BLOCKCHAIN AND THE ACCOUNTING PROFESSION

PERSPECTIVES FROM THE LITERATURE

WITH EMPHASIS ON ETHICS

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Why emphasize ethics?

- Much has been written about blockchain. The accounting literature emphasize such topics as:
  - Implications of blockchain for accounting education
  - Basic operational aspects of blockchain technology
  - Leveraging general blockchain capabilities
  - Governance and internal control of blockchain technology
  - Blockchain and auditing processes
  - Blockchain & ESG
- A lot less has been written about ethics and misconduct in accounting as well as business in general (Dierksmeier, C. and P. Seele 2020).

Dierksmeier, C. and P. Seele (2020). "Blockchain and business ethics." Business Ethics: A European Review **29**(2): 348-359.

Some observations about the diffusion of blockchain in business

Already diffusing in business at a rapid pace, and is believed to offer unprecedented levels of accuracy and transparency

Described as impactful, disruptive and transformative

Has implications for professional accountants

50+ BLOCKCHAIN REAL WORLD USES CASES

The 'World Economic Forum' anticipates that 10% of global GDP will be stored on the blockchain by 2025.

https://www.weforum.org/whitepapers/realizing-the-potential-of-blockchain

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 blockchainbased 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 experimen- ting 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. Louis Dreyfus Company

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

ДРУЖОВАЯ КОМПАНИЯ 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

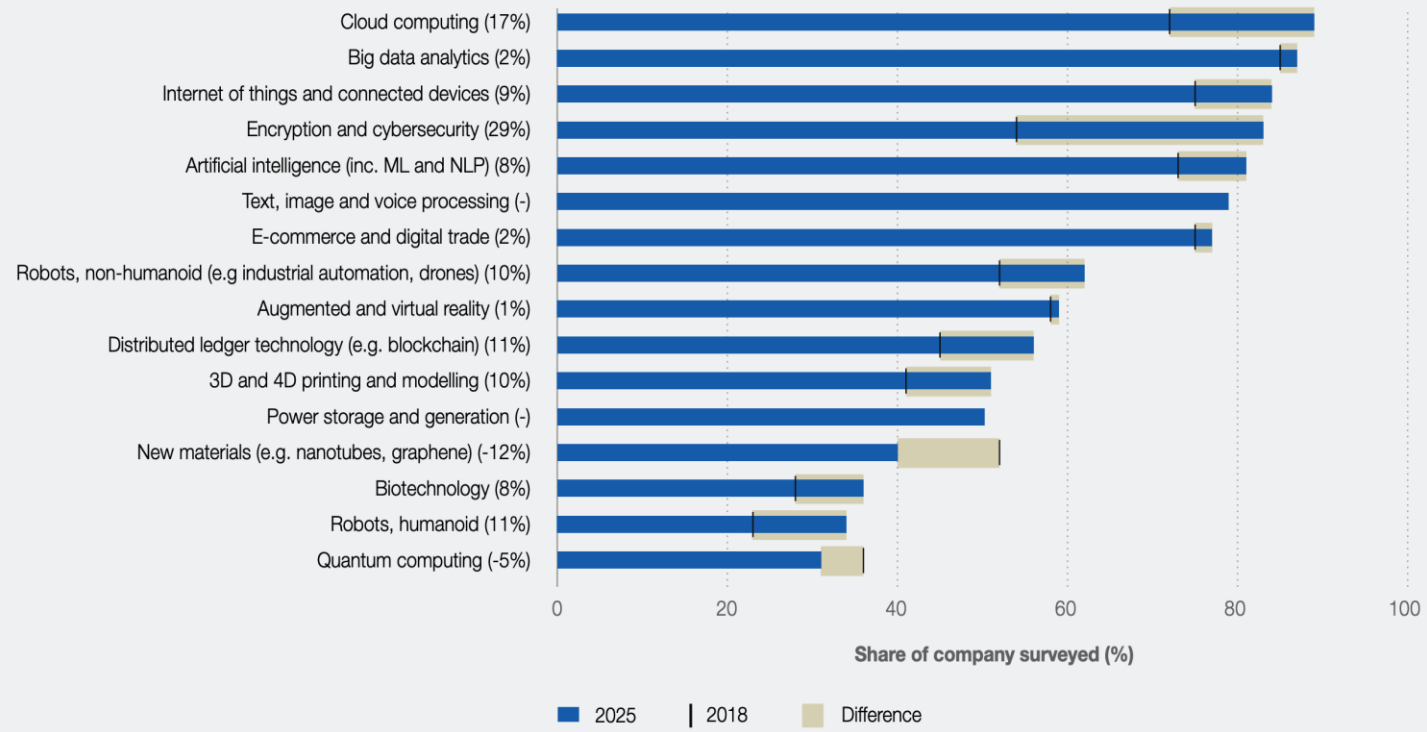
FISHING
Blockchain technology has been used to provide a transparent record of where fish was caught, as a means of ensuring it was legally landed.

https://medium.com/@essentia1/50-examples-of-how-blockchains-are-taking-over-the-world-4276bf488a4b

THE INTERNET OF BLOCKCHAIN FOUNDATION

Disruptive Consequences & Emerging Opportunities

FIGURE 18 | **Technologies likely to be adopted by 2025 (by share of companies surveyed)**

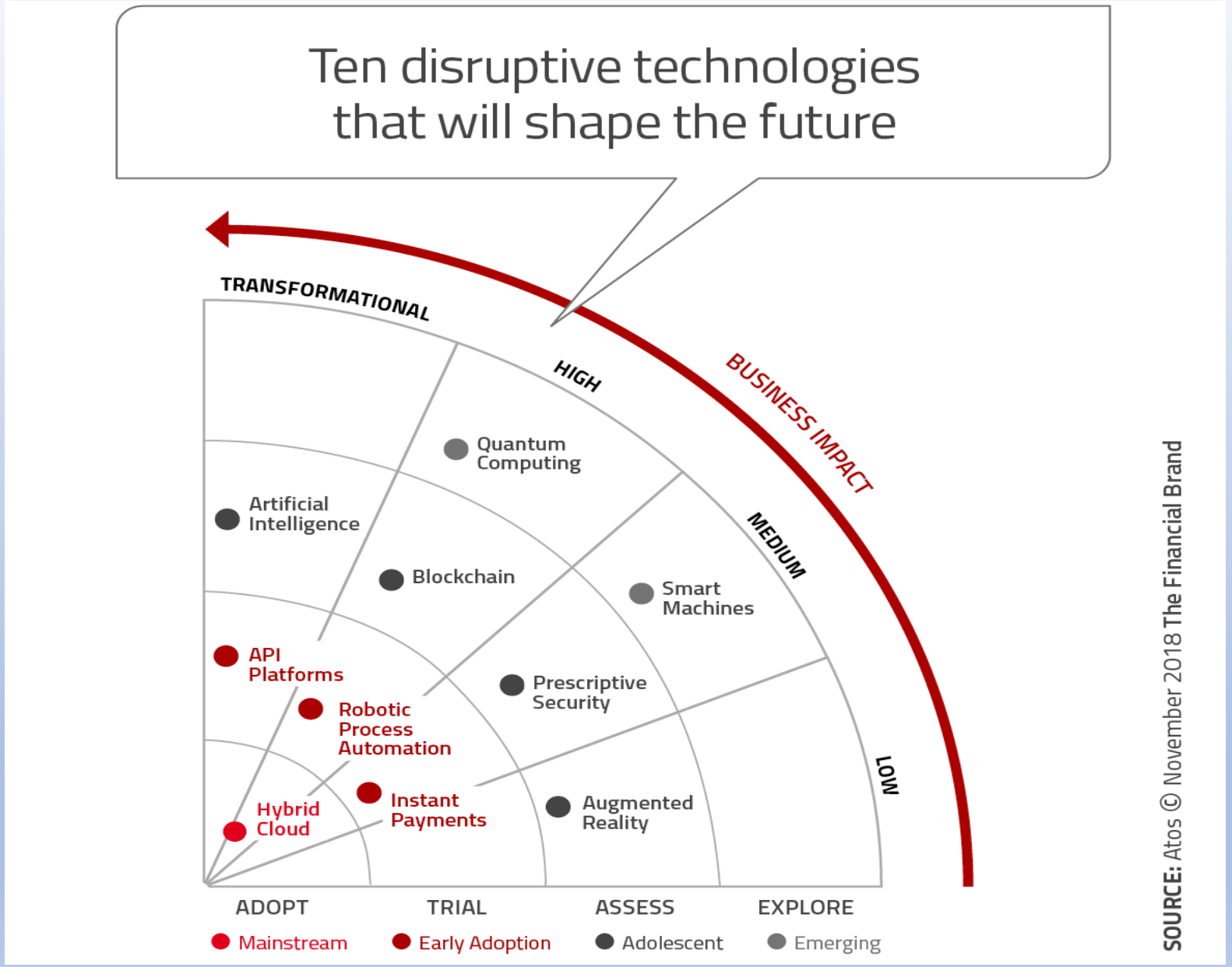


Source

Future of Jobs Survey 2020, World Economic Forum.

http://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf

Disruptive Technologies – 2018 Banking Context



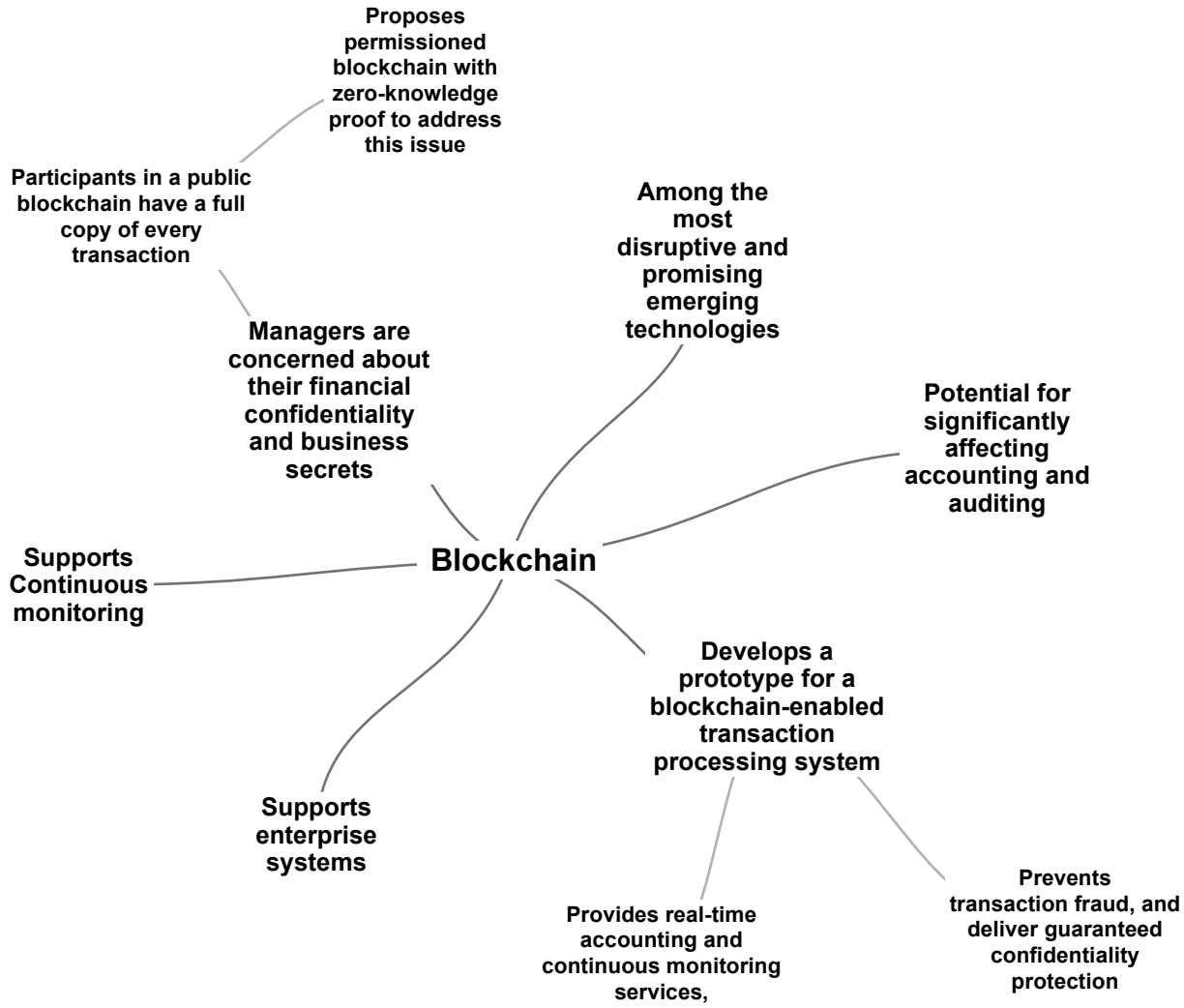
Source: https://www.wowso.me/blog/technology-in-banking

IMPLICATIONS FOR ACCOUNTING EDUCATION

- **Prediction**: the traditional mix of jobs in accounting firms will change substantially, and accountants will need to learn new skills as more traditional tasks become automated and the technical maintenance and analytic needs of the work increase substantively.
- Disruptive technologies that are reshaping business models and the accounting profession include:
  - robotic process automation
  - artificial intelligence (AI),
  - Blockchain and smart contracts
  - Analytics
- Developments in these technologies are ahead of what accounting students are learning
- **Implications**: possibly fewer entry-level jobs and different approaches to preparing individuals for entry-level positions in accounting.

Zhang, C., et al. (2018). "The Impact of Disruptive Technologies on Accounting and Auditing Education." CPA Journal **88**(9): 20-26.

Leveraging Blockchain Capabilities in Accounting & Auditing



- Wang, Y. and A. Kogan (2018). "Designing confidentiality-preserving Blockchain-based transaction processing systems." International Journal of Accounting Information Systems **30**: 1-18.
- O'Leary, D. E. (2017). "Configuring blockchain architectures for transaction information in blockchain consortiums: The case of accounting and supply chain systems." Intelligent Systems in Accounting, Finance & Management 24(4): 138-147. This is somewhat similar to Wang & Kogan 2018.

Leveraging Blockchain Capabilities in Accounting & Auditing – Strengthening COSO

- Need to understand the impact of blockchain and smart contracts on the assessment of internal controls and enterprise risk.
- Distributed ledger and smart contracts blur the system boundaries between trading partners
- Thus, **there is a need to understand whether internal control assessments based on a single company approach is adequate in an integrated and collaborative environment**
- COSO's integrated framework and Enterprise Risk Management (ERM) framework does not adequately address a collaborative supply chain ecosystem.
- Vincent, N. E. and R. Barkhi (2021). "Evaluating Blockchain Using COSO." Current Issues in Auditing **15**(1): A57-A71.

Leveraging Blockchain Capabilities in Accounting & Auditing – The First Mile Problem

- Ensuring that data stored on the blockchain distributed ledger is isomorphic with the real life data that it purports to represent.
- The first mile problem arises only when the blockchain is used to store data about physical items, especially ones involving a service component, rather than being native digital, as is the case with the genesis blockchain application, bitcoin.
- There is a role for auditors, with the training in professional skepticism, to help alleviate the first mile problem.
- There is no guarantee, however, that this new demand for auditing will be met by the traditional financial statement auditors.

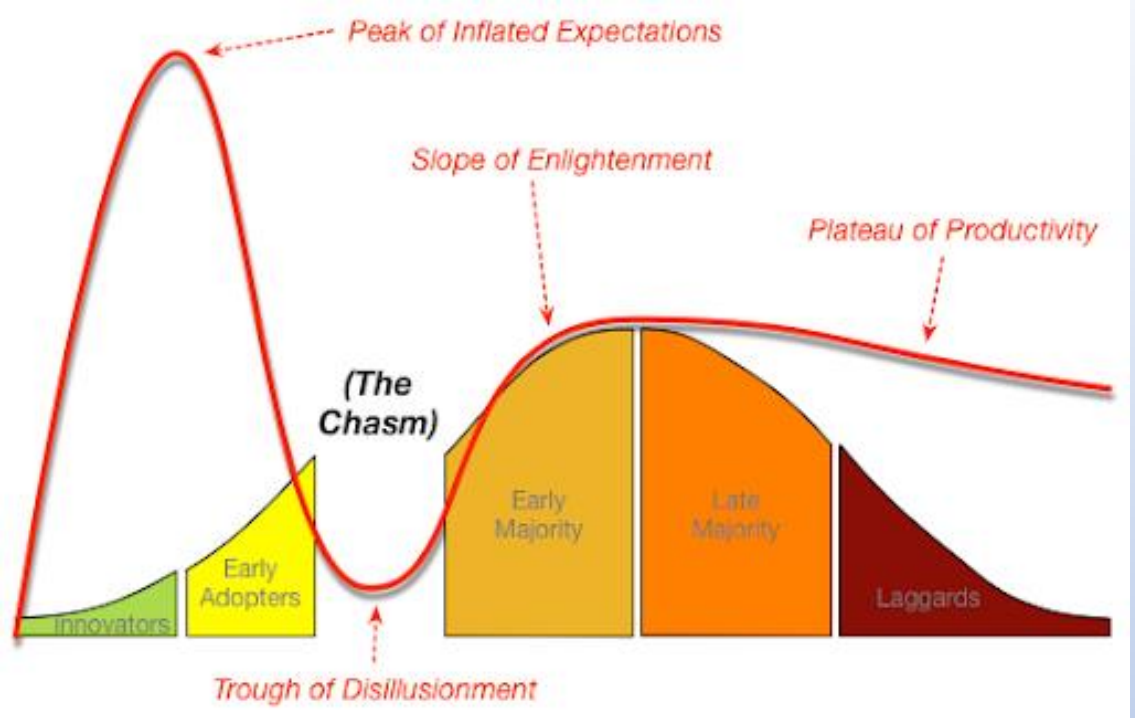
Alles, M. and G. L. Gray (2020). ""The first mile problem": Deriving an endogenous demand for auditing in blockchain-based business processes." International Journal of Accounting Information Systems **38**: N.PAG-N.PAG.

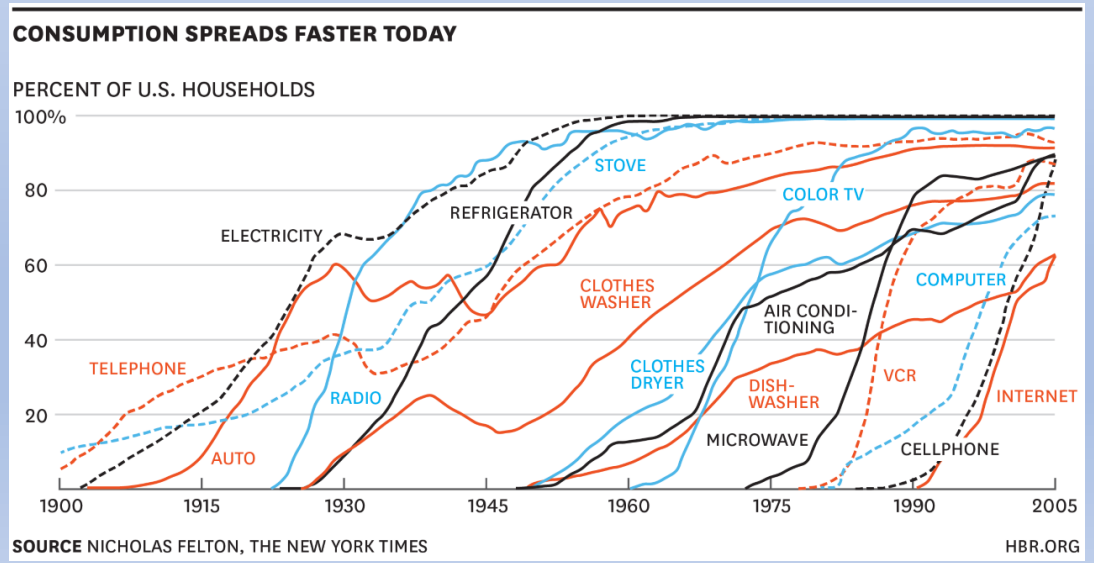
Leveraging Blockchain Capabilities in Accounting & Auditing - Skepticism and Cautious Optimism

- Blockchain became widely known with the emergence of Bitcoin in 2009
- Has since gotten a lot of hype as a technology to disrupt the field of financial services.
- Blockchain was even suggested as a possible solution to UK's border issues after Brexit.
- Praise for blockchain's promise to enhance the speed and security of transactions
- Some question the real-world applicability of blockchain. Is blockchain
  - the internet of our time?
  - a disruptive technology?
  - or just an overhyped phenomenon?

Nordgren, A., et al. (2019). "BLOCKCHAIN IN THE FIELDS OF FINANCE AND ACCOUNTING: A DISRUPTIVE TECHNOLOGY OR AN OVERHYPED PHENOMENON?" ACRN Oxford Journal of Finance & Risk Perspectives **8**: 47-58.

Grounds for Skepticism: Technology Adoption Cycle





https://hbr.org/2013/11/the-pace-of-technology-adoption-is-speeding-up

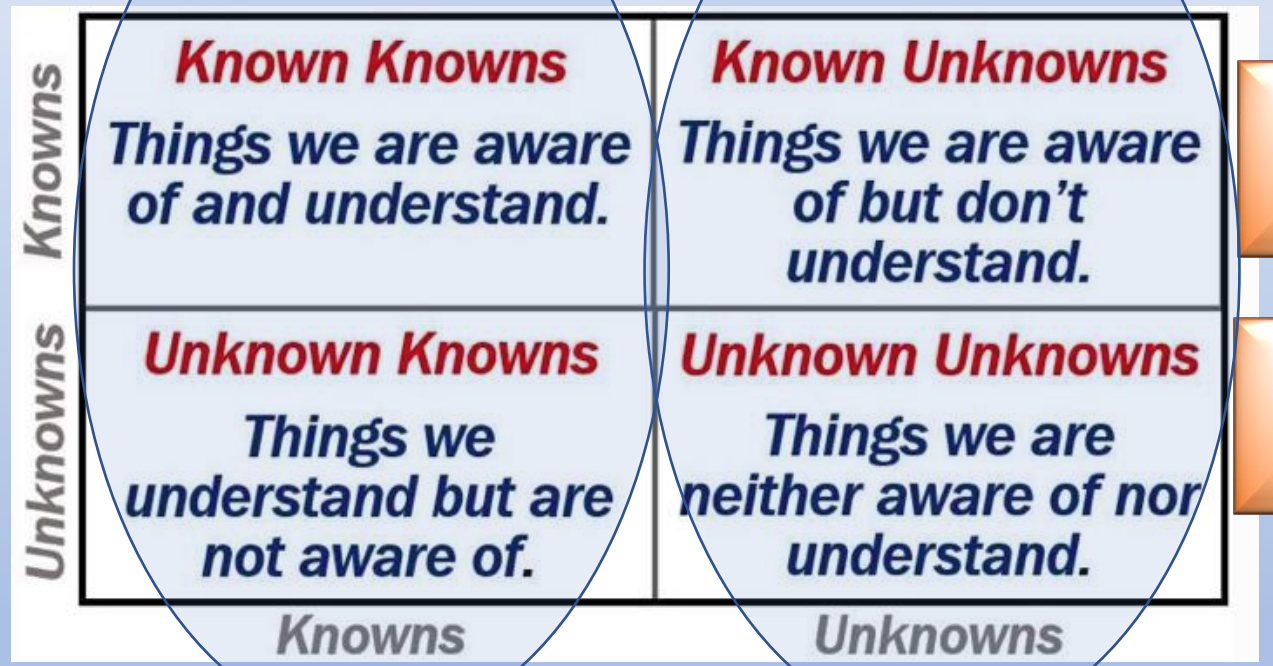
RUMSFELD MATRIX & THE BLOCKCHAIN

Grounds for Skepticism: Can we really predict anything?

AWARENESS

Risk | Uncertainty

KNOWLEDGE AND FACTS



Knowns about blockchain

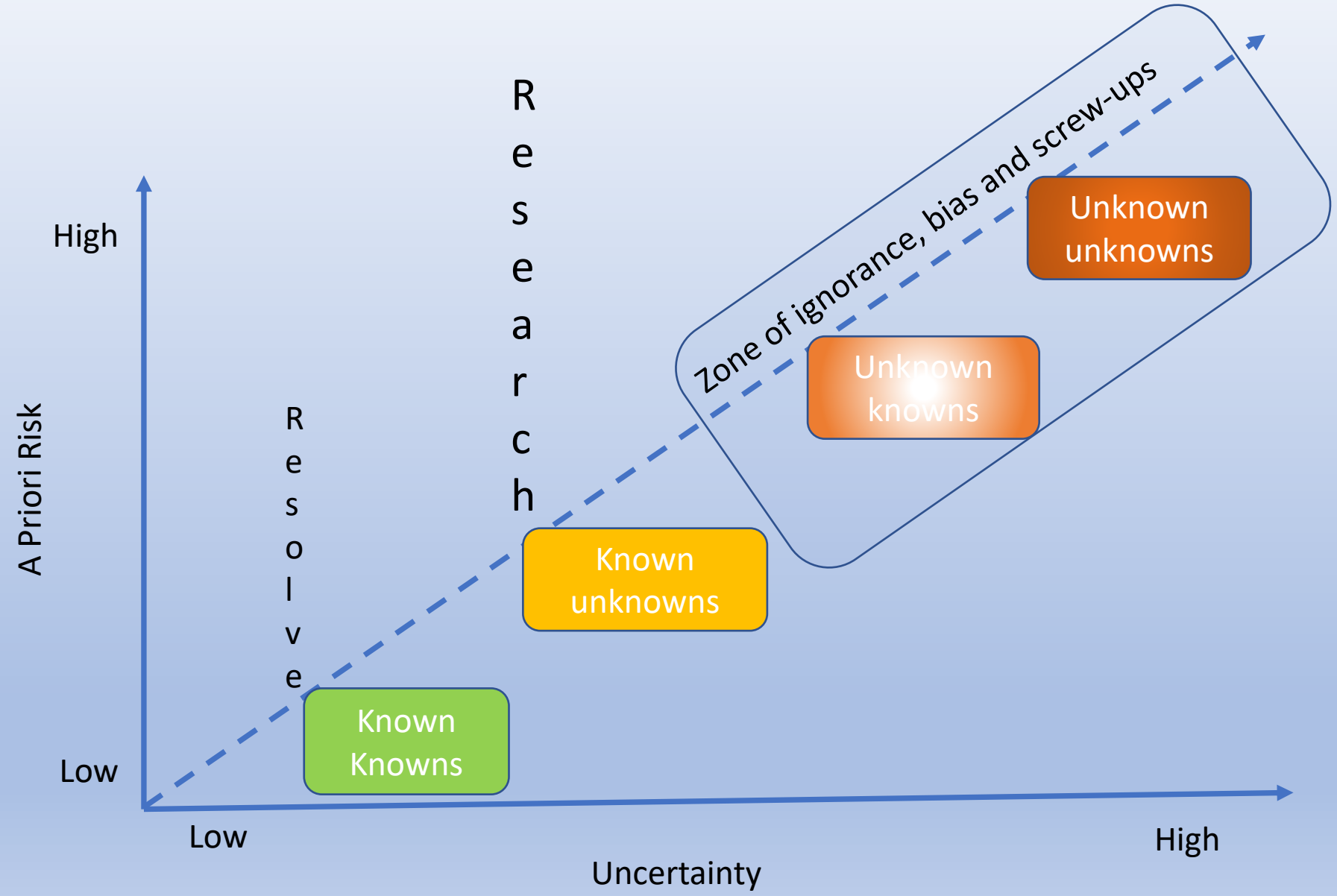
Unknowns about blockchain

Need for further understanding & knowledge development

"…there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns — the ones we don't know we don't know."
– Donald Rumsfeld 2002

Blockchain Technology – Ignorance, Bias & Screw-ups

Grounds for Skepticism: Implications for moving forward



Known Knowns

Blockchain is currently in use

Blockchain is being or will be supplemented with other technologies

Hypothetical Example – Known Knowns (somewhat)
Smart Contracts & New Ways of Transacting Business

Bill leaves a boat and a key on the boat inventory lot with a smart contract controlled lock. That boat has a (pk) =123456

1 Bill, Inc. wants to sell a boat. He identifies himself with his public (pk)= 730484) and uses a smart contract to define the terms of the sale with his private key.

2

2

6

Phyllis can unlock smart contract with (sk) and pick up boat

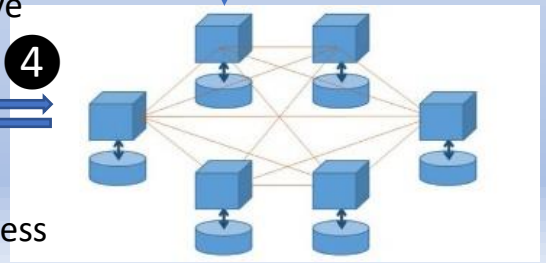
Smart Contract

If $20K is sent to account (pk 730484) then automatically transfer boat ID 4920x8 and smart access to the account that transferred the funds.

Digital Signature

The smart contract is verified by each node on the network if Bill is the owner of the boat and if Phyllis have enough money to pay.

4



5 Network agrees, all conditions are true. Phyllis automatically gets access to the smart garage lock. Money exchanges and a new block is created.

3 Phyllis wants to buy the boat. She finds the boat on the internet. She signs the contract with her private key transferring $20K from her blockchain address (sk) to Bill's blockchain address 730484

Adapted from Campbell, Calderon & Ramamoorti. 2021. *Blue Sky Topics on Blockchain Technology*. ISACA Technology Symposium. ISACA Northeast Ohio. February 19, 2021

Assertions-based Auditing (ISA 315)

Assertions about classes of transactions and events, and related disclosures, for the period under audit:

Occurrence

Completeness

Accuracy

Classification

Presentation

Assertions about account balances, and related disclosures, at the period end:

Existence

Rights and obligations

Completeness

Accuracy valuation allocation

Classification

Presentation

(Effective for audits of financial statements for periods beginning on or after December 15, 2021)

https://www.iaasb.org/publications/isa-315-revised-2019-identifying-and-assessing-risks-material-misstatement

Management Assertions in Auditing

BILLS Inc
Financial Statements

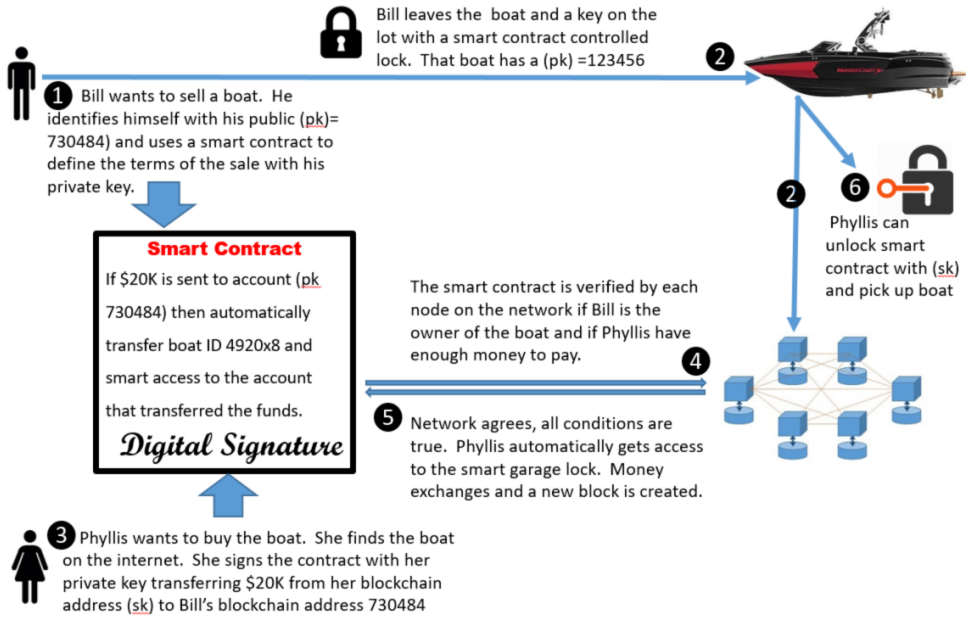
Inventory of boats.	$50,000,000

BILLS Inc uses a blockchain-enabled inventory system with smart contracts

What does this mean for evidence and verification of BILLS INC.'s management assertions?
(e.g. rights & obligations, existence, completeness, valuation etc.)

***Ding An Sich-the thing in itself e.g.) The blockchain is merely a digital representation of the physical asset.**

Management Assertions in Auditing



How do you know the boat is physically there?

Are there any "off-chain" transactions related to the boat inventory?

What is the fair value of the boat?

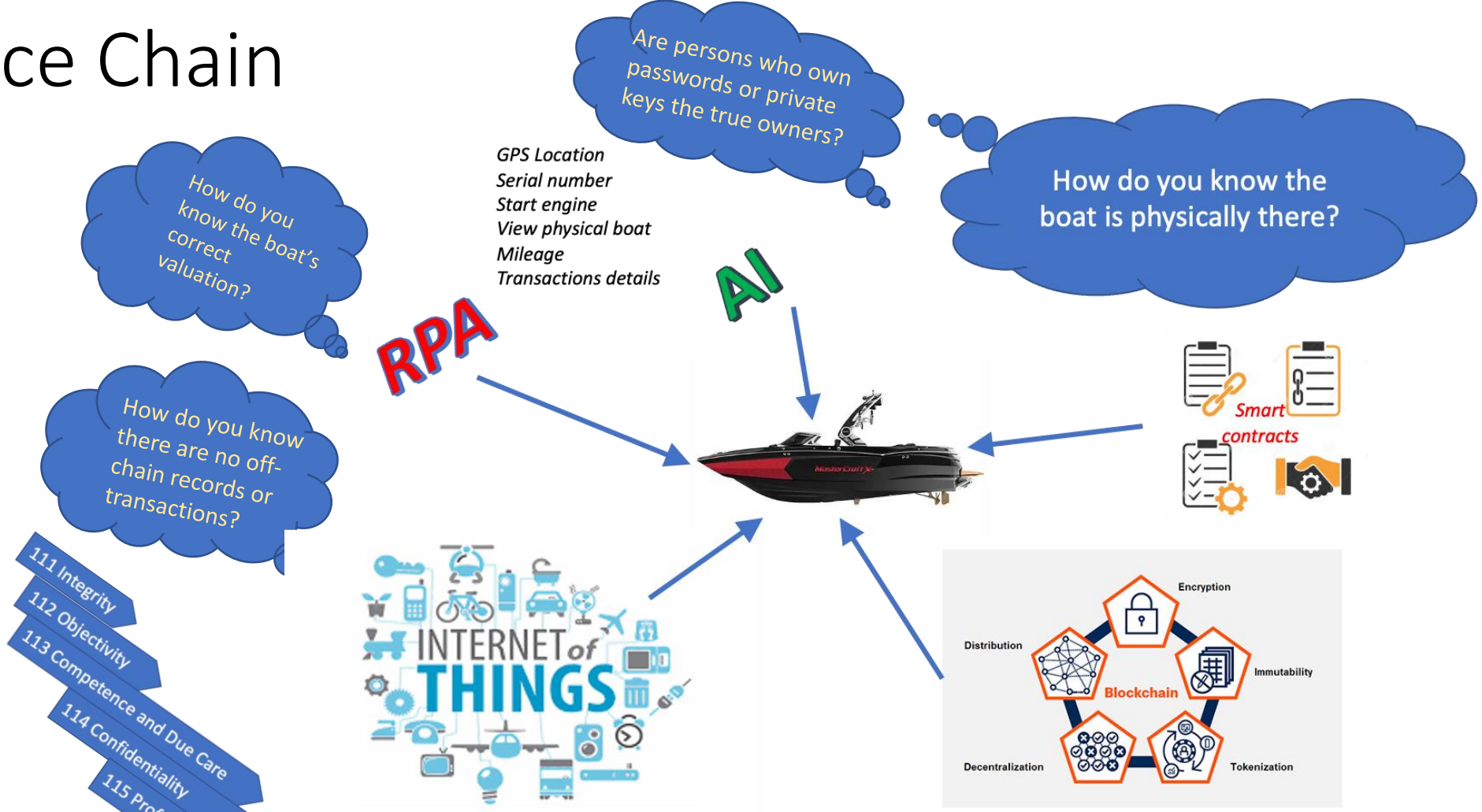
Is there an impairment issue that might trigger a write down in the boat's value?

An Evidence Chain

Professional ethics challenge 1:

Liu et al. (2019) suggest that auditors should "elevate themselves to the role of strategic partners in blockchain implementation." What are the ethical implications if the auditor or the auditor's audit firm:

a. Was consulted and received no fees
b. Was consulted and received a fee
c. Was contracted to design and build any of the systems in the evidence chain?



Oh No!!! There is an off-chain transaction involving ownership

Professional ethics challenge 2: A accountant employed by a listed company accepts an assignment to provide oversight for the elements in an evidence chain although he is fully aware that, at the time of accepting the assignment, he has no background in any of the areas that make up the evidence chain.

Liu, M., et al. (2019). "How Will Blockchain Technology Impact Auditing and Accounting: Permissionless versus Permissioned Blockchain." Current Issues in Auditing **13**(2): A19-A29.

Searching for Answers – Known Unknowns

A Sample of Blockchain Research Opportunities

FINANCIAL MARKETS

How does the market react to blockchain technology adoption in the supply chain?

Market response to security breaches in blockchain-enabled supply chains?

TECHNOLOGY & GOVERNANCE

What mechanisms exist to assure optimal governance structures for the blockchain?

Efficacy issues in integration of blockchain and smart technologies.

ACCOUNTING/AUDITING

Integration of blockchain in the financial reporting systems and the impact on the accounting profession

Preparers' and auditors' perceptions of blockchain-enabled financial systems and the propensity for over- or under-reliance on the technology (the Goldilocks effects)

ETHICS & PROFESSIONAL RESPONSIBILITY

Unintended consequences of blockchain-enabled financial systems on auditor Independence

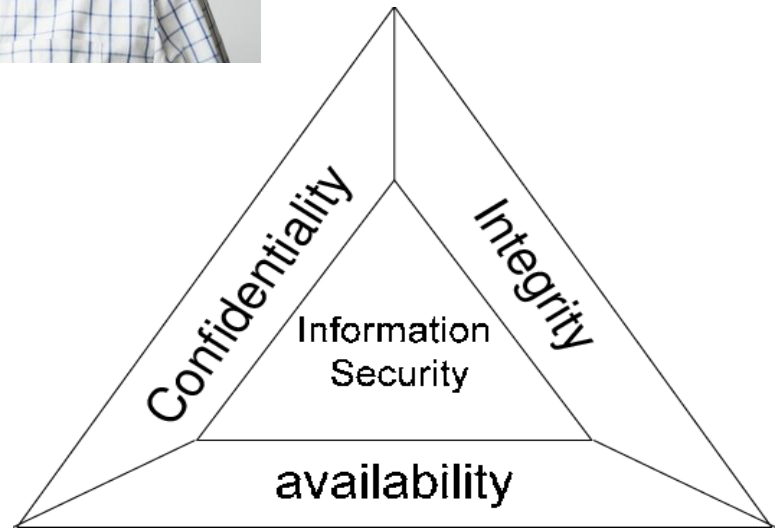
Threats to compliance with fundamental ethical principles for accounting professionals

Blockchain+: Some Security Questions With Ethical Implications

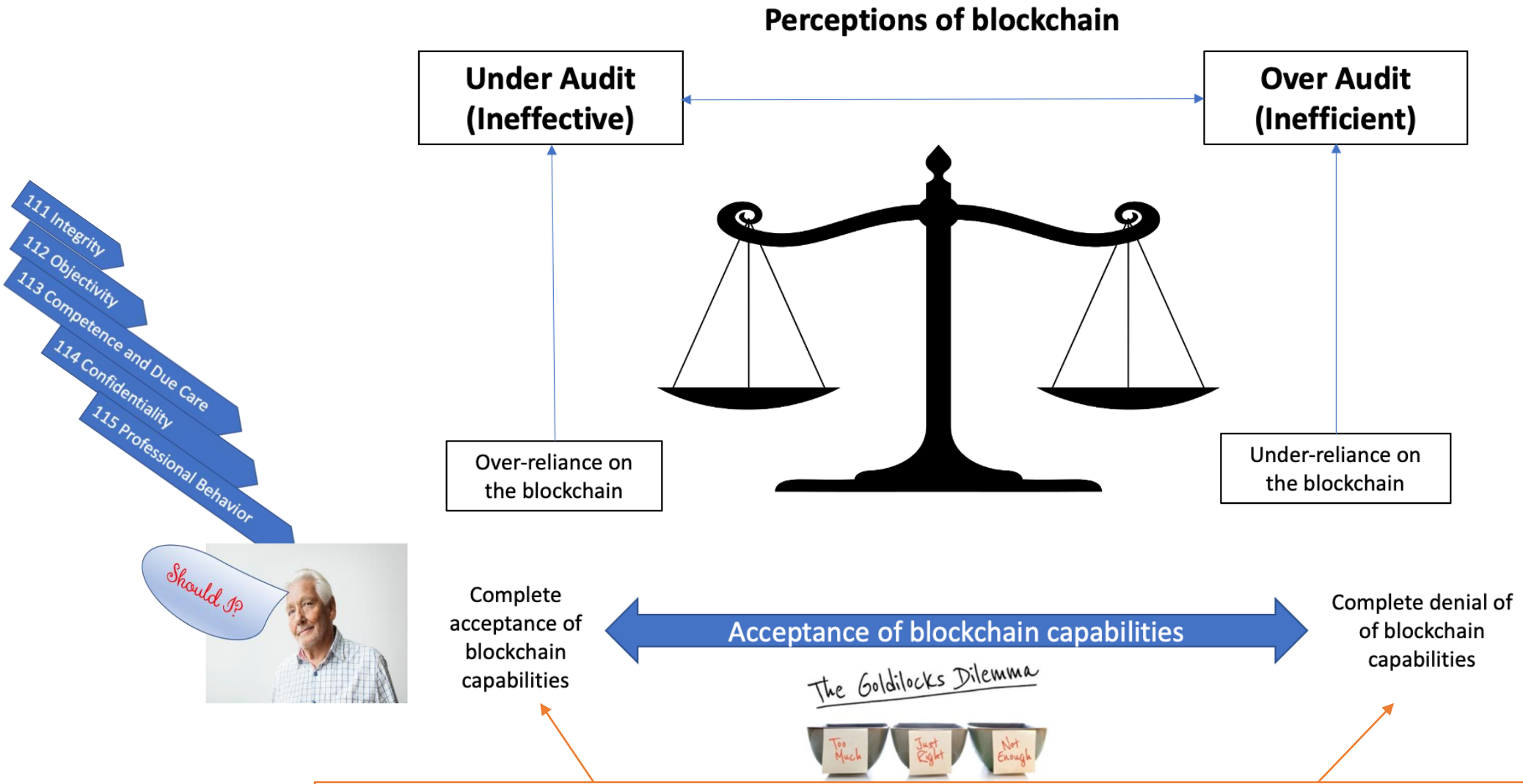
What happens as RPA + AI + Blockchain + Smart Contracts are used to take over the work?

- 111 Integrity
- 112 Objectivity
- 113 Competence and Due Care
- 114 Confidentiality
- 115 Professional Behavior

- Confidentiality →
  - Who sees what? Who gets access to private keys in the possession of the accountant?
- Integrity →
  - Could the accountant over-rely on the Blockchain+ and assess zero risk to the likelihood of errors and omissions?
  - What if the accountant becomes of aware of off-chain transactions after closing and after submitting financial statements to executives and the board, and no other person is aware of those off-chain transactions?
- Availability →
  - What if data is only available to only the accountant? With whom and how should she share it?
  - What if the system is not available because of a ransomware attack and the accountant needs the data to meet a critical deadline? Pay or don't pay?



Mindset and Perceptions: *Audit and Professional Ethics Implications*



Is an auditor at either end of this continuum complying with the IESBA Code?
Is an auditor who fails to seek out the right balance on this continuum complying with the code?

When the account is unethical

- How can the profession aggregate and share instances of practitioner misconduct?
- The AICPA and various state boards of accountancy collect data and publish information about the unethical acts of CPAs. ,
- Sheldon proposes use of blockchain technology to flawlessly collect and share unethical acts of CPAs
- This will allow key stakeholders to aggregate and share instances of practitioner misconduct on a nearly real-time basis.
- A blockchain-enabled misconduct
  - creates an immutable record of misconduct
  - allows key constituents in the accounting profession to work together and share information
  - assures zero risk of a single entity taking control of the data.

Sheldon, M. D. (2018). "Using Blockchain to Aggregate and Share Misconduct Issues across the Accounting Profession." Current Issues in Auditing **12**(2): A27-A35.

Need for further research

Ethics and ethical implications

Implications of ethical challenges that go beyond accounting (e.g.,

- ESG,
- possible links to criminal elements,
- cryptojacking by outsiders,
- cyberjacking by insiders,
- disruption effects
- illegal content in the distributed ledger and computer owners' defense

Recognizing ethically favorable consequences of blockchain-enabled systems (e.g., transparency, potential traceability of ownership)

Recognizing ethically ambivalent transaction (trustless trust, costly blockchain-enabled commitments because blockchain is considered "better", over-reliance on technology at the expense of personal contacts, recruitment platforms, etc.).

Privacy and transparency as competing issues with moral and ethical implications

Questions?

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