

Supply Chain Security with Blockchain

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Research Issues 1

Task 6

**Selected article: “ Zero-Trust Blockchain Framework for
Pharmaceutical Supply Chain Integrity “
(Authors: Gupta & Patel, 2024)**

INTRODUCTION

Hello! Did you know that 1 in 10 medications in the world is counterfeit? For this 6th task, I will reveal how blockchain and Zero-Trust are saving lives in pharmaceutical supply chains. The article by Gupta & Patel (2024), tested with Pfizer, shows how to detect altered vaccines in 8 minutes instead of 45 days!



Title and variables

The title is technical but precise:

- ❖ **Independent variable:** Types of threats (counterfeiting, alteration, diversion)
- ❖ **Dependent variable:** Detection time of anomalies (in critical minutes)
- ❖ **Moderator variable:** The number of blockchain nodes in the network Why is it vital? Because a contaminated batch of vaccines can kill before it is even detected!

Fundamental problem

The filled gap is alarming: traditional systems only detect fraud after an average of 45 days.
Crucial question:
How to ensure the integrity of medicines in real time from production to the patient, in a complex ecosystem with over 100 intermediaries?

Revolutionary solution

Innovation? A brilliant marriage between:

- 1) **Private blockchain:** Each scanned box creates an unforgeable NFT token
- 2) **Zero-Trust modules:** Automatically verify temperature, geolocation, and authenticity Shocking result: Anomaly detection in 8.2 minutes with irrefutable cryptographic evidence!"

Revolutionary model

- 1) IoT sensors seal the packages (+2°C? Alert!)
 - 2) Smart contracts validate each transfer
 - 3) The Zero-Trust system blocks unverified actors
- Key equation: **Trust_score = Number of verified proofs ÷ Number of transactions**

Field method

Their test is conclusive:

- 1.2 million boxes of COVID vaccines traced
- 15 suppliers + 120 pharmacies
- Injection of 4 realistic attacks:
 - Counterfeiting in Indonesia
 - Vaccines reheated in Sudan Result: 100% detection with complete traceability!

Relentless comparison

Facing existing solutions:

Technology	Detection	Cost
RFID systems	78%	1M€
Simple blockchain	88%	500K€
Zero-Trust BC	100%	200K€

CONCLUSION

This technology will save millions of lives. Next frontier? Extending it to food supply chains to eradicate scandals like spoiled meat. Zero-Trust blockchain will become the nervous system of vital supply chains!

The next time you take medication, remember: behind that little pill, a blockchain is keeping watch. Health safety has just entered the era of cryptographic trust!

Key References

Main Article

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Concrete Cases

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Thank You

