

# 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**  
**HOBOTPAHC**

**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:**

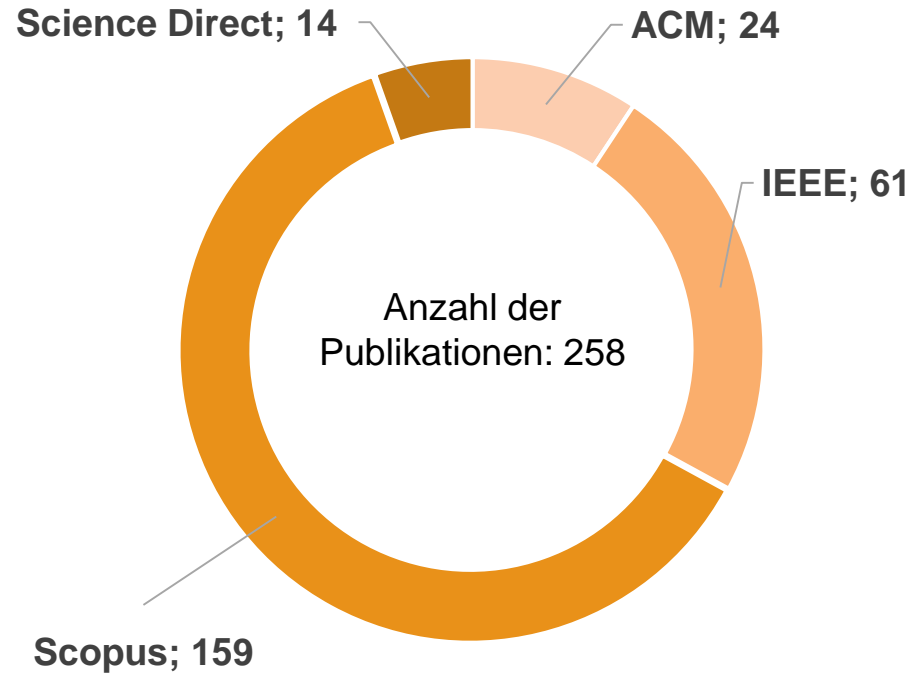
What are the use cases of Blockchain Technology for manufacturing industry?

## **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")

## Data Sources

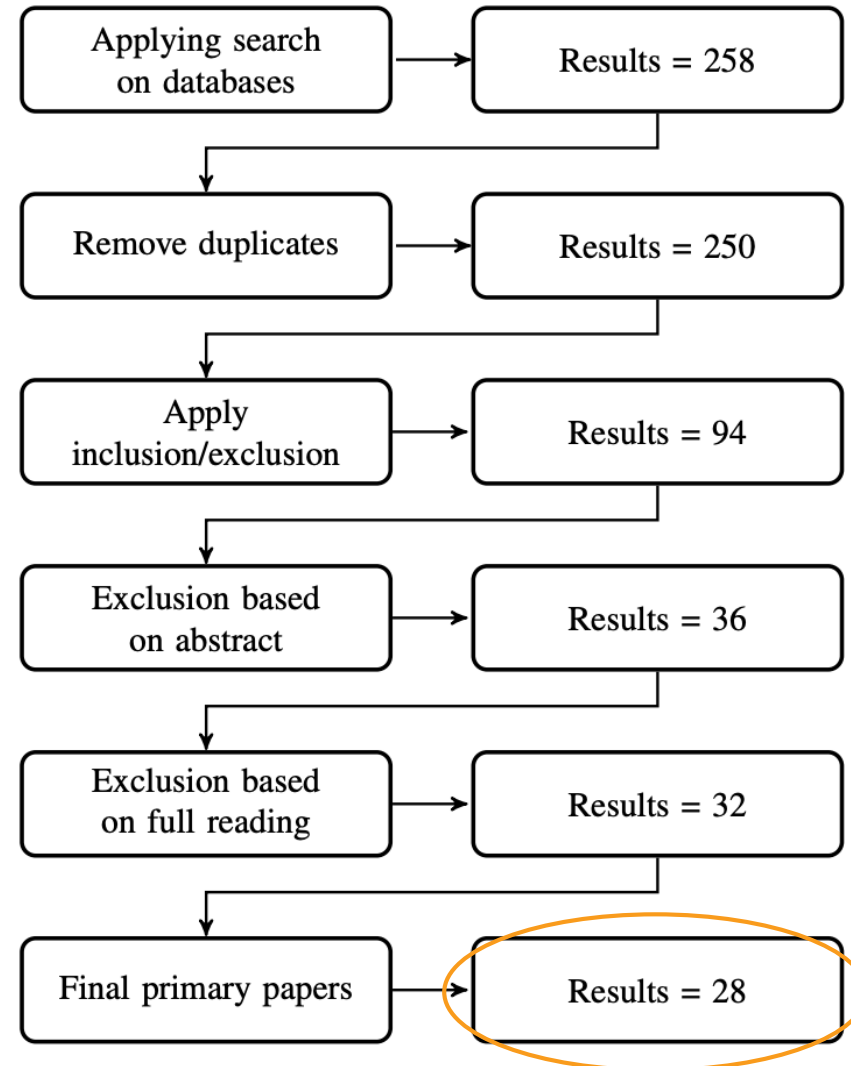


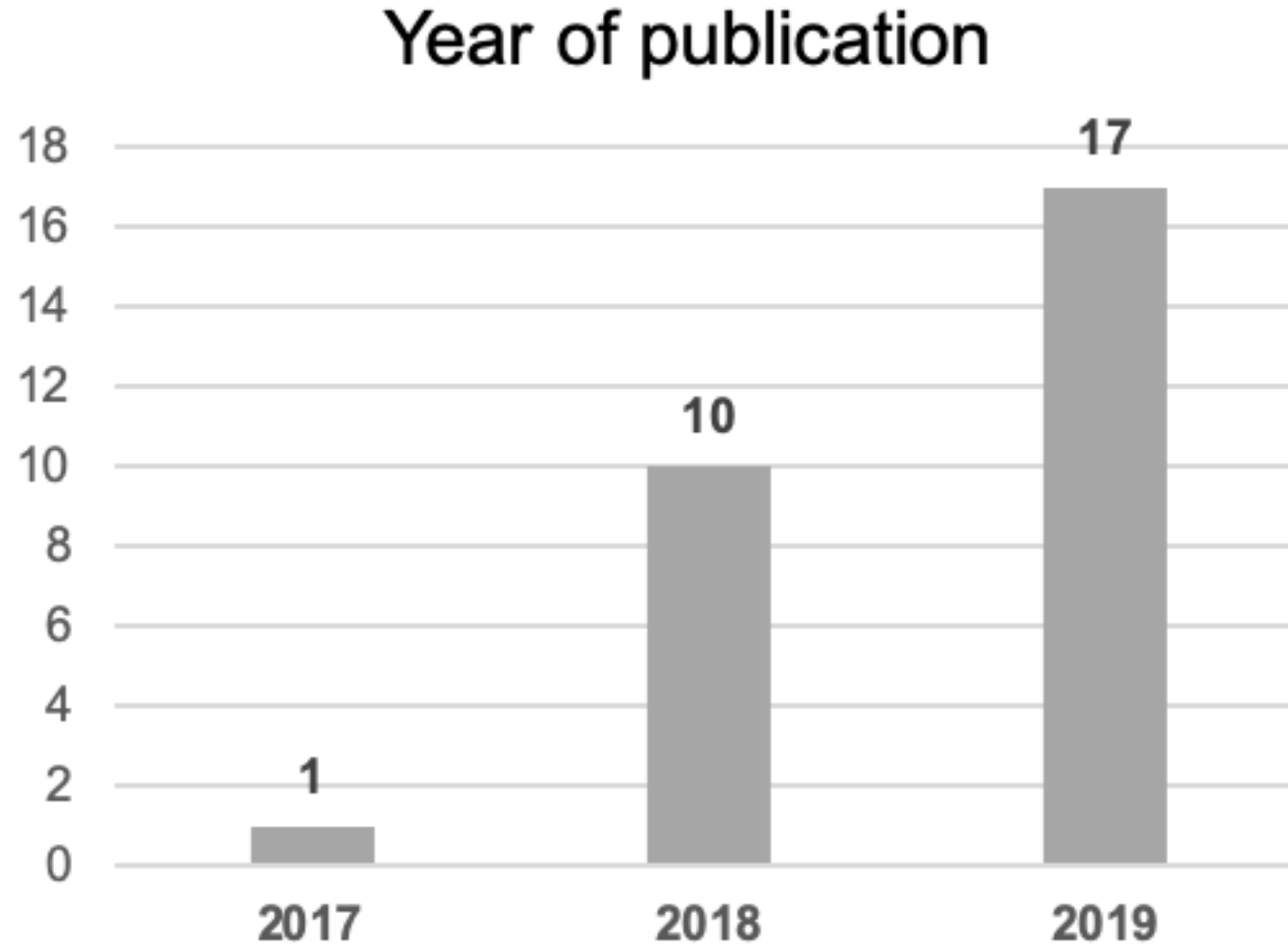
### Inclusion:

- Title: Blockchain

### Exclusion:

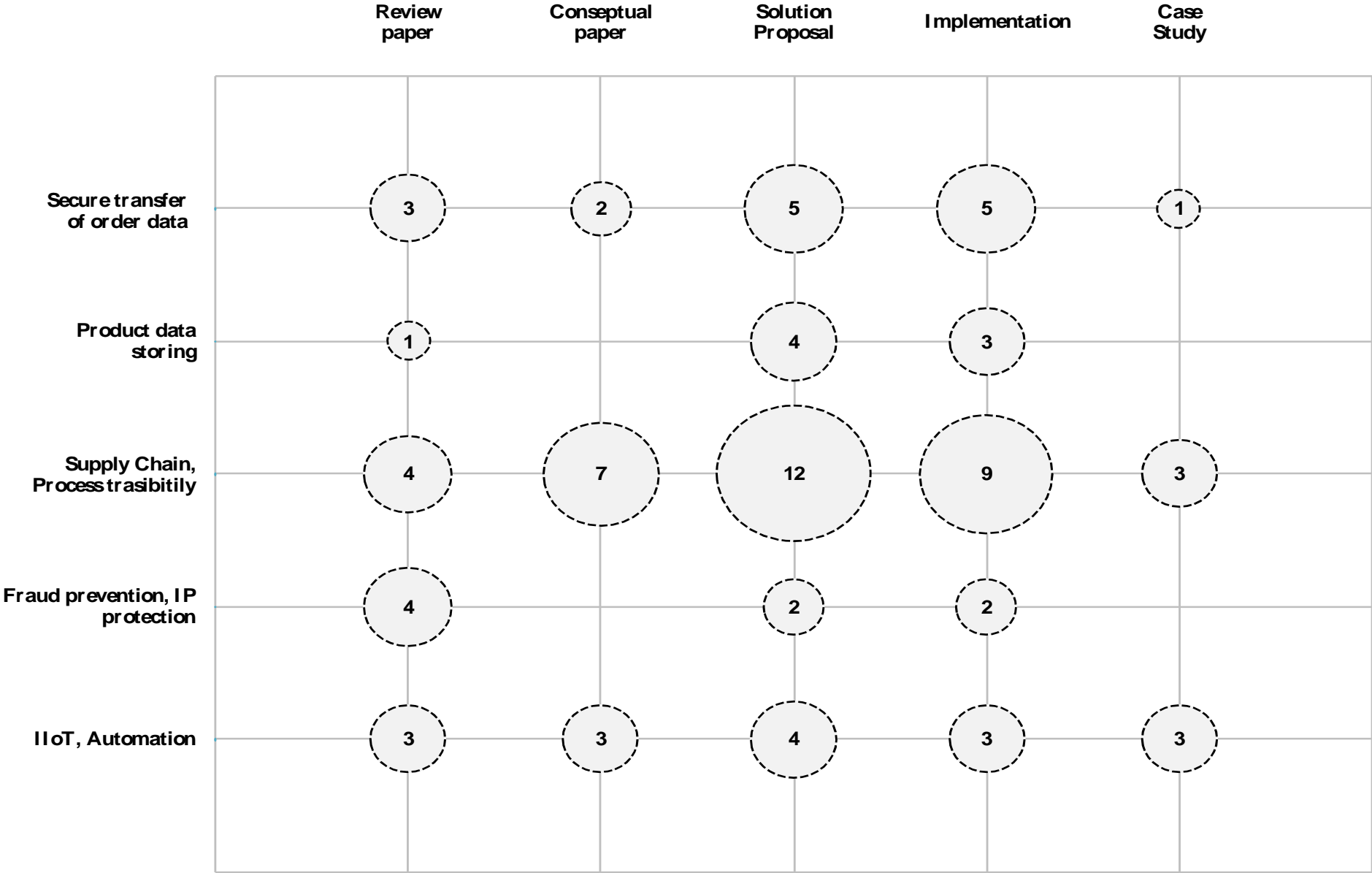
- Bitcoin
- Cryptocurrency

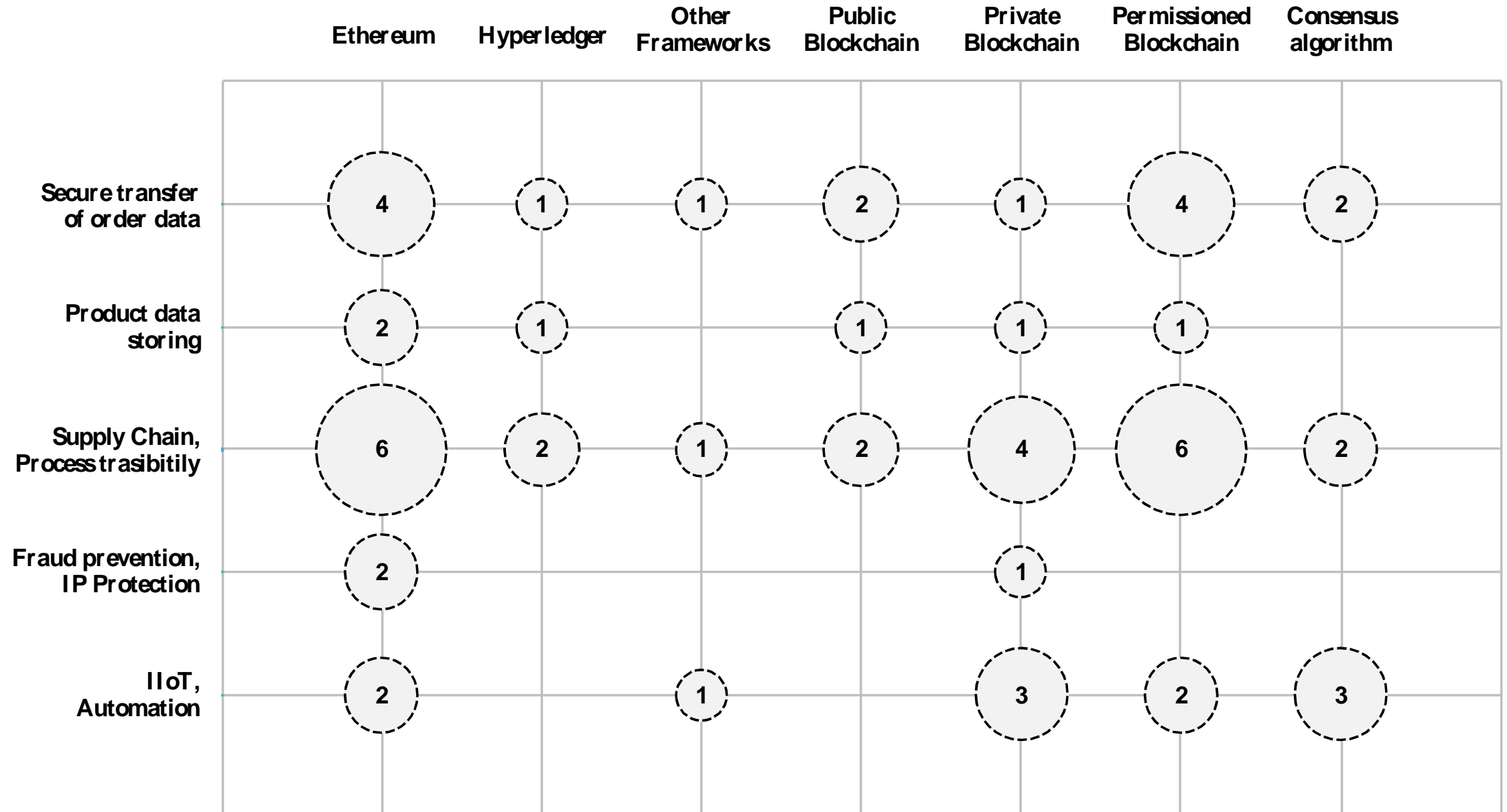






- Use case of Blockchain,
- Research facet,
- Blockchain facet.





- **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/indin2020bc>
- Link to Smart Production Systems at HTW Dresden
  - <https://www.htw-dresden.de/industrie40>



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