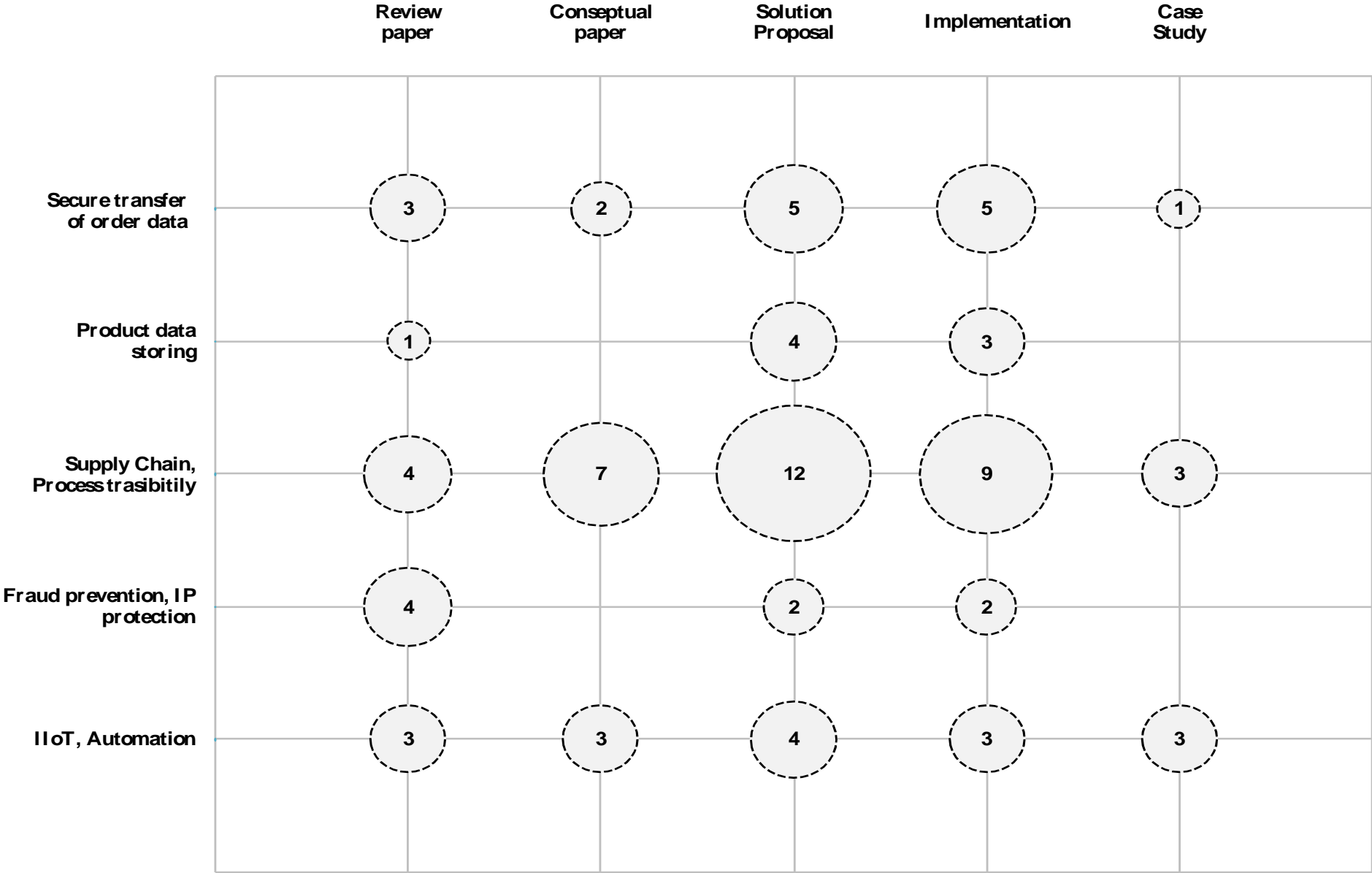
Exclusion:

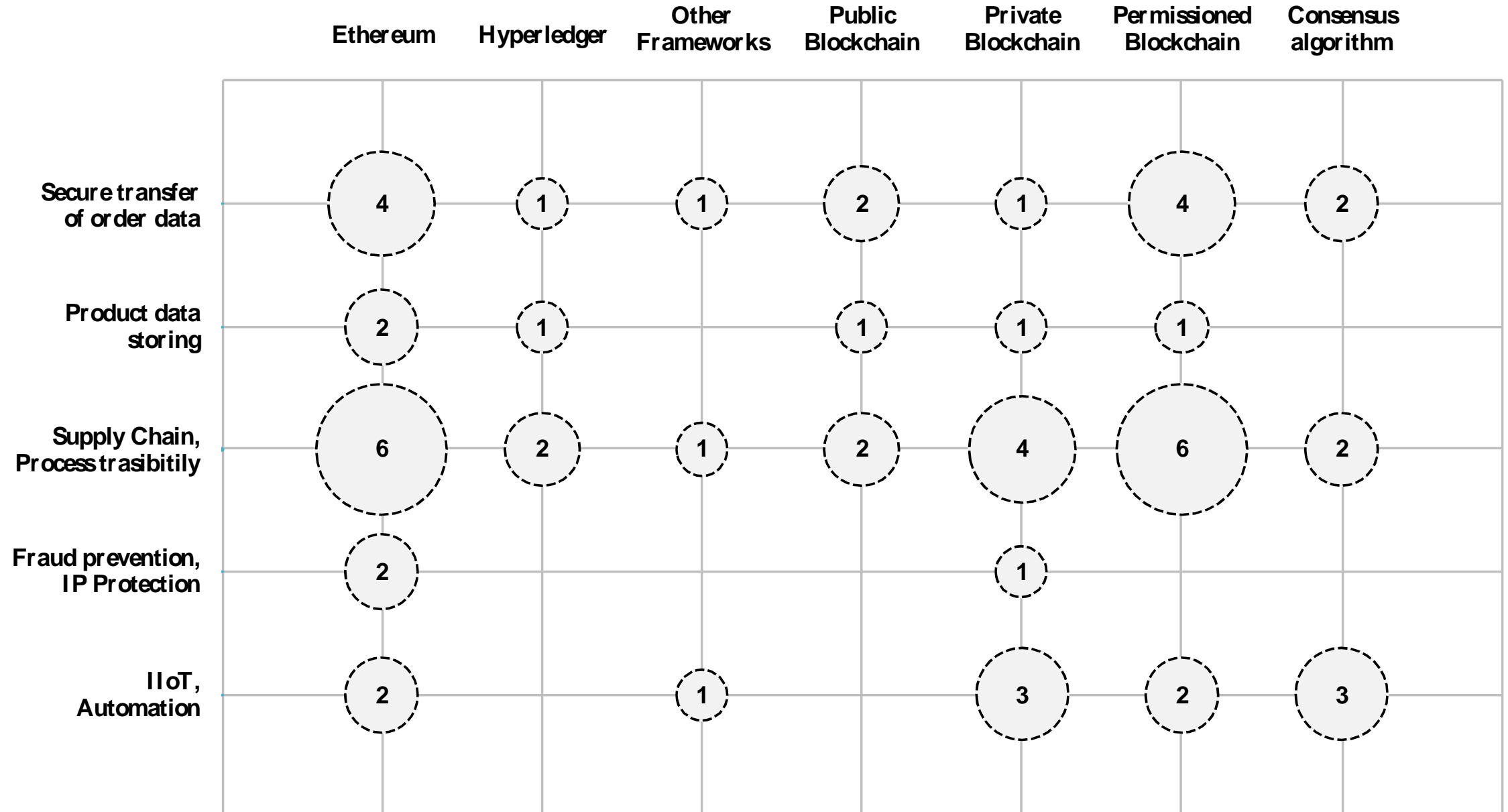
- Bitcoin
- Cryptocurrency





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



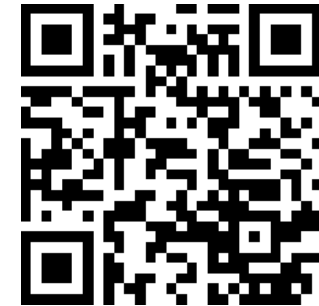


- **RQ1:** What are the problems between stakeholders in manufacturing industry?
 - Dependence on a Trusted Third Party (TTP)
 - Communication of the information to a TTP
 - Insufficient confidentiality
- **RQ2:** What are the data to secure in manufacturing process?
 - Computer-Aided Design (CAD file)
 - 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, Permissioned

- 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

- Link to the Slides
 - <https://tinyurl.com/indin2020cps>



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



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