Blockchain Technology Adoption in the Digitalization of the Food Systems:
A scoping review

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Our food systems

Figure 1: The food ecosystem in the past

Producer — Processor — Wholesaler — Restaurant — Consumer — Grocer

Figure 2: The food ecosystem today

Producer, Wholesaler, Processor, Restaurant, Deliverer, Grocer, Consumer
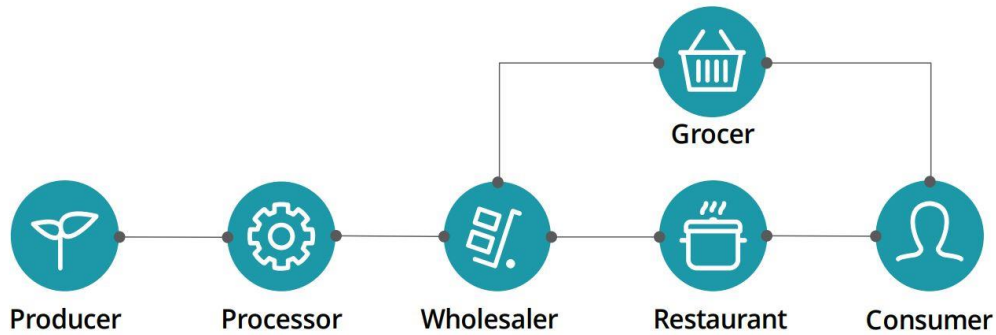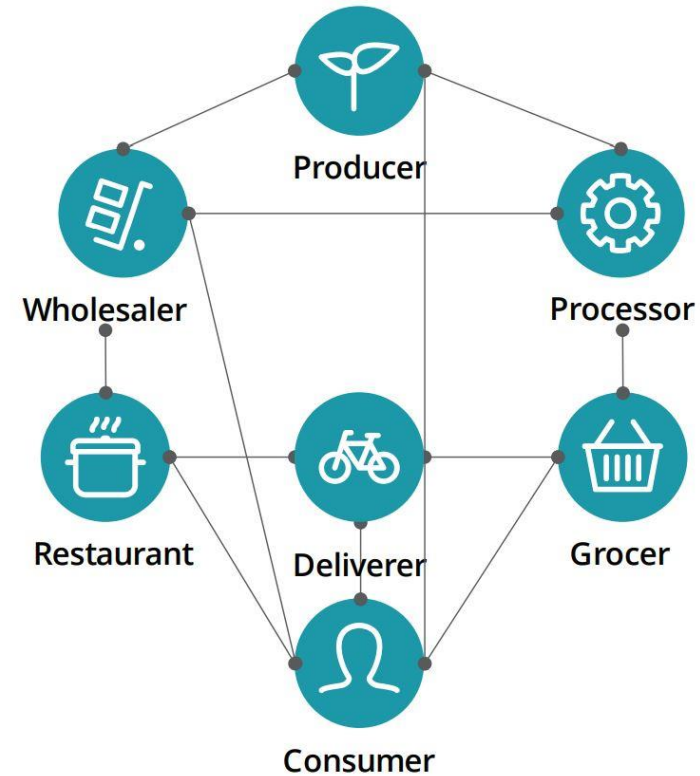
Source: Deloitte. *Future of Food: How Technology and Global Trends are Transforming the Food Industry.* 2019.
https://www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloitte-au-economics-future-food-uber-eats-100719.pdf

Digital technologies in the food systems

Cloud Computing

Autonomous Robots

Cybersecurity

Augmented Reality

4.0

Additive Manufacturing

Big Data

Simulation

System Integration

Internet of Things

101 Blockchains

BLOCKCHAIN IN FOOD INDUSTRY

FOOD TRACEABILITY AND SAFETY

ORDER FOOD ONLINE

KFC
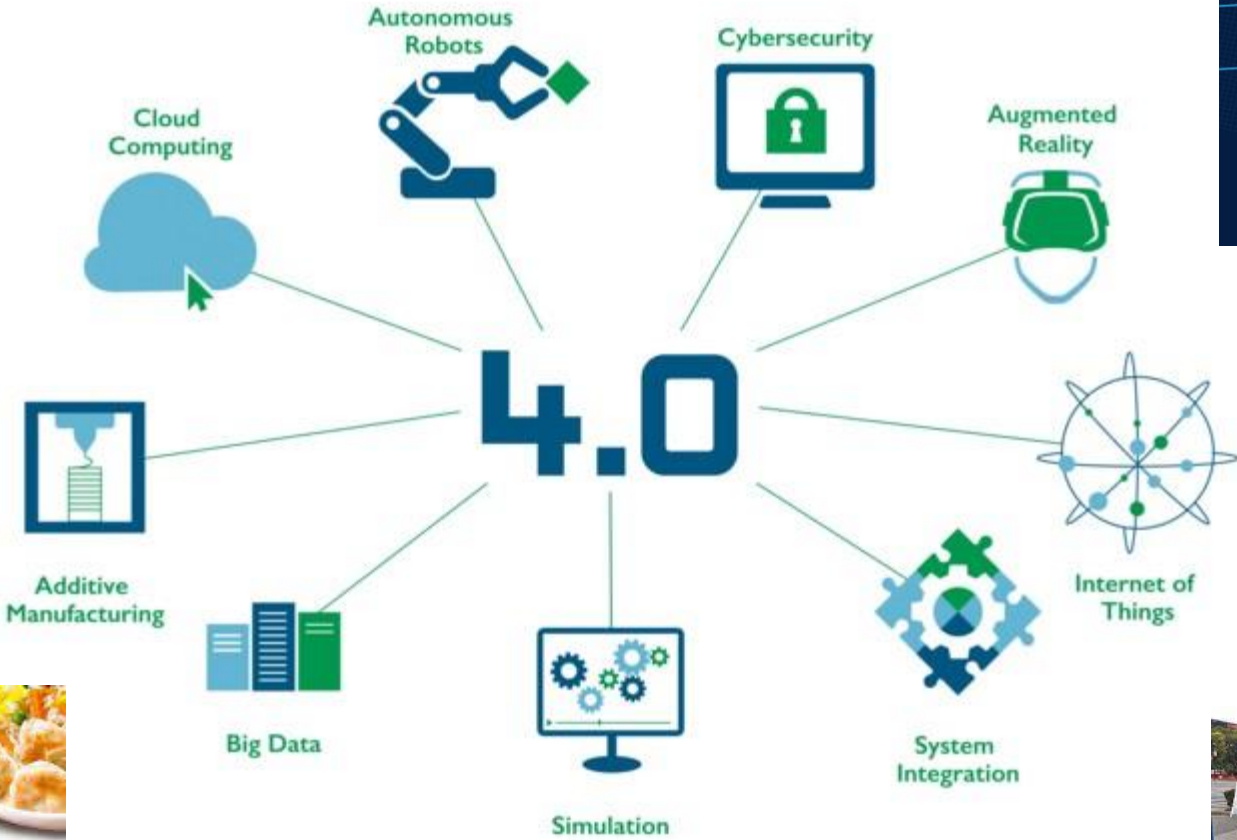
Blockchain in the food systems

**Safety and Traceability in the Food Chain.
Powered by Blockchain.**

Traditional View of the Connected Supply Chain

Grower → Processing Plant → Blend Manufacturer → Quality Control → Logistics Provider → Seller → Consumer
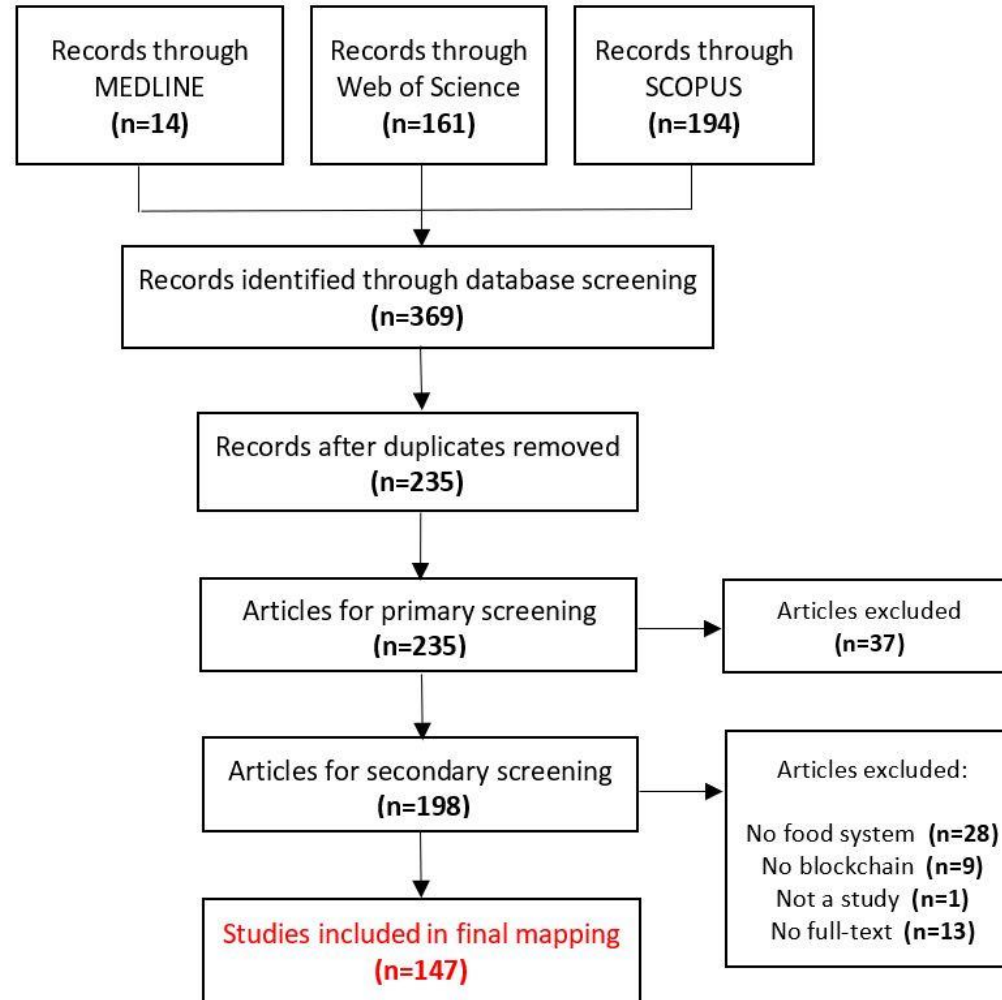
Information Silos

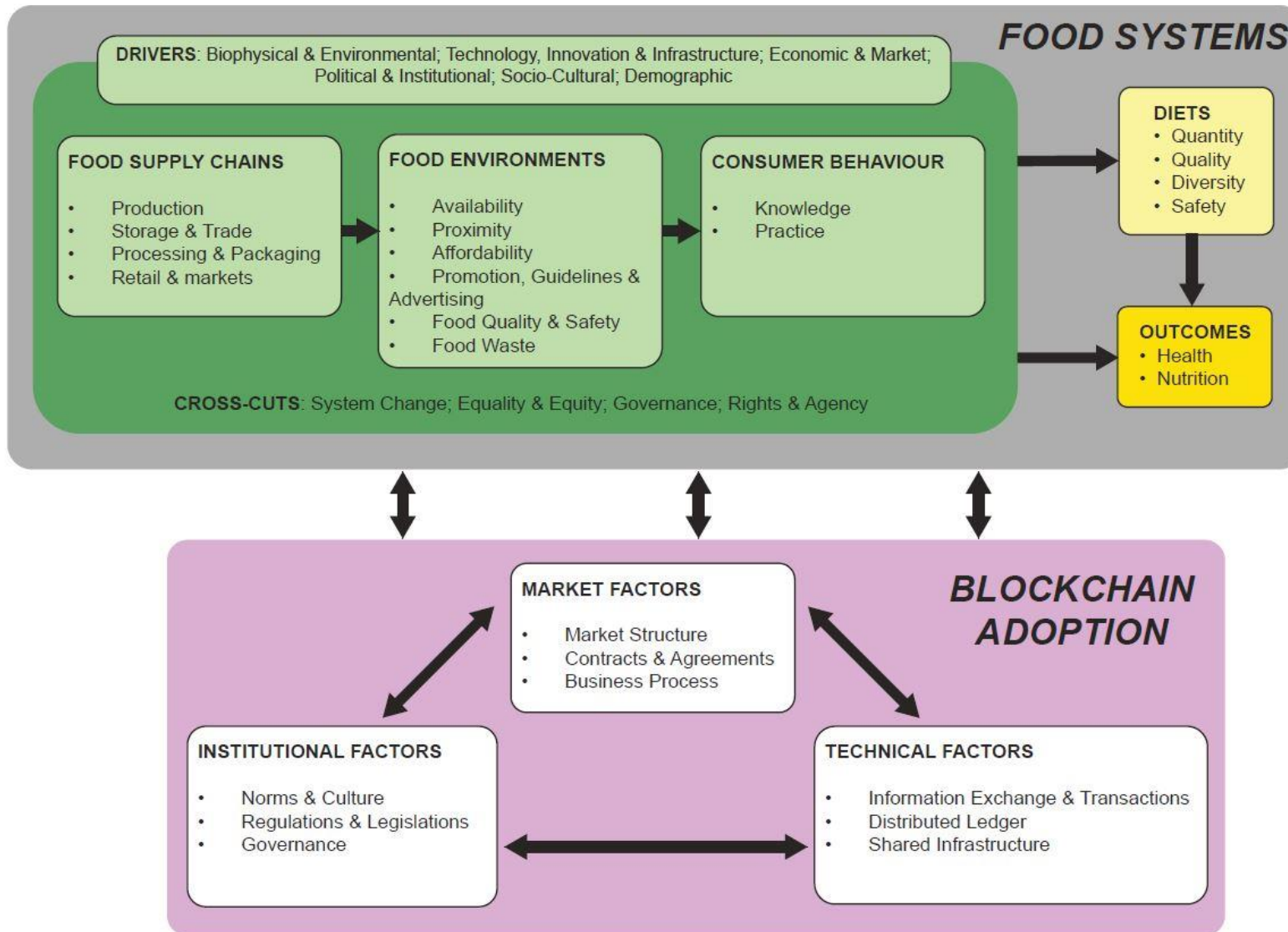# Blockchain in the food systems

Source:

How does research address blockchain technology adoption in the digitalization of the food systems?

Review methods

(blockchain* OR "block chain*") AND (food* OR agri* OR farm* OR diet* OR meal* OR nutritio* OR malnutritio*)

Theoretical framework

Guiding framework adapted from HLPE (2020) and Janssen et al. (2020)

Study types & Geographical contexts

Data Type

Theoretical	67
Primary	37
Secondary	30
Unspecified	13

Geographical distribution

Europe and Central Asia	35
East Asia and Pacific	27
South Asia	15
North America	9
Middle East and North Africa	3
Sub-Saharan Africa	3
Latin America and Caribbean	1
Unspecified	56

Country distribution

China	23
India	16
USA	11
EU	11
Italy	10
Australia	6
UK	5
Thailand	4
Other countries (n=20)	34

- Most studies are still theoretical only.

- Relatively less empirical studies (case studies).
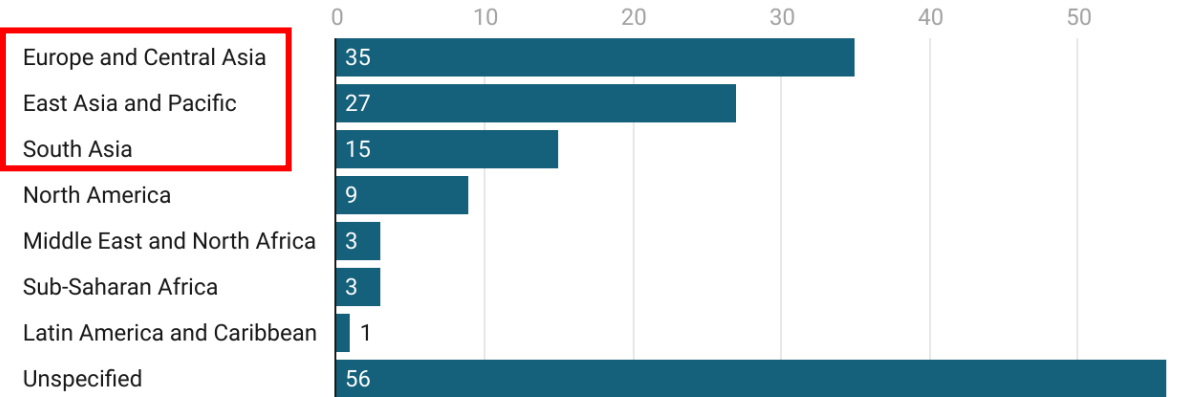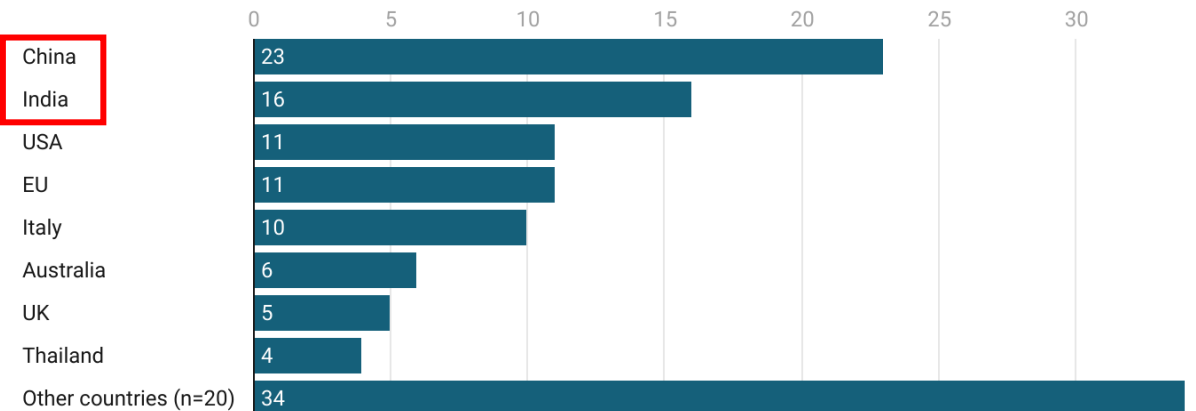
Country contests

Country Income-level Distribution

Income level	Value
High	40
Upper-middle	32
Lower-middle	20
Low	0
Unspecified	72
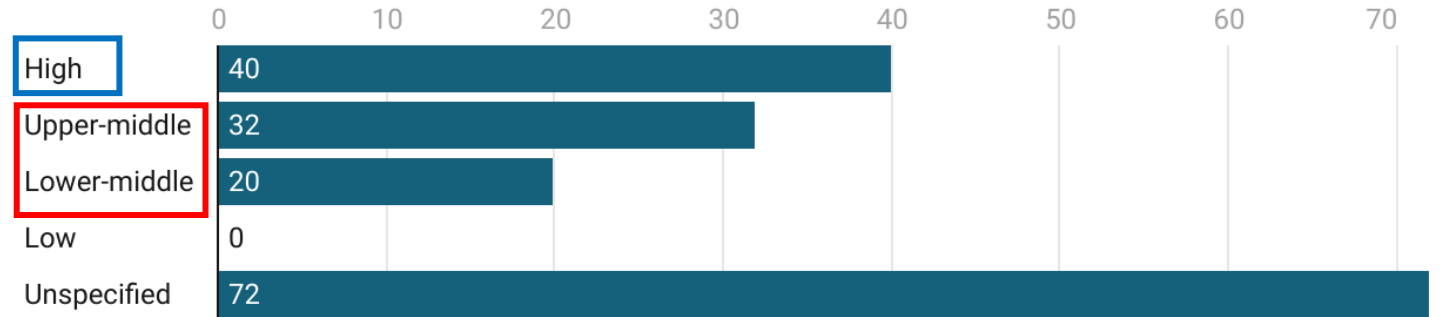
Transparency, traceability, and supply chain management

Food productivity, and natural resource management

Blockchain-based food supply chain traceability: a case study in the dairy sector

Fran Casino[a], Venetis Kanakaris[b], Thomas K. Dasaklis[a], Socrates Moschuris[c], Spiros Stachtiaris[c], Maria Pagoni[d] and Nikolaos P. Rachaniotis[c]

Blockchain and more - Algorithm driven food traceability

M. Creydt, M. Fischer[*]

Ensuring transparency and traceability of food local products: A blockchain application to a Smart Tourism Region

Gavina Baralla | Andrea Pinna | Roberto Tonelli | Michele Marchesi | Simona Ibba

Interventions to Scale-Up Palmpreneurship in Tamilnadu

P.Malarvizhi

Is Digital GOOD for providing water security?- A case study of India

Dr Lakshmi Shankar Iyer [†], Sirish C Venkatagiri [*]

An intelligent and secure smart watering system using fuzzy logic and blockchain[☆]

M. Safdar Munir[a], Imran Sarwar Bajwa[b,*], Sehrish Munawar Cheema[a]
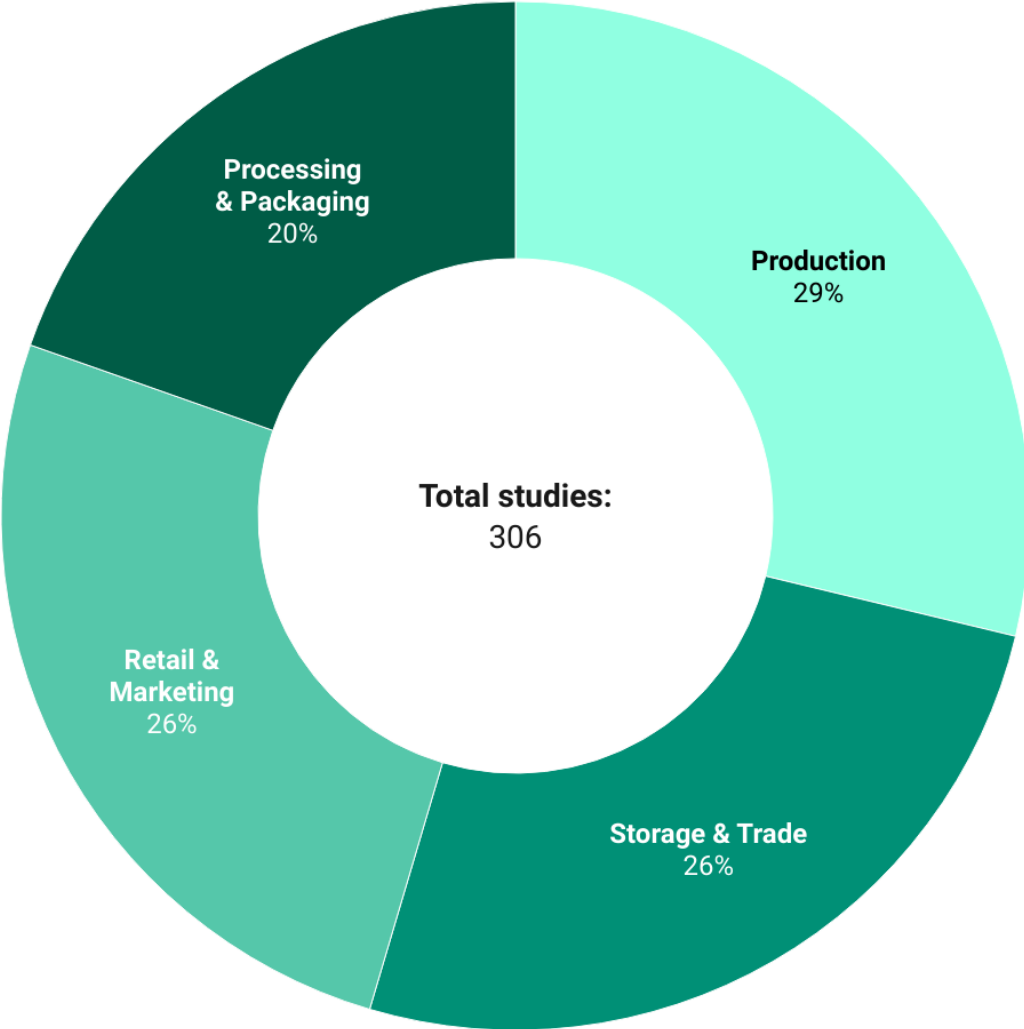
Blockchain adoption in food systems

Food Environment

Food Quality & Safety	120
Promotion, Guidelines & Advertising	120
Avaliability	84
Affordability	14
Food Waste	9
Proximity	5
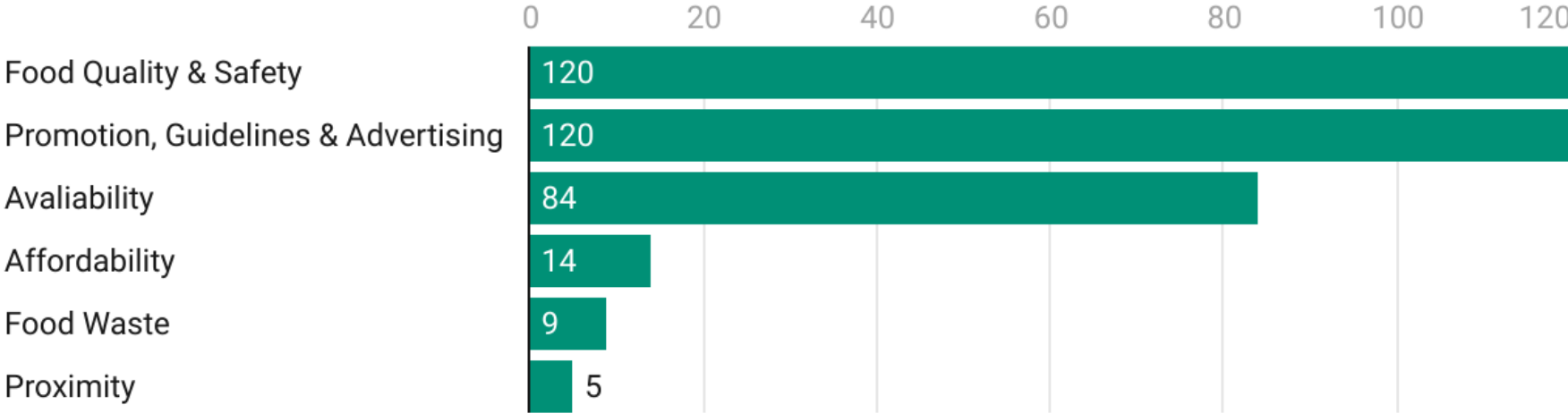
Blockchain adoption in food supply chains

Food Supply Chains

Total studies: 306

- Production 29%
- Storage & Trade 26%
- Retail & Marketing 26%
- Processing & Packaging 20%

Processing & Packaging Stakeholders

Stakeholder	Value
Processing − industry	37
Processing − small & medium enterprise	5
Packaging - industry	7
Packaging − small & medium enterprise	0
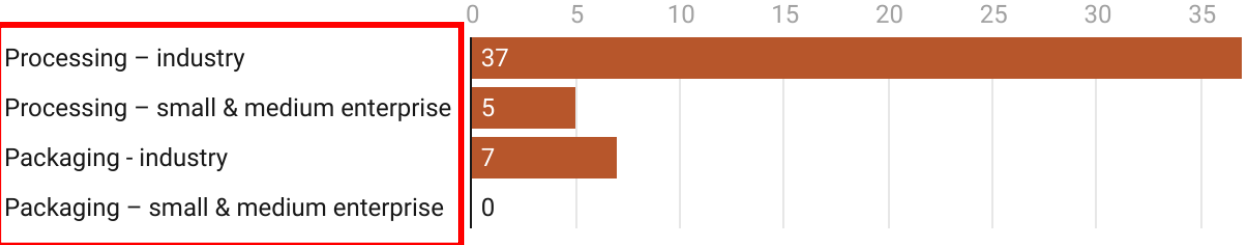
Retail & Marketing Stakeholders

Stakeholder	Value
Consumer	65
Retail - industry	52
Retail - small & medium enterprise	4
Wholesaler	24
Food outlet owner	6
Informal vendor	0
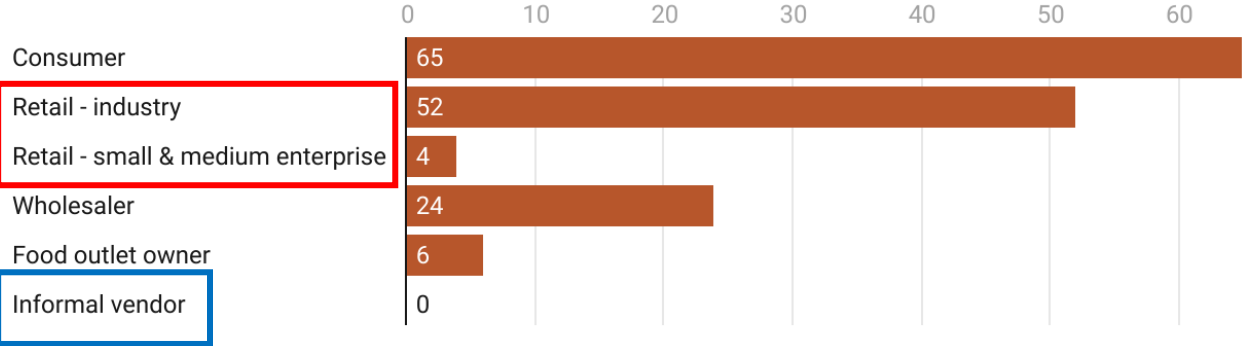
Blockchain adoption in food systems

Cross-cutting Issues in Food Systems

	0	20	40	60	80	100	120
System Change							124
Governance							103
Equality and Equity	3						
Rights or Agency	0						
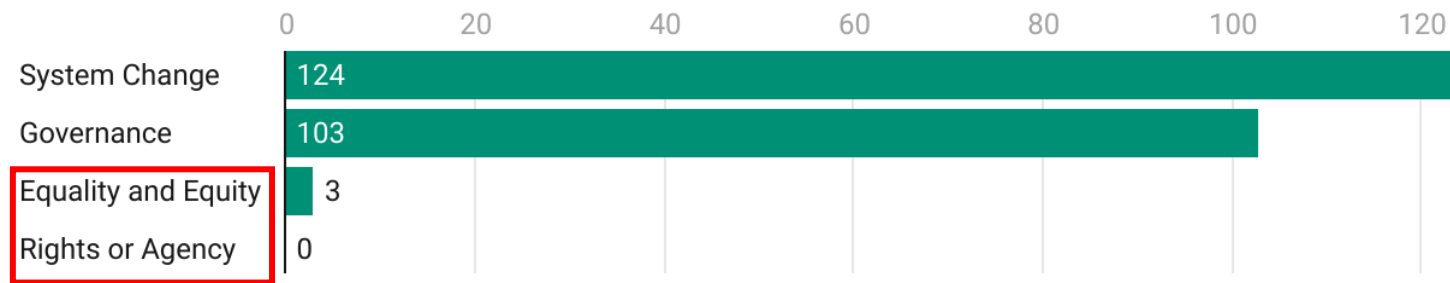
- A handful looking at equality & equity

- No study looked at issues of rights and agency.

  - Right to privacy

  - Right to food

  - Right to health

Food choices, diets, health and nutrition

Evidence found in this review

Linkages established in health & nutrition literature
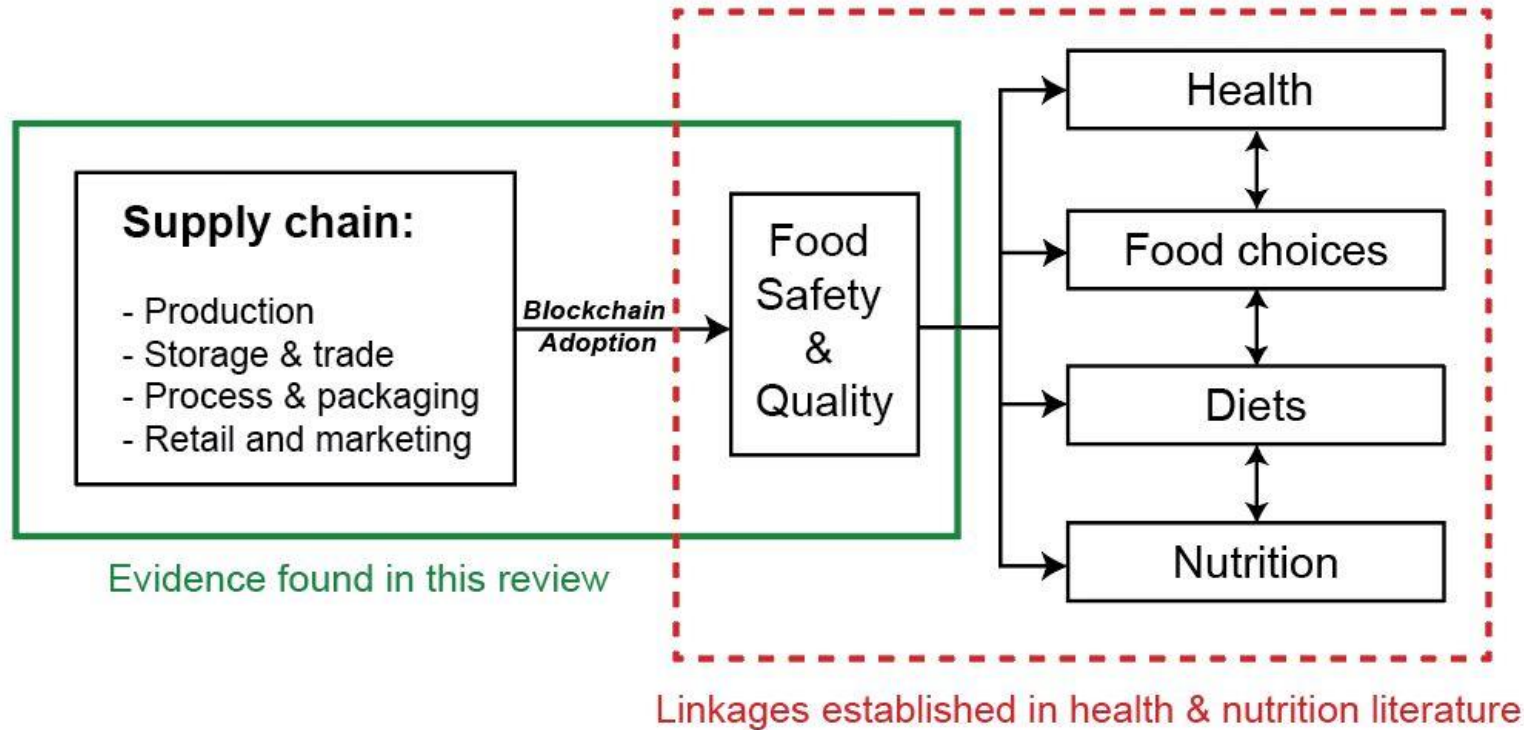
e.g. Food safety is a main driver of food choices in LMICs (Constantinides et al., 2020)

- Only a handful of studies looked at health outcomes (n=2) and nutrition outcomes (n=3).

- No study looked at dietary outcomes (i.e. the quantity, quality, diversity and safety of diets).

Content analysis - Thematic findings

1. Food safety and quality

   Food safety: Food-borne illnesses

   Food quality: Farm-to-fork application

2. Trust

   Negates the need for trust (in technical sense), while also improving trust (in emotive sense)

   Consumer trust - deter food fraud

3. Accountability

   Transparency (visibility) and immutability of data

   For supply chain: Data consolidation to address information siloes among actors

   For consumers: Food miles, greenwashing

4. Supply chain management efficiency

   Standardised record-keeping (i.e. documentation)

   Real-time issue resolution to problems (e.g. food recalls)

   Traceability

Discussions – Cost & cost-effectiveness

1. Costs to businesses

   - More efficient supply chain management can reduce costs, especially in crisis management (e.g. food recalls)

2. Distribution of cost

   - Costs incurred at point of transaction, allowing distribution of costs among wide network of actors

   - Could lower adoption cost-barrier, and capital loss in adoption failure

3. Costs to consumers

   - The jury is still out – a research gap.

4. Costs beyond material

   - Environmental costs

   - Human costs

Gaps and research priorities

Need more research on:

- Downstream outcomes in health, nutrition and diets

    More concrete linkages between upstream aspects of the food systems with their downstream outcomes.

- Critical assessment of the feasibility of the blockchain technology through real-world empirical studies.

- Intersectionality of blockchain with other technologies.

- Digital governance and regulatory environments of blockchain. – in its technical application and the adoption process in the food systems.

- Ethical implications and social repercussions of the technology.

    Addressing equity in multiple forms – includes digital, material and social equity.

    Power dynamics among stakeholders, data ownership, and information privacy.

References

Constantinides SV, Warren AM, Bhandari S, Kenney E, Frongillo EA, Blake CE. How does food safety influence food choice in LMICs? Evidence from the Drivers of Food Choice Program. Food Safety. 2020.

HLPE. Food security and nutrition: building a global narrative towards 2030. Rome; 2020.

Janssen M, Weerakkody VJP, Ismagilova E, Sivarajah U, Irani Z. A framework for analysing blockchain technology adoption: Integrating institutional, market and technical factors. 2020.

Thank you

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