

CHALMERS

Blockchain in construction – hype, hope or harm?

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AIM OF THIS STUDY

Consider the emerging potential of **blockchain technology** for a new **digital business model** for **construction logistics**, where the **material and economic flows are integrated**, and

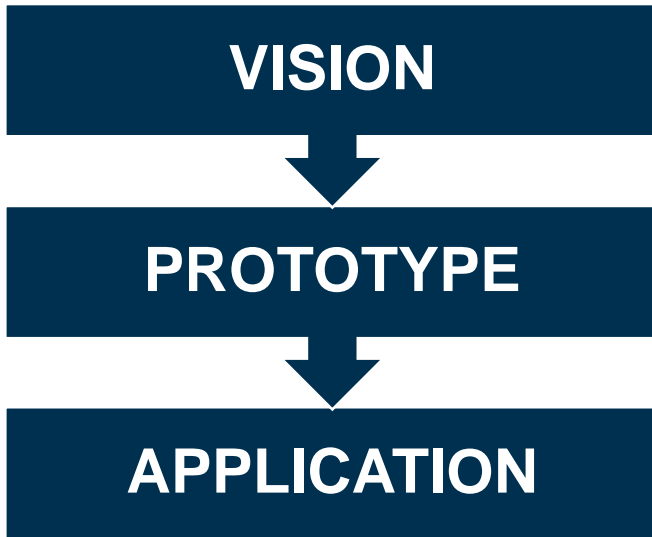
Investigate whether such a solution would constitute **hope**, **harm**, or just **hype**, through: (i) the **lessons-learned** from other **blockchain application prototypes** within the **construction context**, and (ii) the **constellations of different building logistics actors** in Sweden,

A SOCIOMATERIAL TAKE ON BLOCKCHAIN

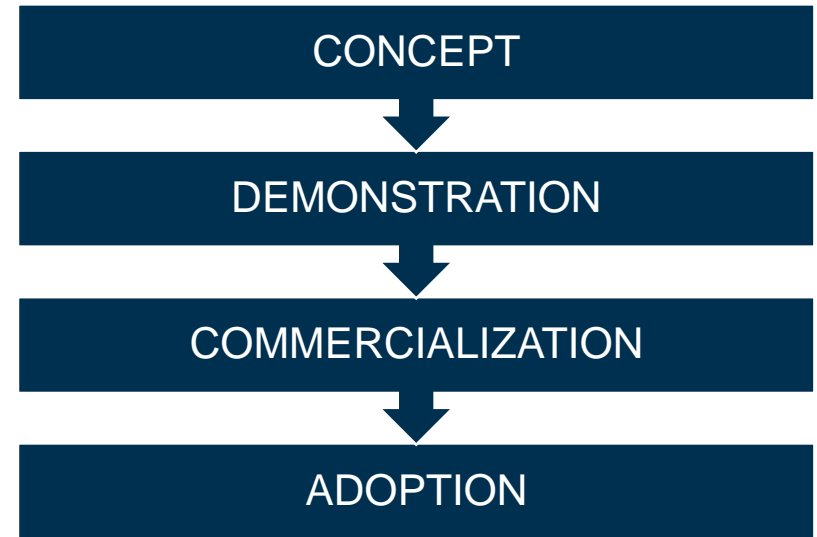
- **Sociomateriality:** a sociotechnical approach emphasizing the way digital technologies are co-shaped with practices
- Social and material aspects of digital technologies: inseparable
- Blockchain in building logistics and supply chain management **cannot be understood separately from processes and practices**

SOCIOMATERIAL MATURITY LEVELS

Sociomaterial maturity scale



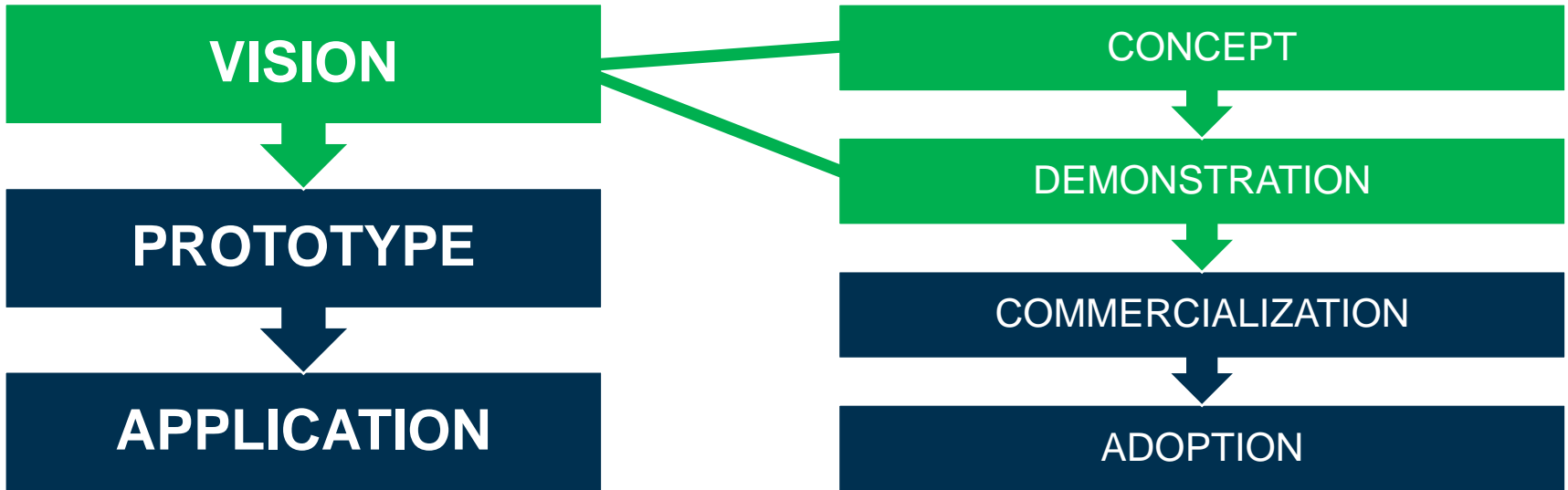
Technology readiness scale



SOCIOMATERIAL MATURITY LEVELS

Sociomaterial maturity scale

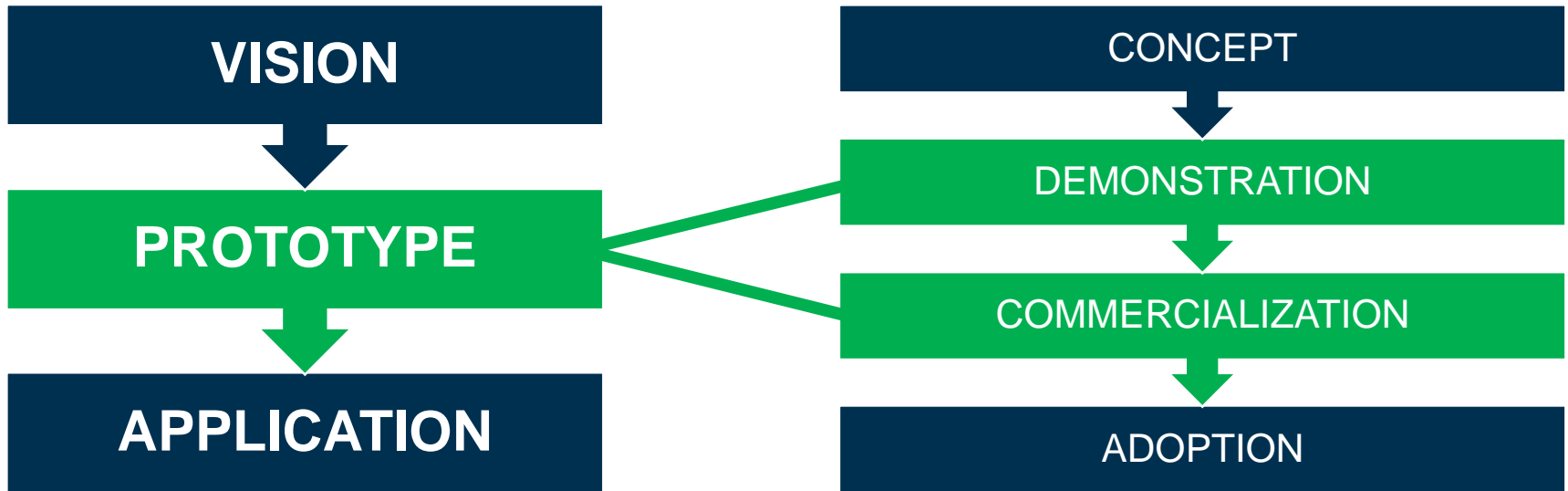
Technology readiness scale



SOCIOMATERIAL MATURITY LEVELS

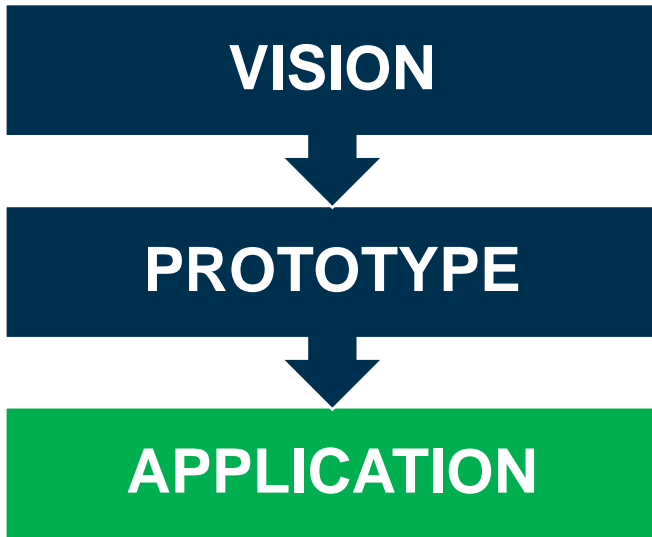
Sociomaterial maturity scale

Technology readiness scale

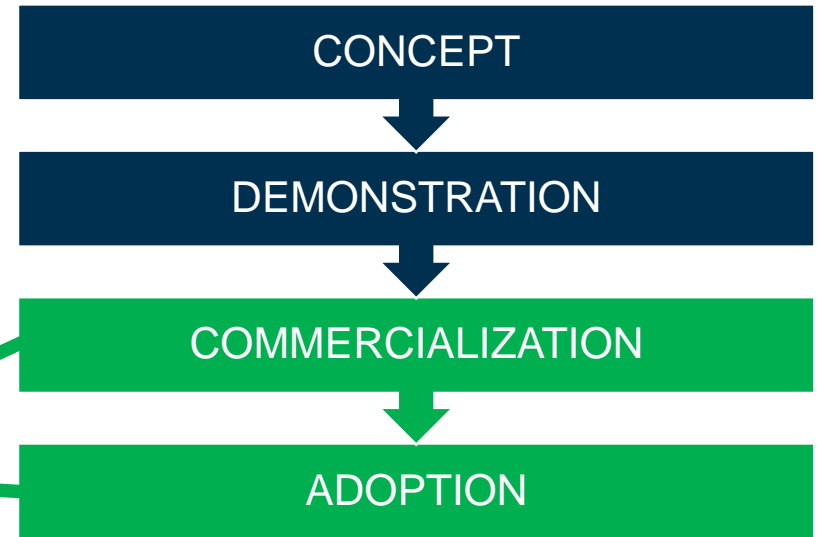


SOCIOMATERIAL MATURITY LEVELS

Sociomaterial maturity scale



Technology readiness scale



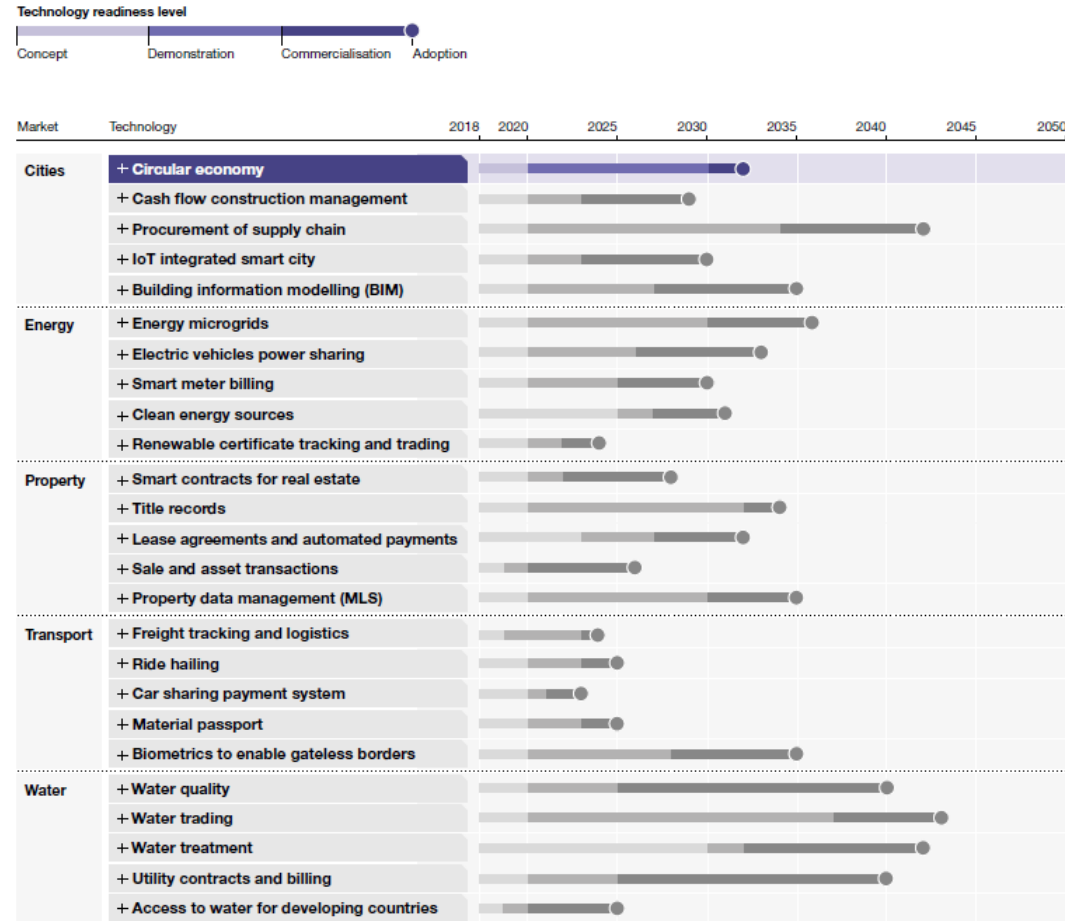
WHAT IS BLOCKCHAIN?

A sociomaterial perspective:

- A **team technology** fostering collaboration to solve business challenges
- **Peer-to-peer** system for value transaction
- **Digital ledger: append-only, shared, decentralized**
- **Reduced** need for in-between verification
- New entries reflected on all database replicants hosted in ledger nodes
- Each “block” stores **a finite set of transactions- and system-related data**; then blocks are connected in a fixed order
- The **autonomy-control paradox**

BLOCKCHAIN IN CONSTRUCTION - VISIONS

- Research on development and implementation relatively new (Penzes, 2018)
- Research mainly discretized into:
 - Holistic efforts on understanding and implementing blockchain
 - Dedicated efforts on integration of blockchain with distinct fields
- Application systems and solutions generally not yet technologically and commercially mature (Gerber & Nguyen, 2019; Nguyen et al. 2019) – mainly visions →



BLOCKCHAIN IN CONSTRUCTION - PROTOTYPES

- BIMCHAIN
- Circularise
- SiteSense®
- Blockchain tool for real estate transactions and mortgage deeds
- Tradelens – shipment tracking solution by Maersk and IBM



LESSONS-LEARNED FROM PROTOTYPES

A *sociomaterial perspective*:

- Prototypes not mature enough to be assessed... but show potential
- Construction logistics → little research on utilizing blockchain for the **integration of material and economic flows...**
- ... also, a relative business case is largely absent
- Creating monetary and qualitative value for the stakeholders → **value proposition of a new digital business model**
- Crucial to focus on the issue of **value creation for all interested parties and stakeholder groups across the supply chain**

CONSTELLATIONS OF DIGITAL BUILDING LOGISTICS IN SWEDEN

Three main identified sociomaterial constellations – with a potential to utilize blockchain:

1. **Large contractors** integrating building logistics internally (**typical case**)
2. **Independent third-party building logistics consultants** employed by clients
3. **Third-party players** (e.g. construction equipment suppliers or industrialized housing suppliers), offering digital building logistics solutions



LESSONS-LEARNED FROM THE CONSTELLATIONS

A sociomaterial perspective:

- Building logistics in Sweden → possible field of blockchain implementation
- Different constellations with **different business models**:
 - **Different modes of collaboration** between the participants in a blockchain network
 - **Different sociotechnical solutions involving characteristic distributions of power**, rather than just technical choices among rationally discernible models
 - The issue of value creation is also dependent on the current realization of, mainly, the economic flow
- Operational frameworks dependent on knowledge exchange, but also a political game

BLOCKCHAIN IN CONSTRUCTION LOGISTICS – HOPE?

- Better overview of construction production and supply
- Mitigating currently problematic transactions
 - Time + cost savings in construction
 - Higher profit margin
 - Safer timetables with fewer delays
 - Less administrative redundancy + duplication: fewer data errors + interruptions
 - Fostering trust, transparency and traceability
- Enhancing delivery + quality management of on-site deliverables
- Aiding in stakeholder collaboration through decentralization



BLOCKCHAIN IN CONSTRUCTION LOGISTICS – HARM?

- Security issues
- Ambiguous value creation
- Difficult implementation
- Barriers in sociotechnical and market adoption
- Data-related issues
- Currently non-existent regulations framing the use of blockchain for construction logistics
- Mistrust in cryptocurrencies
- No widespread sociotechnical knowledge about blockchain in the construction context



BLOCKCHAIN IN CONSTRUCTION LOGISTICS – JUST HYPE?

- Skyrocketing of business and public interest and investments in digital ledgers, smart contracts and virtual currencies
- Momentum in adopting due to “fashion”
- Do benefits outweigh the drawbacks?
- Only a buzzword?



CONCLUSIONS

- Blockchain: emerging technology with potential for the construction sector
- Present systems immature – rather visions with just a few actual prototypes
- Disintegration of material and economic flows in construction logistics: **major issue**
→ **integration could be facilitated through blockchain**
- Crucial for the adoption of such a solution is the value creation of a new digital business model – which differs for each constellation of construction logistics actors
- Implementing blockchain in integrated construction logistics to reap the relative benefits (**hope**) entails negotiations, and requires tackling of **security, integration, and technology introduction** issues (to avoid **harm**), as well as understanding the sociomaterial requirements and potential of the technology (to go past **hype**)
- **Future cross-fertilization** of blockchain with other digital technologies such as IoT, machine learning, and digital twin

THANK YOU FOR YOUR ATTENTION!

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