PMI San Diego Chapter
2023 Annual Conference

Track 1: AI/Technology

Session 2:

Bryan Berthot

At The Intersection of Blockchain, Internet of Things, and Theory…

At The Intersection of Blockchain, Internet of Things (IoT), and Theory…

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Germination of Idea

- Worked at AT&T
- As PM, ordered Cisco routers for equipment upgrades, which were shipped from China
- Routers at at Port of Long Beach; during COVID no containers were being moved
- Solution: Easier to reroute them to Port of South Louisiana and truck them to Los Angeles
- Identified a need to have a more agile, heterogenous SC

Presentation Overview

1. • Exposition (Definitions)
2. • Supply Chain Theories
3. • Future Directions

EXPOSITION

Agile Supply Chain Management (ASCM)

- Organizations have strived to improve their supply chains to get products and services to their customers more quickly, cheaply, and reliably; this is the notion of the ***agile supply chain***.
- A blockchain/IoT architecture is exemplary of a specific type of agile supply chain.

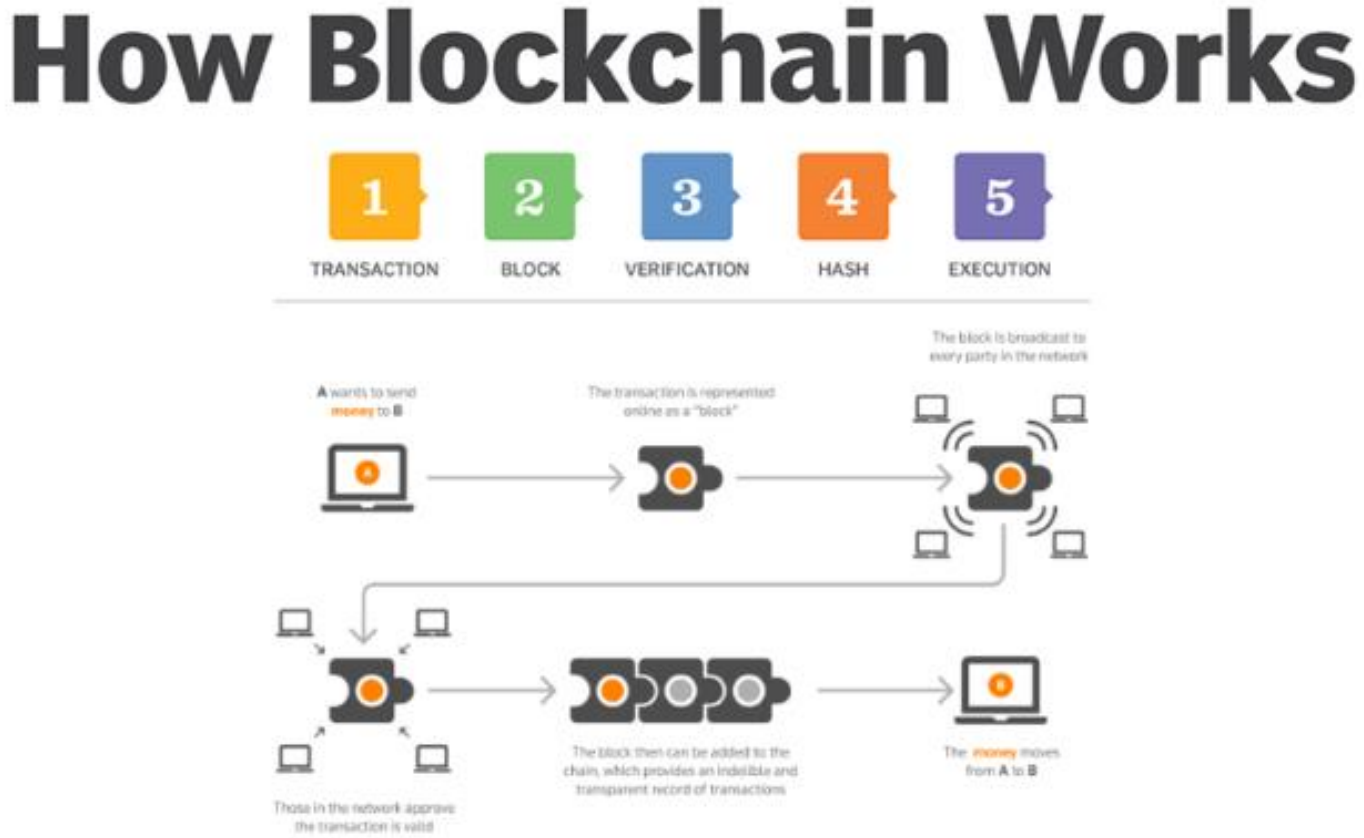
Challenges for SC Managers

- Assessing the agility of their firm's supply chain (SC)
- Making improvements to SC agility
  - This is what the intersection of theory, blockchain, and IoT is all about!

BLOCKCHAIN (BC)

- What is ***blockchain***?
  - A decentralized, distributed, encrypted digital ledger comprised of records called **blocks**
  - Records transactions across many computers so that an audit trail exists and the transaction is unalterable

BLOCKCHAIN (BC)



Source: Figure from Fox (n.d).

INTERNET OF THINGS (IOT)

- What is the ***Internet of Things (IoT)***?
  - Devices (e.g., computers, phones, tablets, software apps, etc.) that communicate with each other over the Internet
  - Applications
    - *Energy sector*: Using a phone app to check your solar system's charge level or to lower your home's temperature
    - *Transportation sector*: Signing for package delivery on a tablet device
    - *Healthcare sector*: Diabetes management (i.e., continuous glucose monitors)

BC & Internet of Things (BCIoT)

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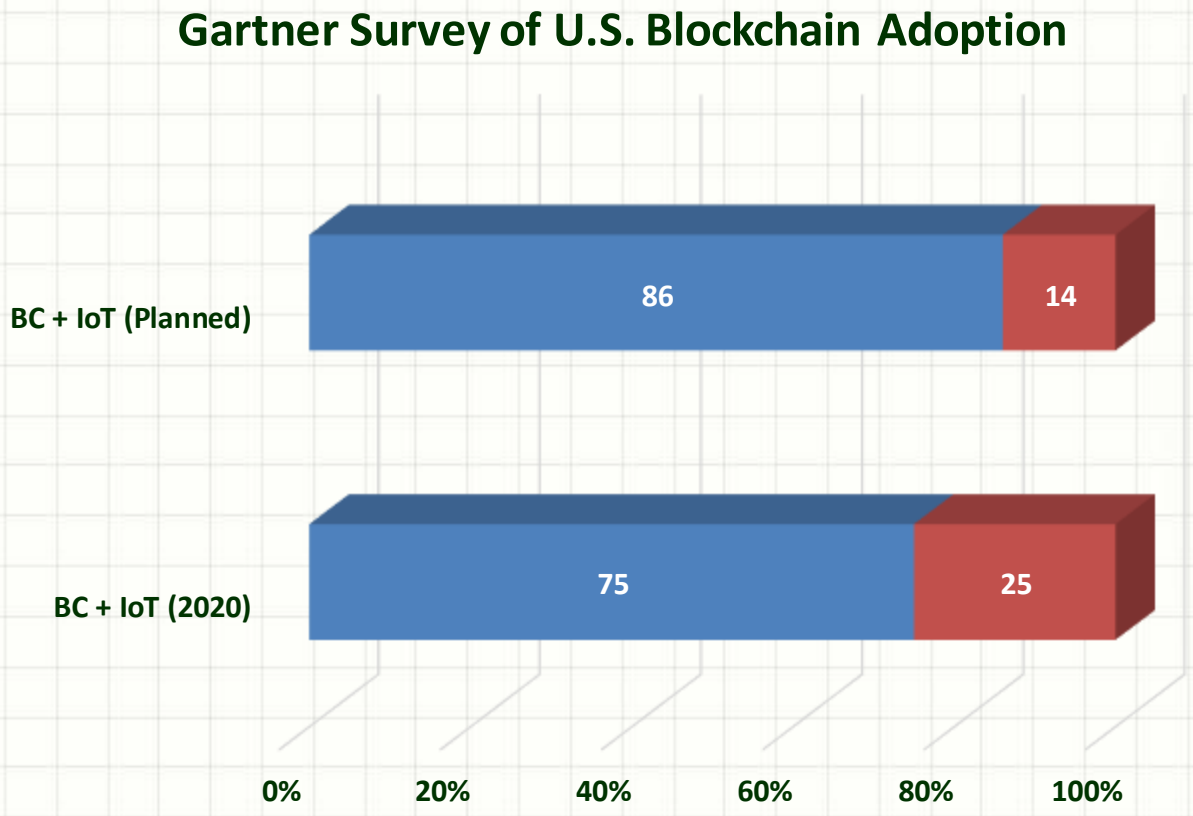
BC & Cloud of Things (BCCoT)

- ***BCCoT*** is blockchain technology integrated with IoT (i.e., devices) and the Cloud of Things (COT) (Uddin et al., 2021).
  - For example, electronic medical records (EMRs) are stored on cloud servers and accessed via handheld devices.
  - Faster, cheaper, and improves end user (i.e., staff and patient) quality of experience.
  - *Risk*: Cloud computing often has bandwidth problems (i.e., slows the more user devices are connected to it).

BC & FOG OF THINGS (BCFOT)

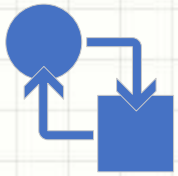
- ***BCFoT*** is blockchain technology integrated with IoT (i.e., devices) and the Fog of Things (FoT) (Uddin et al., 2021).
  - Both cloud computing and *fog computing* provide storage, applications, and data to end users.
  - Reduces energy consumption from top to bottom.
  - However, fog computing is more heterogeneously distributed and closer to end users.
  - *Risk*: Not all BC technology is available on FoT.
  - *Example*: SPAWAR is experimenting with FoT "mesh nodes" on its smart drone swarms to take over if the Internet goes down.

WHY BLOCKCHAIN AND IOT?



Source: Gartner (2019).

Benefits of Using a Blockchain/IoT Model



Speeds Transactions: Reduces settlement time from days to instantaneous

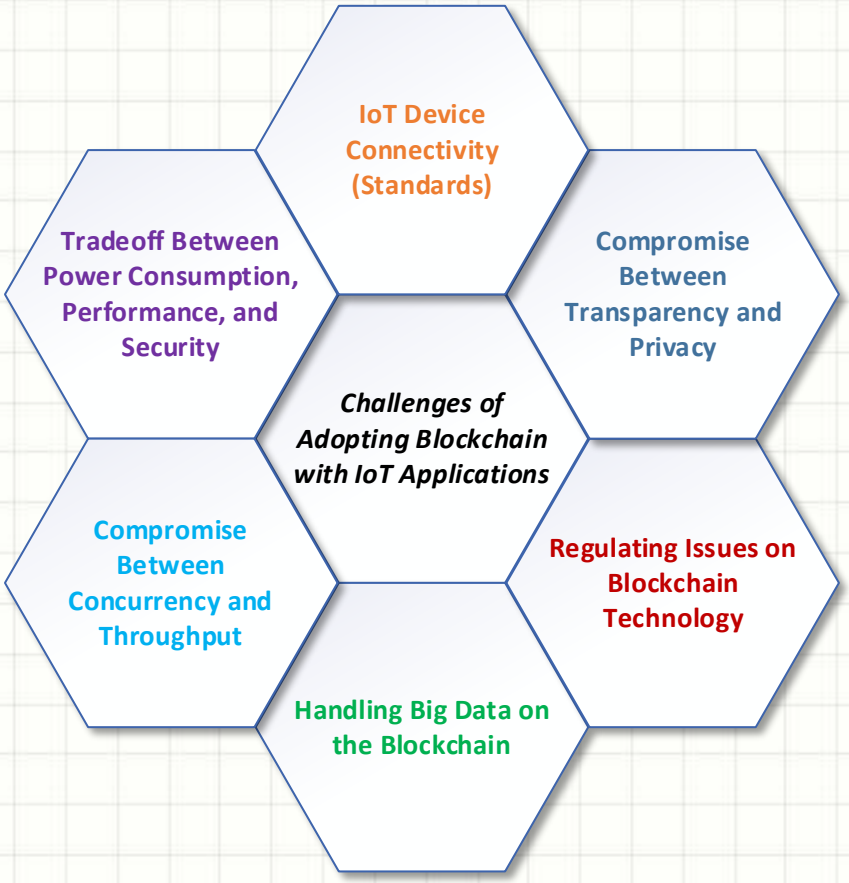
Lowers Costs: Eliminates middlemen and internal staff time

Improves Safety: Reduces risk of collusion, tampering, and theft

Builds Trust: Builds trust between partners

Source: Adapted from IBM (n.d.).

BLOCKCHAIN/IOT MODEL: CHALLENGES

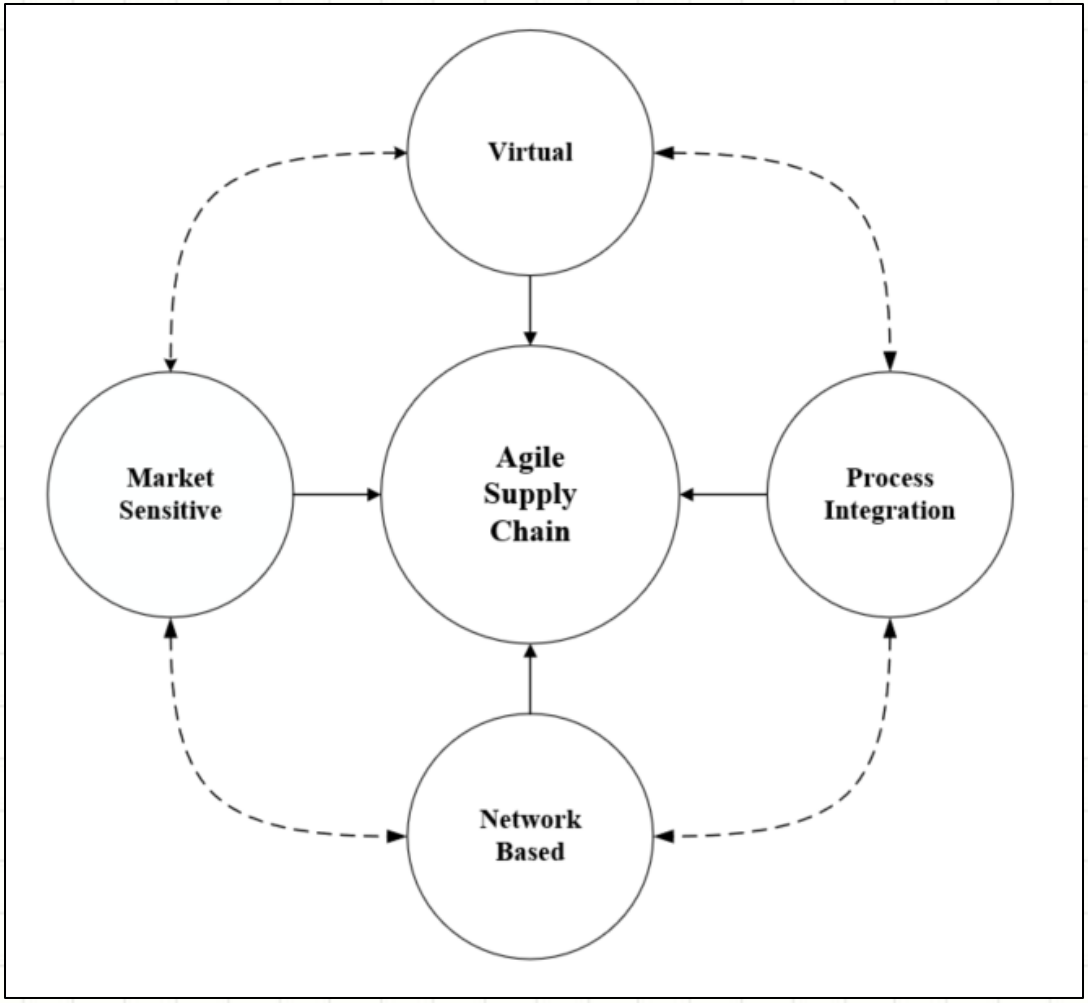


THEORIES

Agile SC Theory

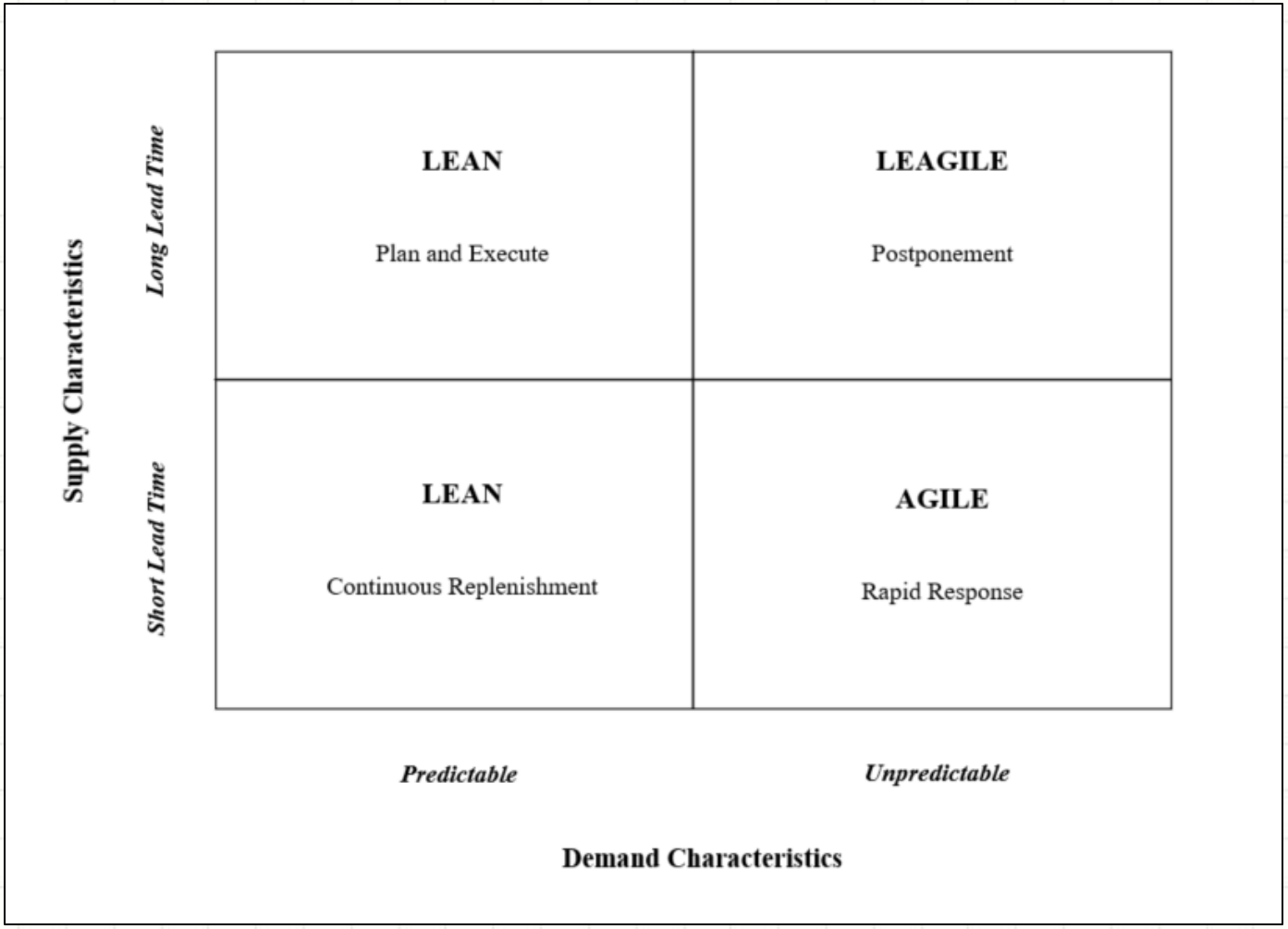
- There is no dominant theory that guides the field. However, there are several theories that spur research and pragmatic decisions.

The Multidimensional Supply Chain



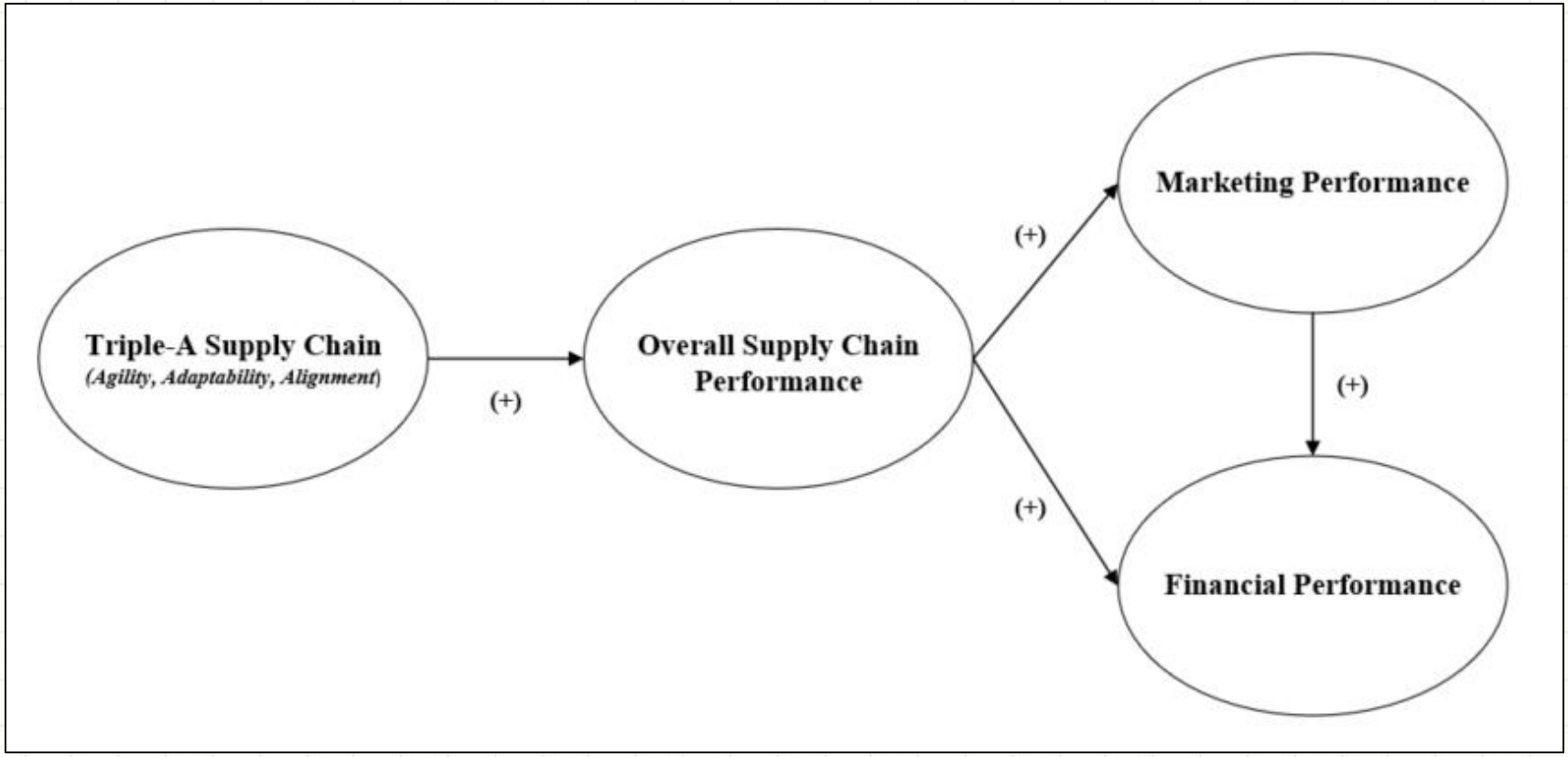
Source: Adapted from Christopher (2000).

Supply Chain as a Function of Supply & Demand



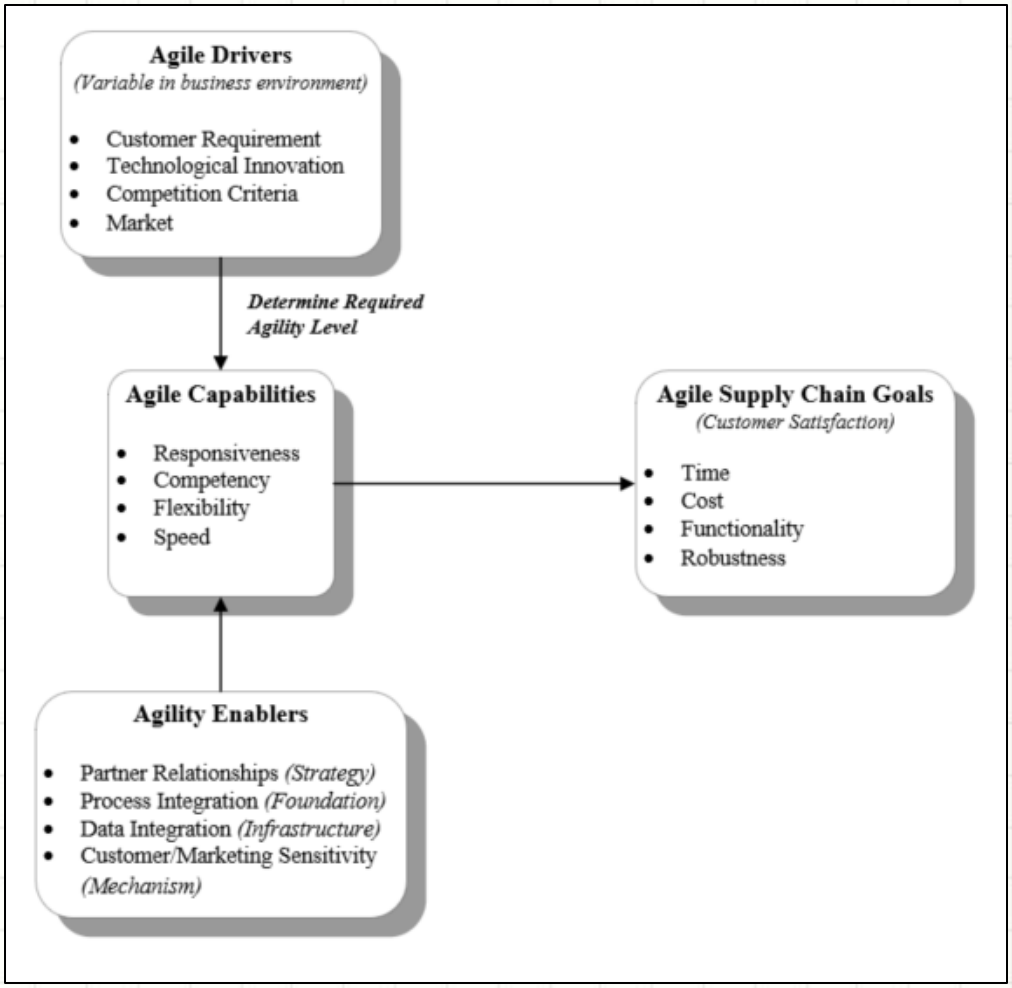
Source: Adapted from Christopher et al. (2006).

The Triple-A Supply Chain



Source: Adapted from Whitten et al. (2012).

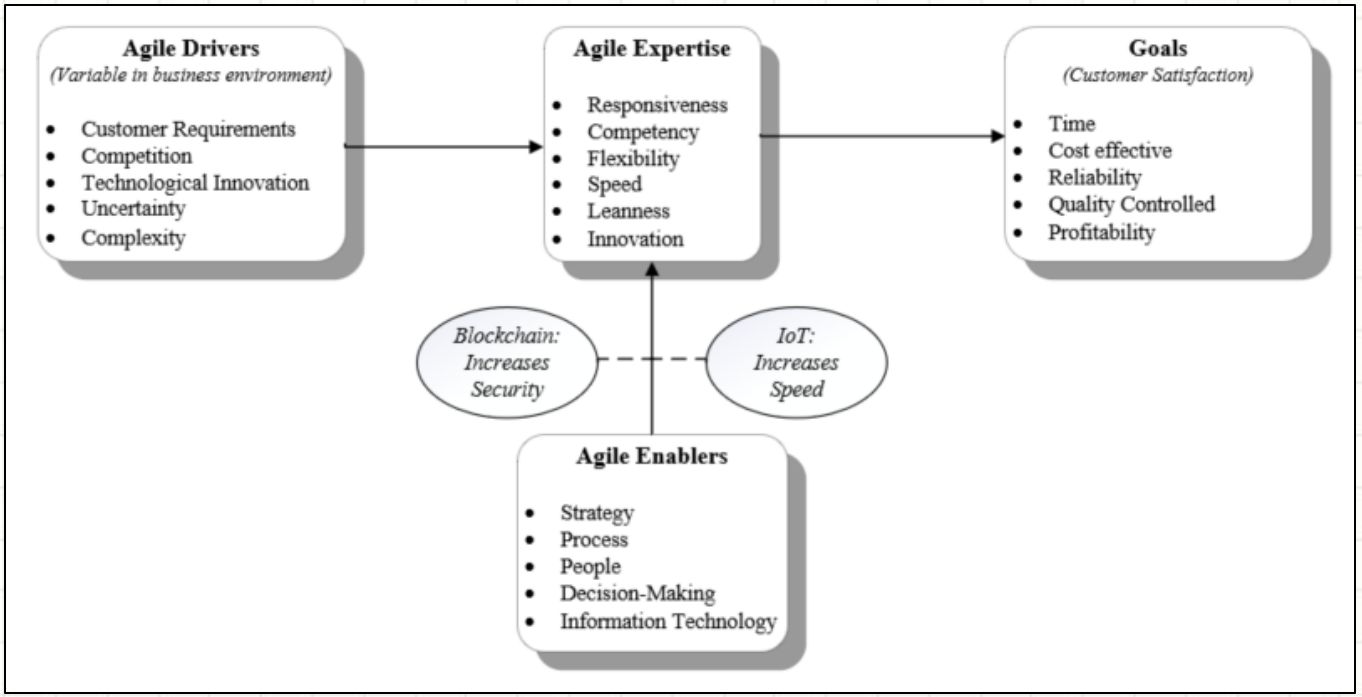
Drivers-Capabilities-Enablers Model



Source: Adapted from Lin et al. (2006).

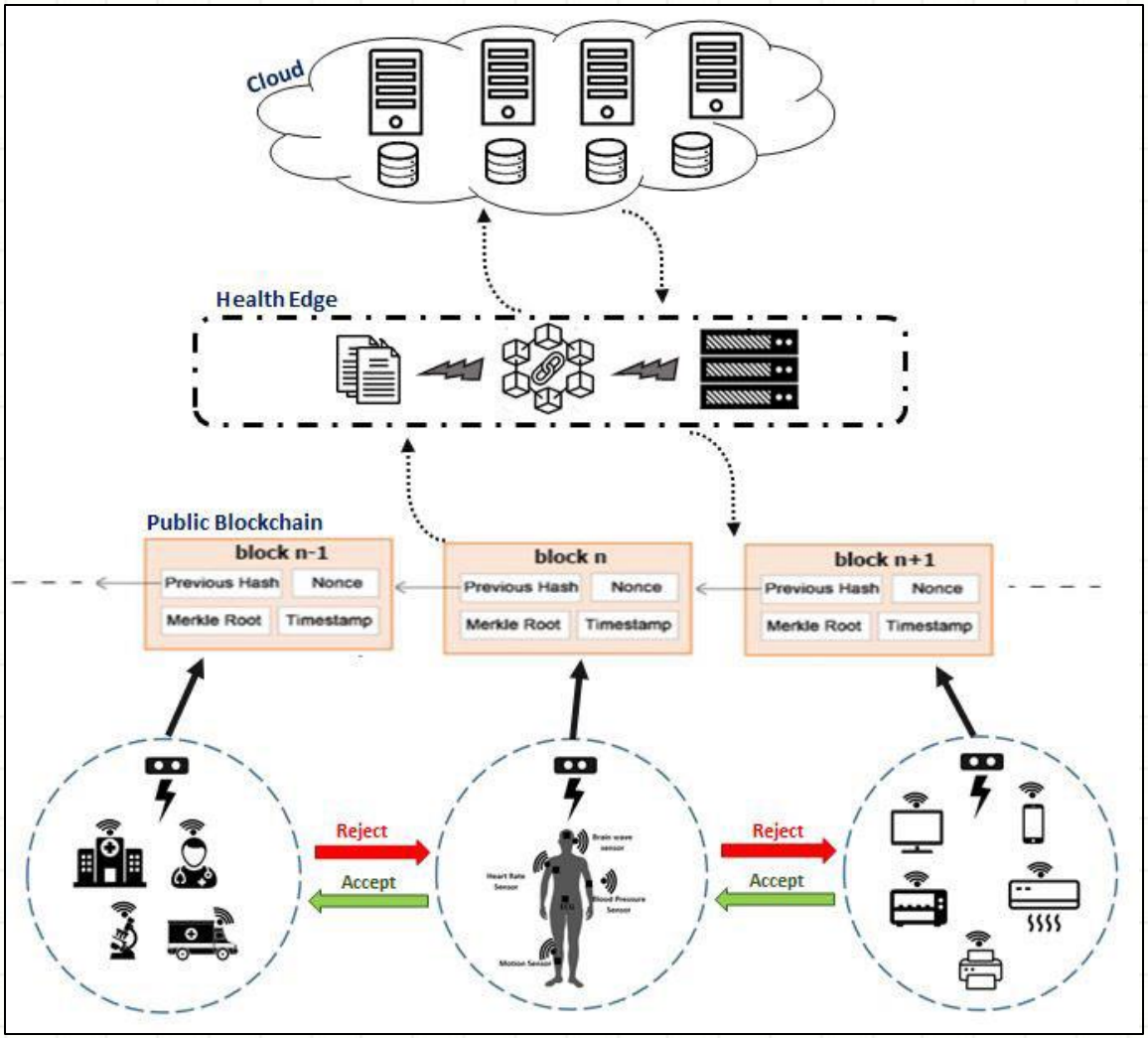
EDGE Model

- Permutation of Drivers-Capabilities-Enablers Model
- Blockchain & IoT are incorporated (i.e., agile enablers) into EDGE Model (Zhu et al., 2022)



Source: Adapted from Zhu et al. (2022).

BCCoT Architecture (*Healthcare App*)



Source: Abu-Nassar et al. (2020).

Recommendation: Future Direction

- Published literature integrating theory, blockchain, and IoT capable SC systems is non-existent (Zhu et al., 2022) *(A few books recently published!)*
- Need empirical data to support EDGE model
- Show that firms with blockchain and IoT enabled supply chains are associated with increased SC agility
  - RQ1: Blockchain-enabled SC correlated with SC agility
  - RQ2: IoT-enabled SC correlated with SD agility
- Problem of practice, one of reconciling pragmatic efforts with the trailing academic literature

Summary

- Challenges for Supply Chain Managers
  - Assessing the Agility of Their Firm's Supply Chain
  - Making Improvements to SC Agility
- Several Good But No Unifying Theory
  - SC As A Function of Supply & Demand (Christopher et al., 2006)
  - Triple-A (Whitten et al., 2012)
  - Drivers-Capabilities-Enablers Model (Lin et al., 2006)
- Future Directions
  - Blockchain & IoT are incorporated (i.e., agile enablers) into EDGE model (Zhu et al., 2022)

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Questions?

…Future Research for Bryan

Project Management Institute San Diego

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