# Project Title: Organic food tracking by using Blockchain in Lao PDR

Faculty of Engineering, National University of Laos (Laos)

Dr. Phonepadith PHOUMMAVONG

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## Background :

Organic food production is one of the largest industries. Moreover, the Organic food supply chain also becomes more global over time . ICT for food have mitigated some of these challenges there is still a lot of problem. Integration costs remain high, there is still a lot of undetected fraud, pesticide, and transparency levels are insufficient to comply with the current and future demands of consumers and other vendors. A new area of technology, the Blockchain, can potentially solve many of the remaining problems for food transparency and control. This research focus on Organic food tracking by using Blockchain.

## Targets:

1. Identify the current state of organic food traceability and control, and technologies and projects that can be valuable in designing Blockchain solutions.
2. Identify Blockchain technologies and projects that can be applied within food traceability and control.
3. Develop the platform for organic food tracking by using Blockchain and Dataset.
4. Protecting consumer health by using proposed platform and testing performance of private blockchain.

5. Write a report and communicate the results to public authorities, the retail and food industry in order to stimulate interest and knowledge of the potential with the Blockchain technology.

**6. Journal : 1**

Speaker: Dr. Phonepadith PHOUMMAVONG

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## Project Members :

**1.Faculty of Engineering  National University of Laos  (Laos)**: Dr. Vimontha KHIEOVONGPHACHANH, Dr. Phonepadith PHOUMMAVONG, Dr. Somsanouk PATHOUMVANH, Mr. Tha BOUNTHANH, Mr. Senglathsamy CHANTHAMENAVONG, Dr. Khampheth Bounnady, Dr. Khamphao SISAAT

2. **King Mongkut's Institute of Technology Ladkrabang  (Thailand**): Dr. Boonprasert Surakratanasakul

3. **Chulalongkorn University (Thailand):** Dr. Gridsuda Phanomcho, Dr. Ratchatin Chancharoen, Dr. Lunchakorn Wuttisitikulkij, Dr. Charnchai Pluempitiwiriyawej

4. **School of computing and informatics, Universiti Teknologi Brunei, Brunei Daussalam (Brunei):** Dr. Ravi Kumar Patchmuthu

## Project Duration :

05/2023 – 05/2025 (2 Years)

## Project Budget:

**$71,975.00**

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## Project Members :

**Dr. Vimontha KHIEOVONGPHACHANH**
**(Project Leader)**

**Assoc. Prof. Tha Bounthanh**
**(Researcher)**

**Dr. Somsanouk Pathoumvanh**
**(Project Coordinator)**

**Dr. Phonepadith Phoummavong**
**(Researcher, Technical)**

**Dr. Khamphao Sisaat**
**(Financial and Management)**

**Senglathsamy Chanthamenavong**
**(Researcher, Technical)**

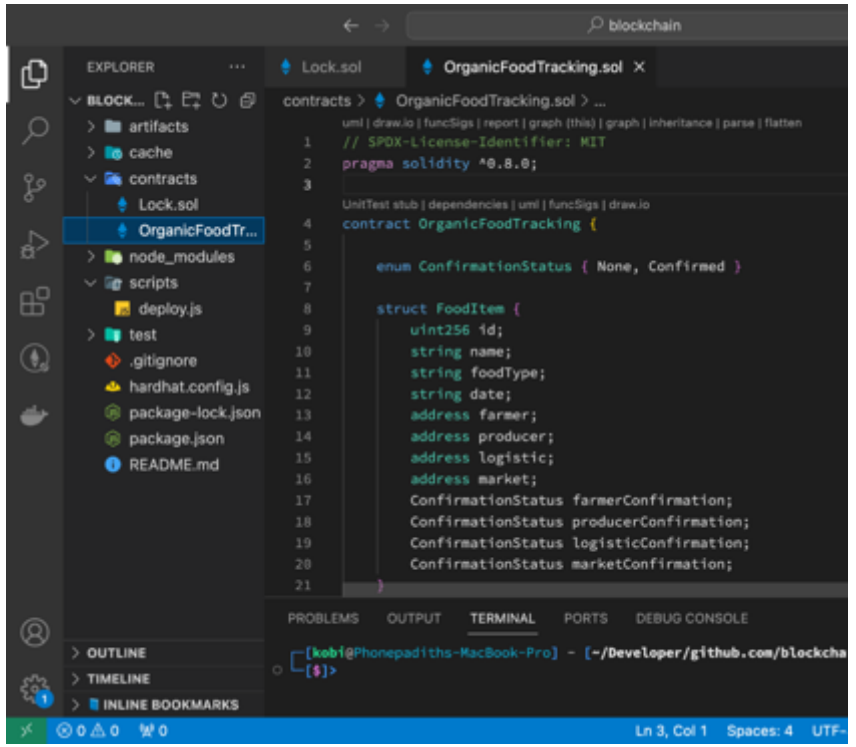
**Dr. Khamphet Bounnady**
**(Researcher, Technical 's Implementation)**

**Assoc. Dr. Khanthanou Laungxaysana**
**(Project Coordinator)**

# Project Activities:  Project Kick-off Meeting with Partner 29/5/2023

Online Meeting with CU, KMITL and UTB

# Project Activities:  Project Kick-off Meeting with Partner 3/6/2023

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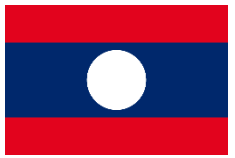


# Project Activities:  ASEAN IVO Forum 15/11/2023

# Project Activities: Host Academic Event and Field Visiting 28-30/July/2024

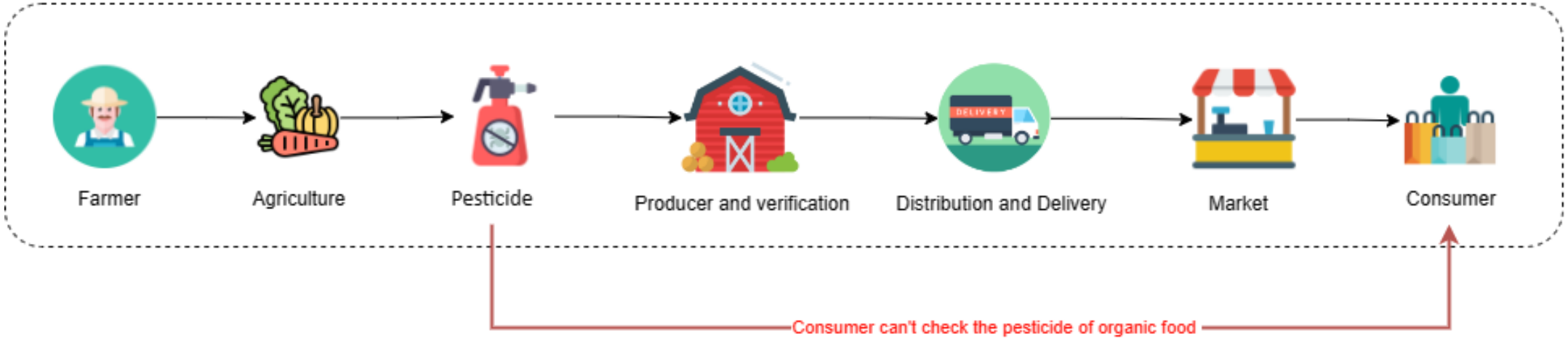
# Project Activities: Scientific and technological

**Globalization of the articulate sector has dramatically increased the cross-border movement of organic goods, and hence increased the complexity of global supply chains.** Today, it is often difficult for organic companies in Laos to trace each and every step in the journey of a specific product back to its origin of production (see Figure below).

•

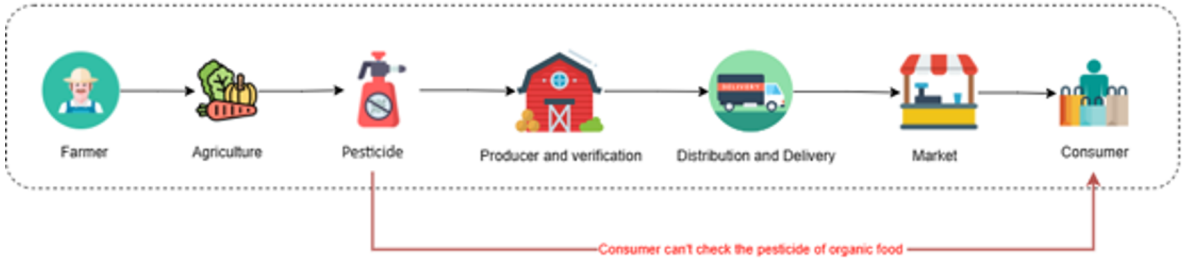
**The organic food supply chain needs to be digitized in order to support full traceability.** Today, weak technical systems aggravate rapid response times and efficient flows of information. Luckily, digitalization and technology innovations such as Blockchain are opening for efficient and low-cost solutions, overcoming these challenges.

# Project Activities: Scientific and technological



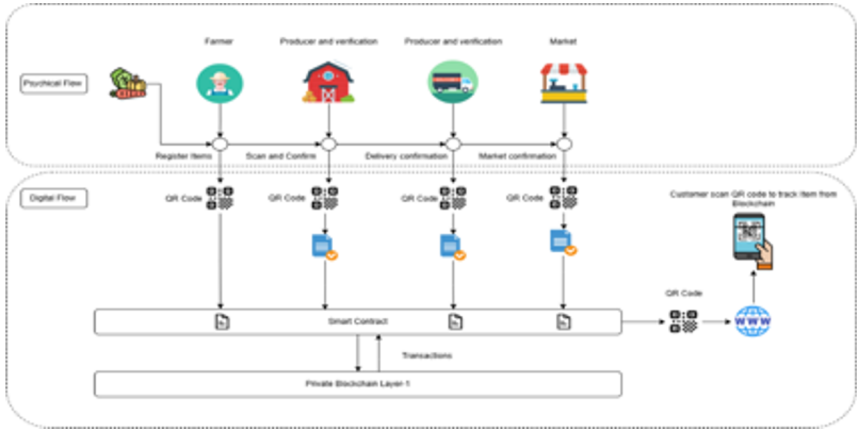
# Project Activities: Scientific and technological

## *Current Problem*

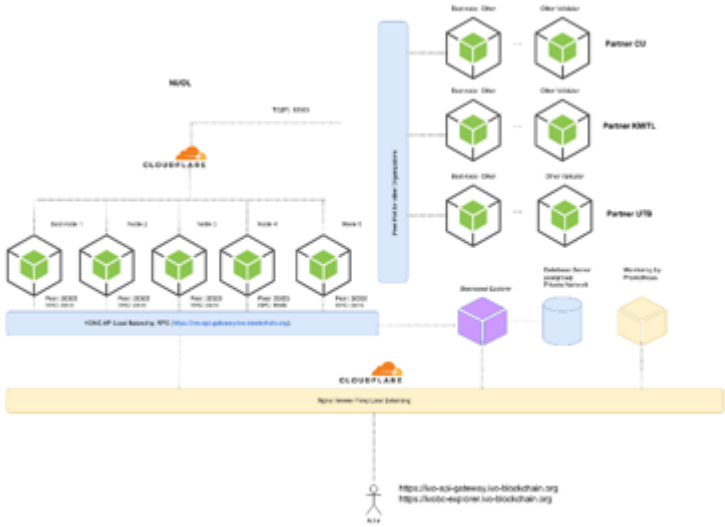



**To be**

## Logical



## Physical



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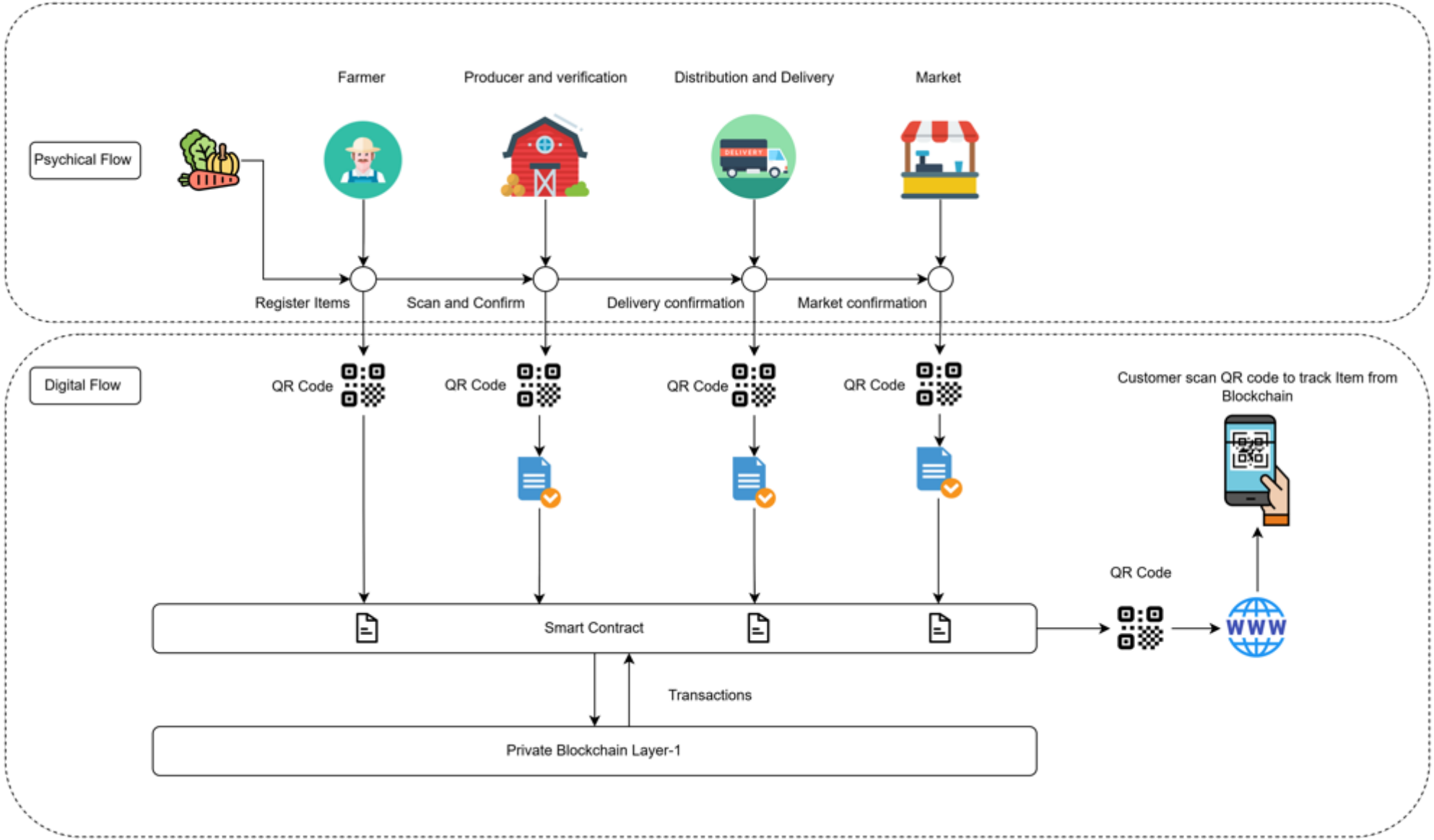

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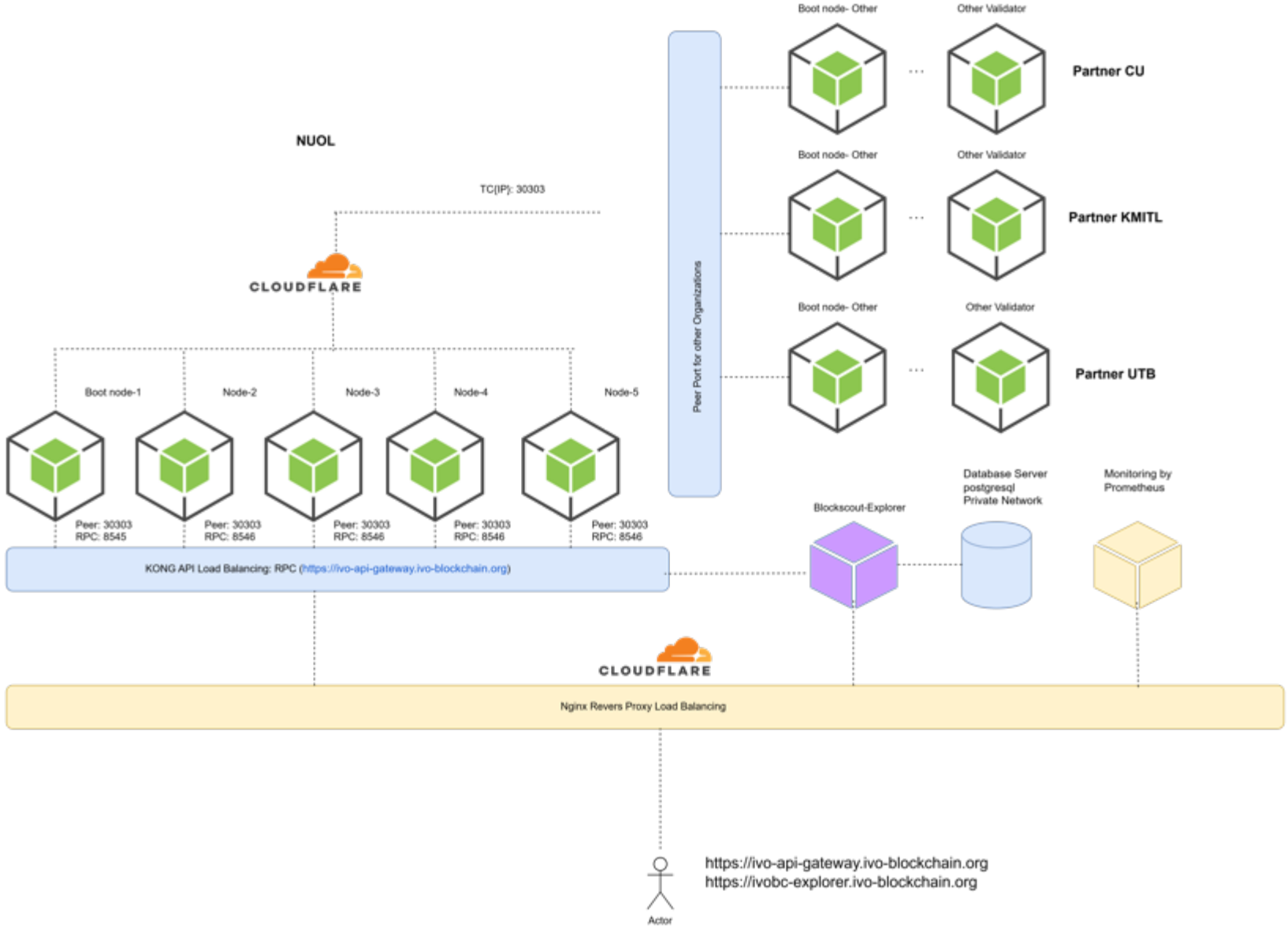
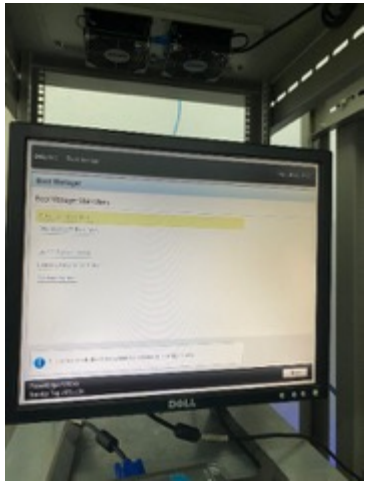
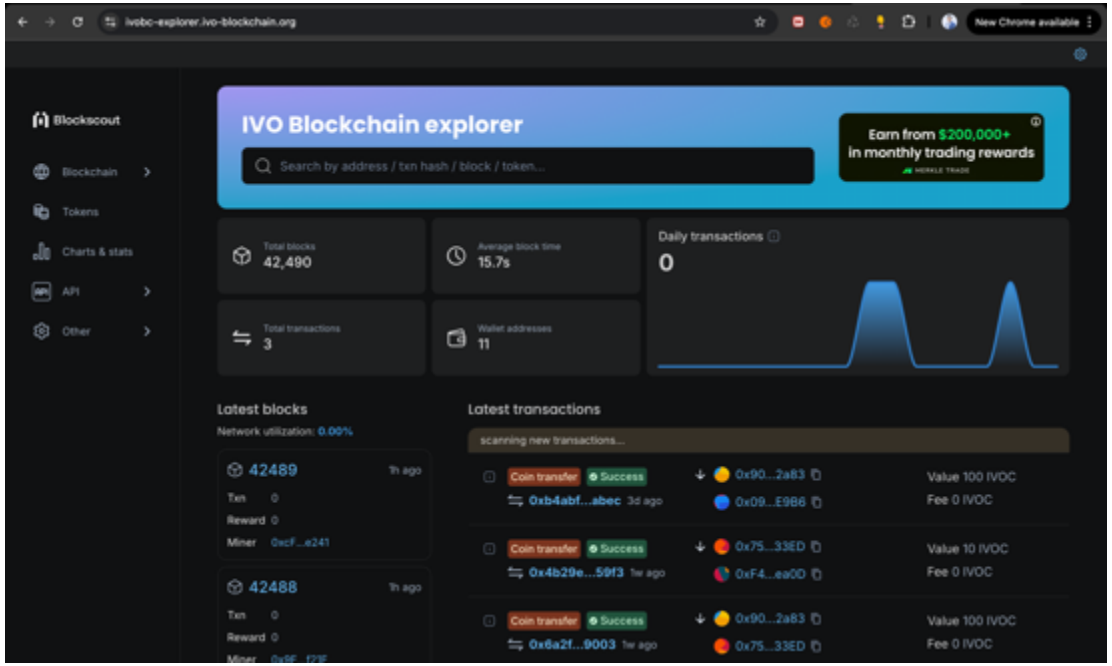


# Project Activities: Servers Setup and Blockchain Configuration



# Project Activities: Servers Setup and Blockchain Configuration

IVO Blockchain Explorer

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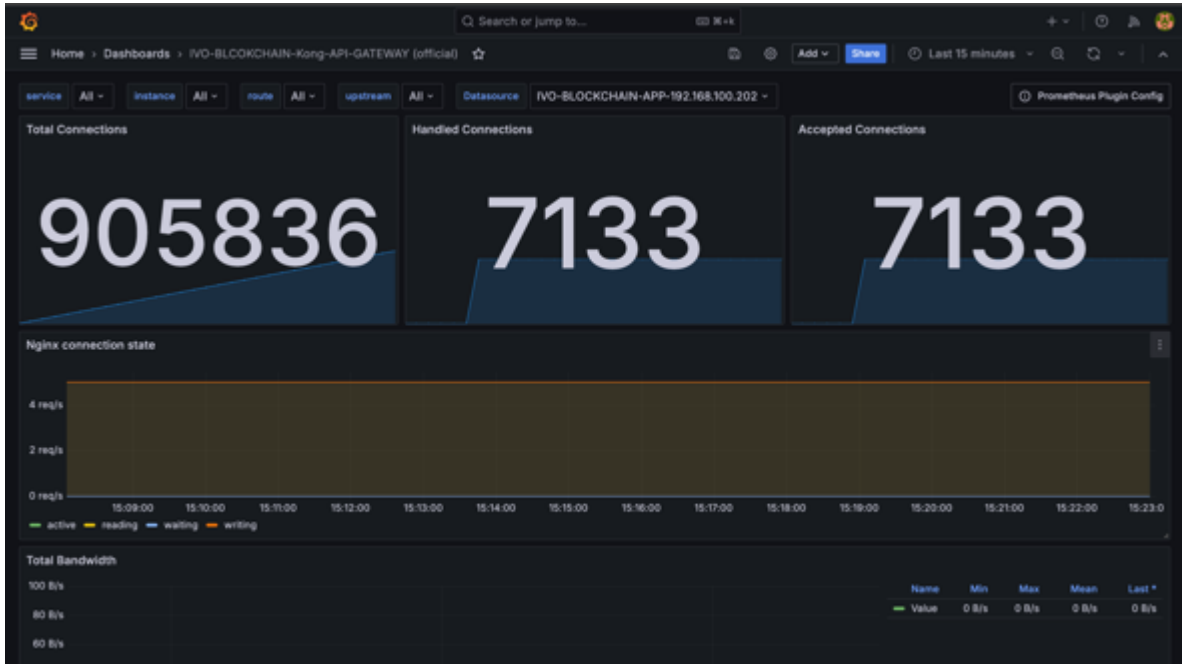
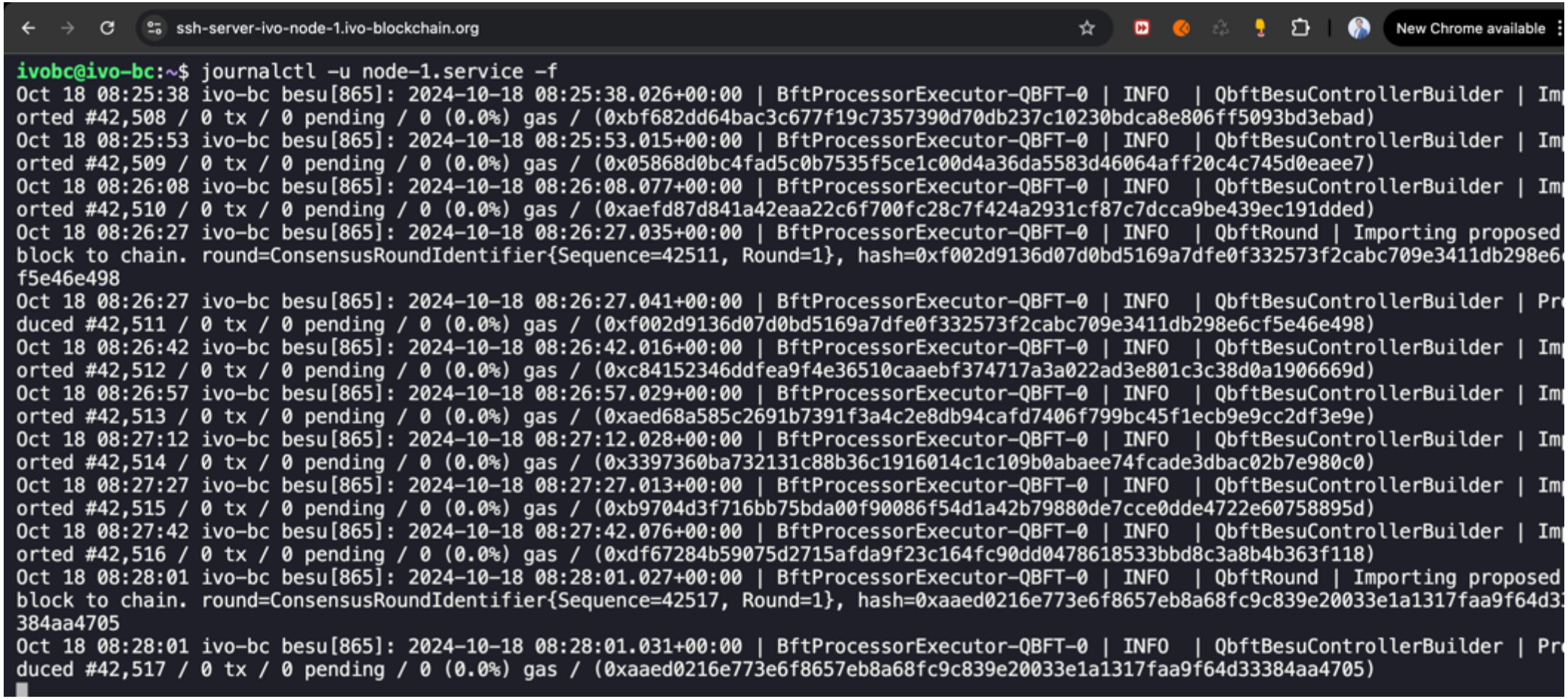
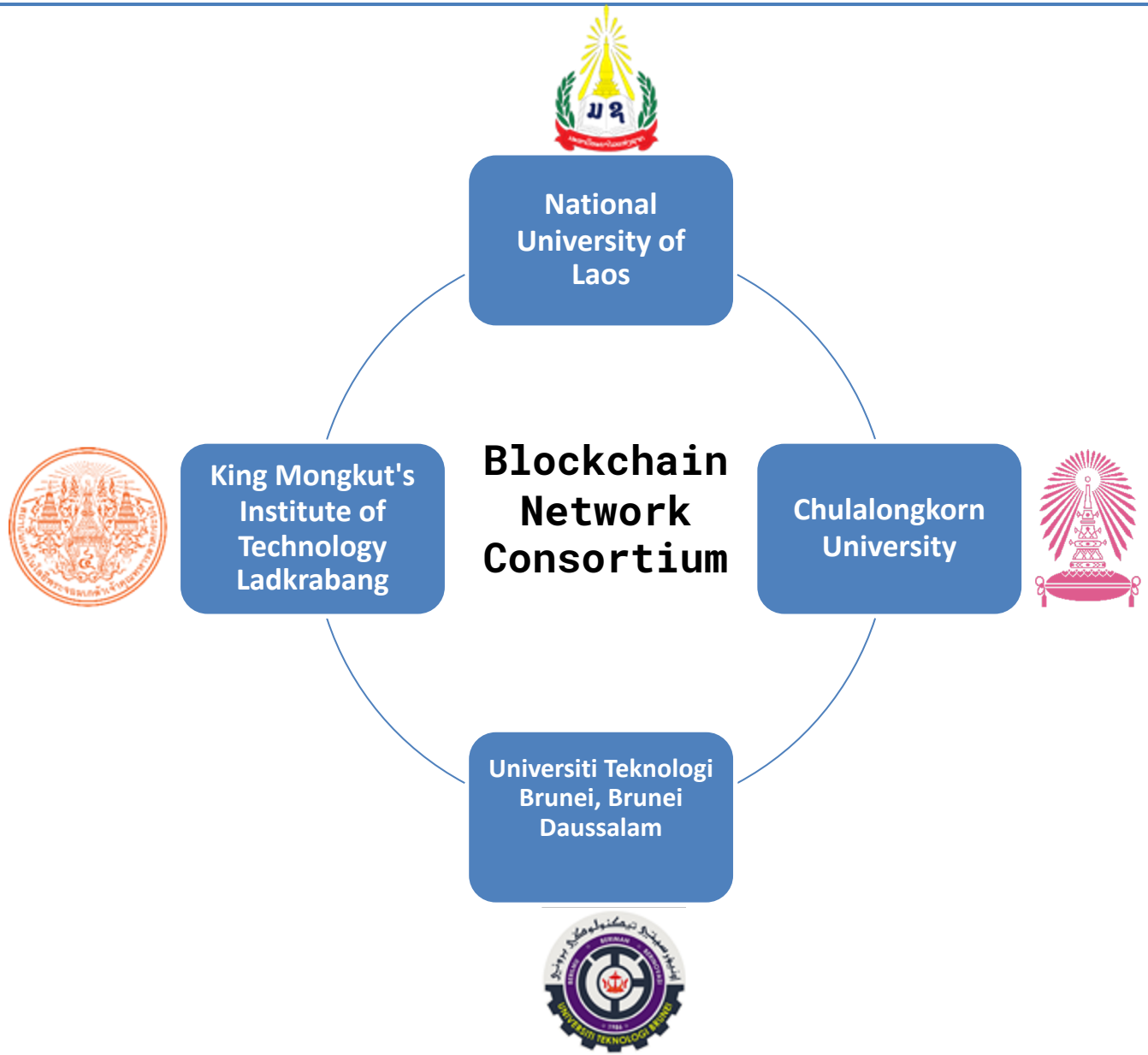


# Project Activities: Servers Setup and Blockchain Configuration

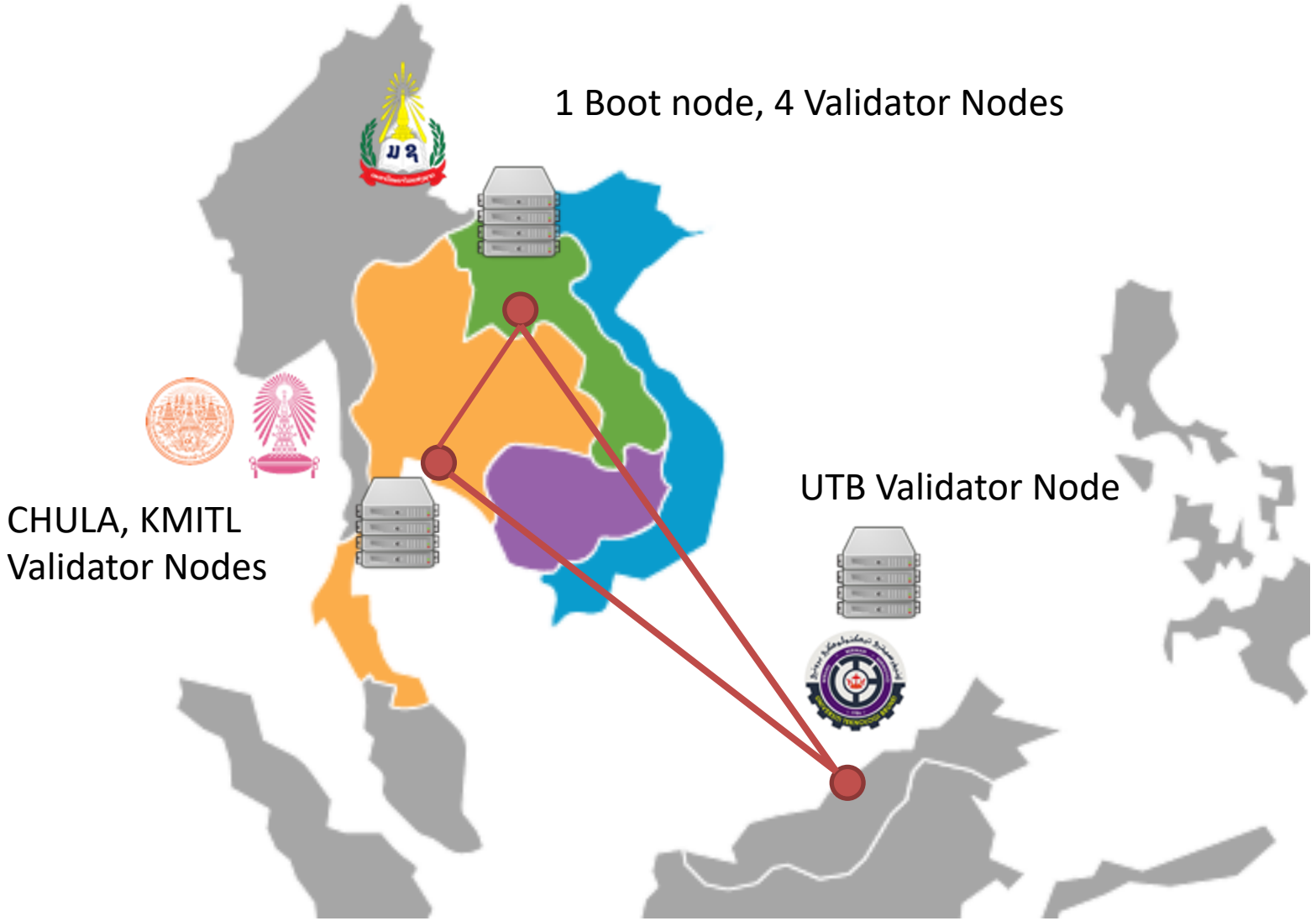
Node Operation Interface



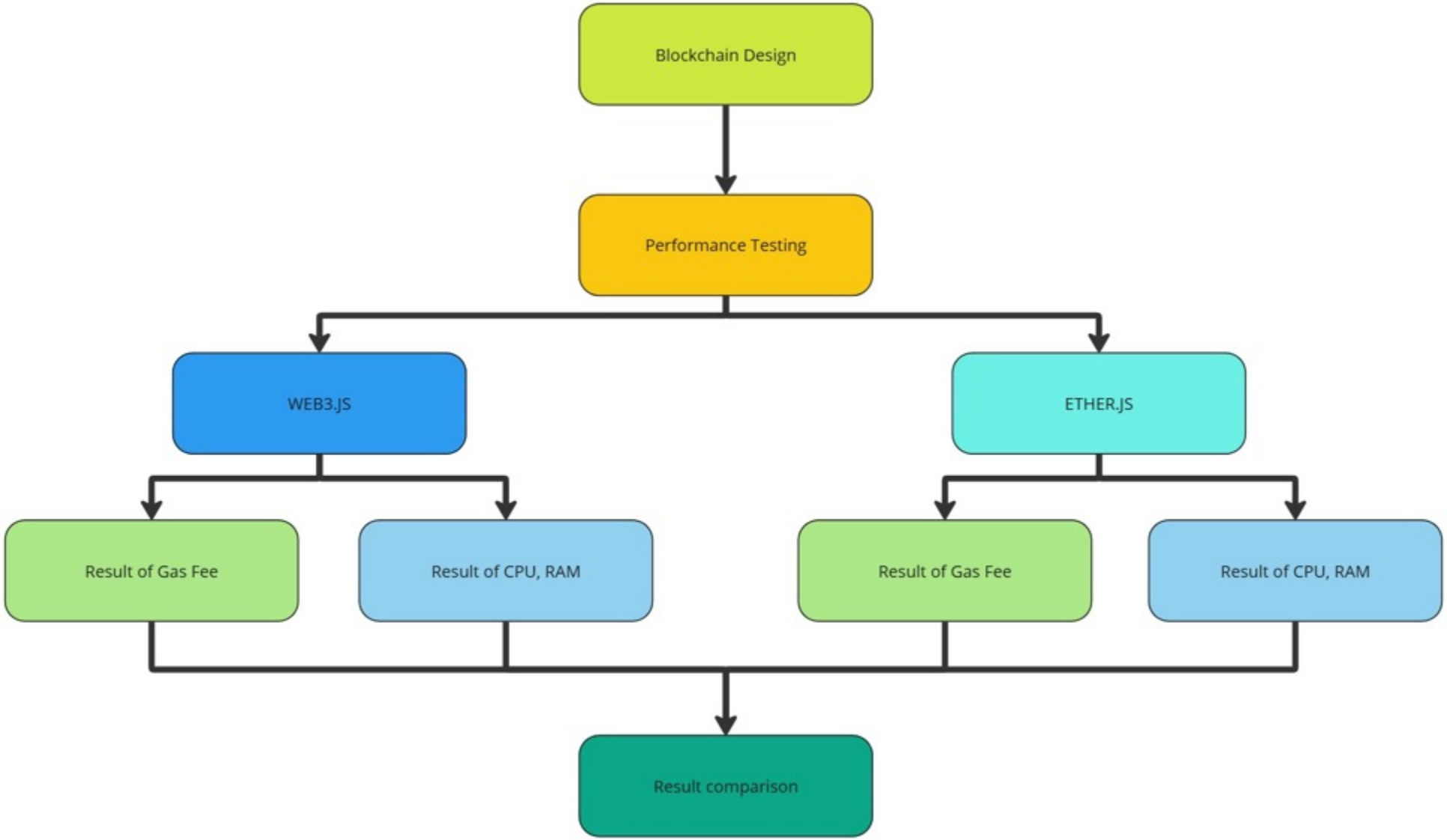
# Project Activities: Implementation Concept



# Project Activities: Servers Location



# Project Activities: Exploring Performance of Web3.JS and Ethers.JS in Blockchain



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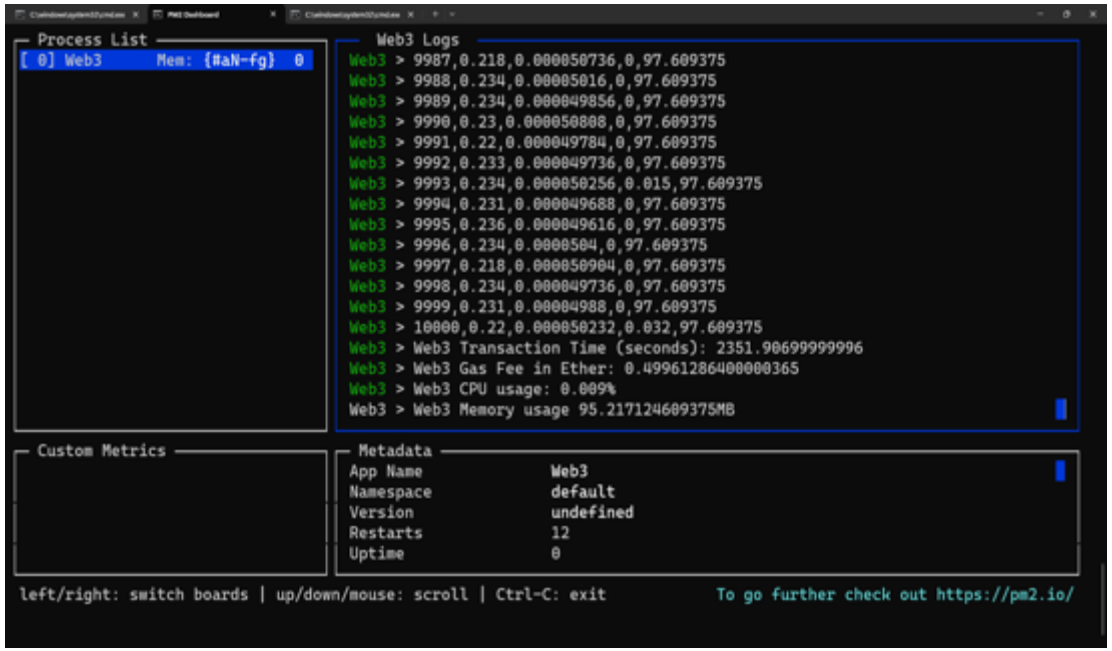
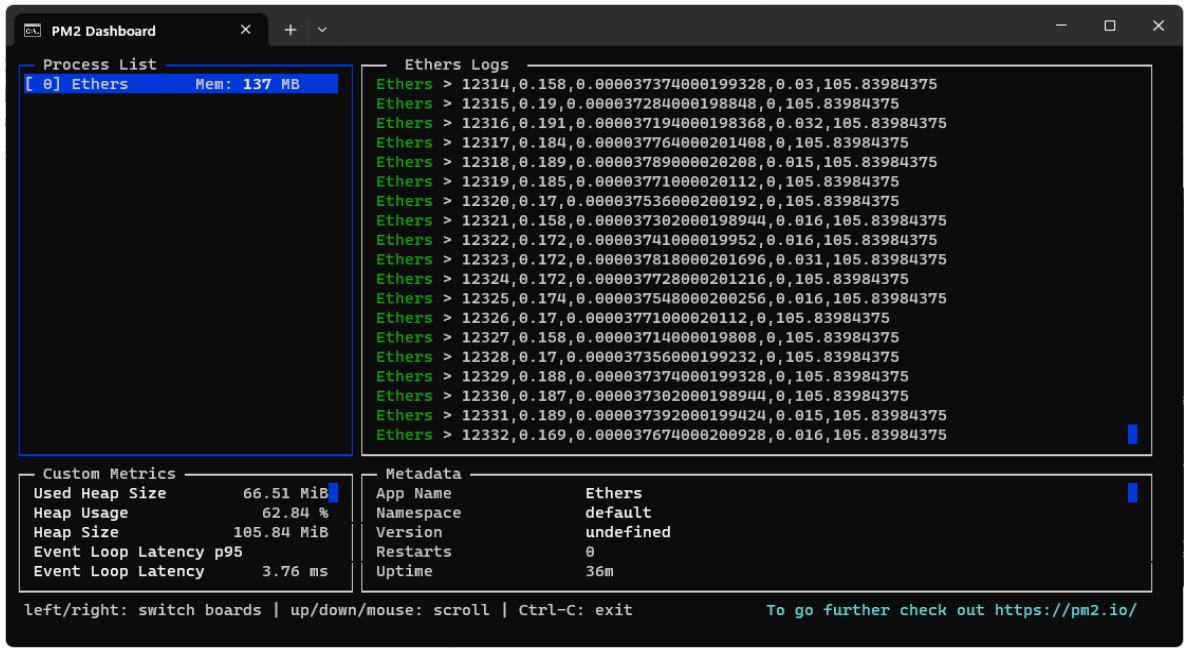
## WEB3JS Testing




## ETHERJS Testing



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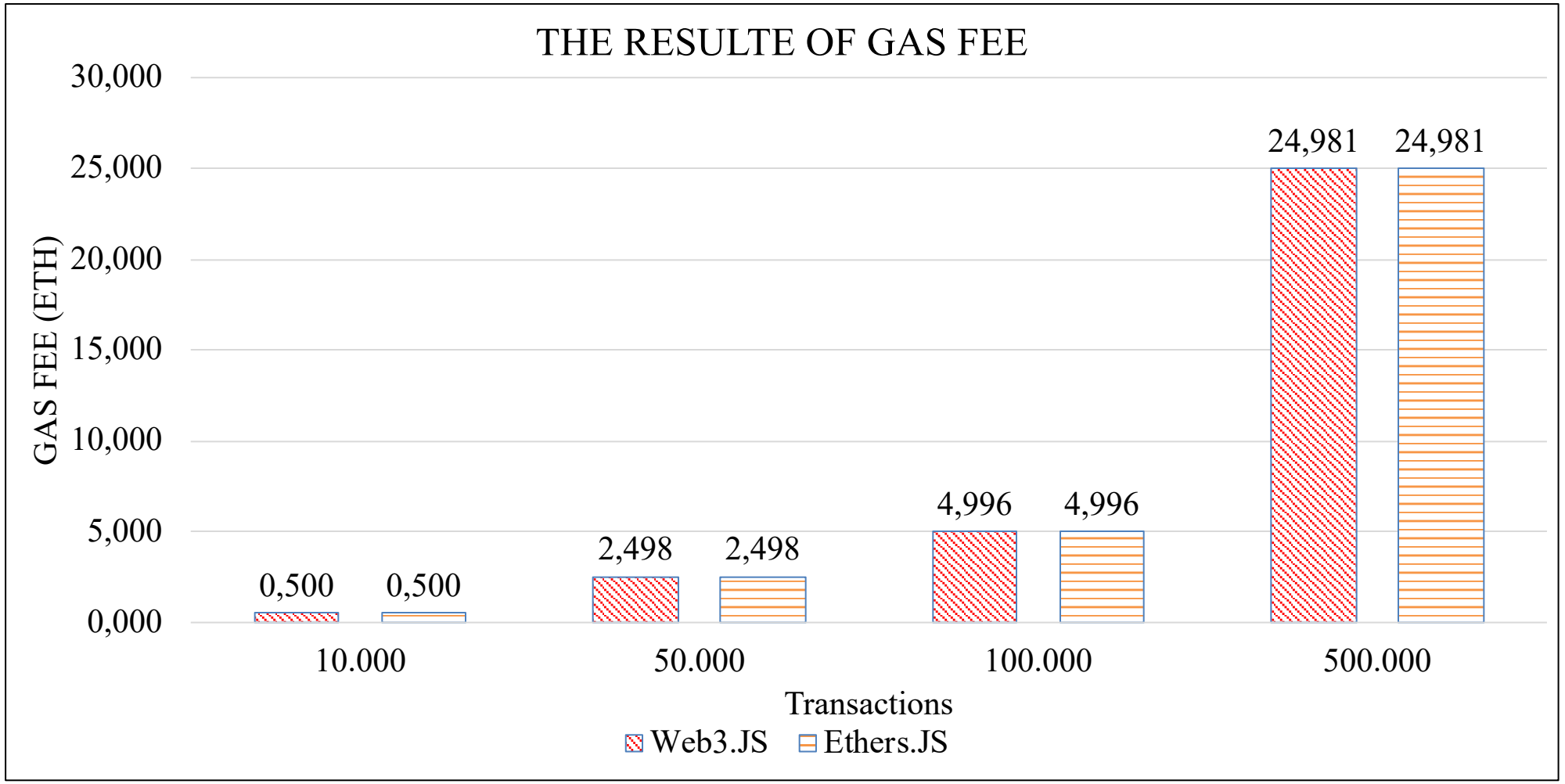

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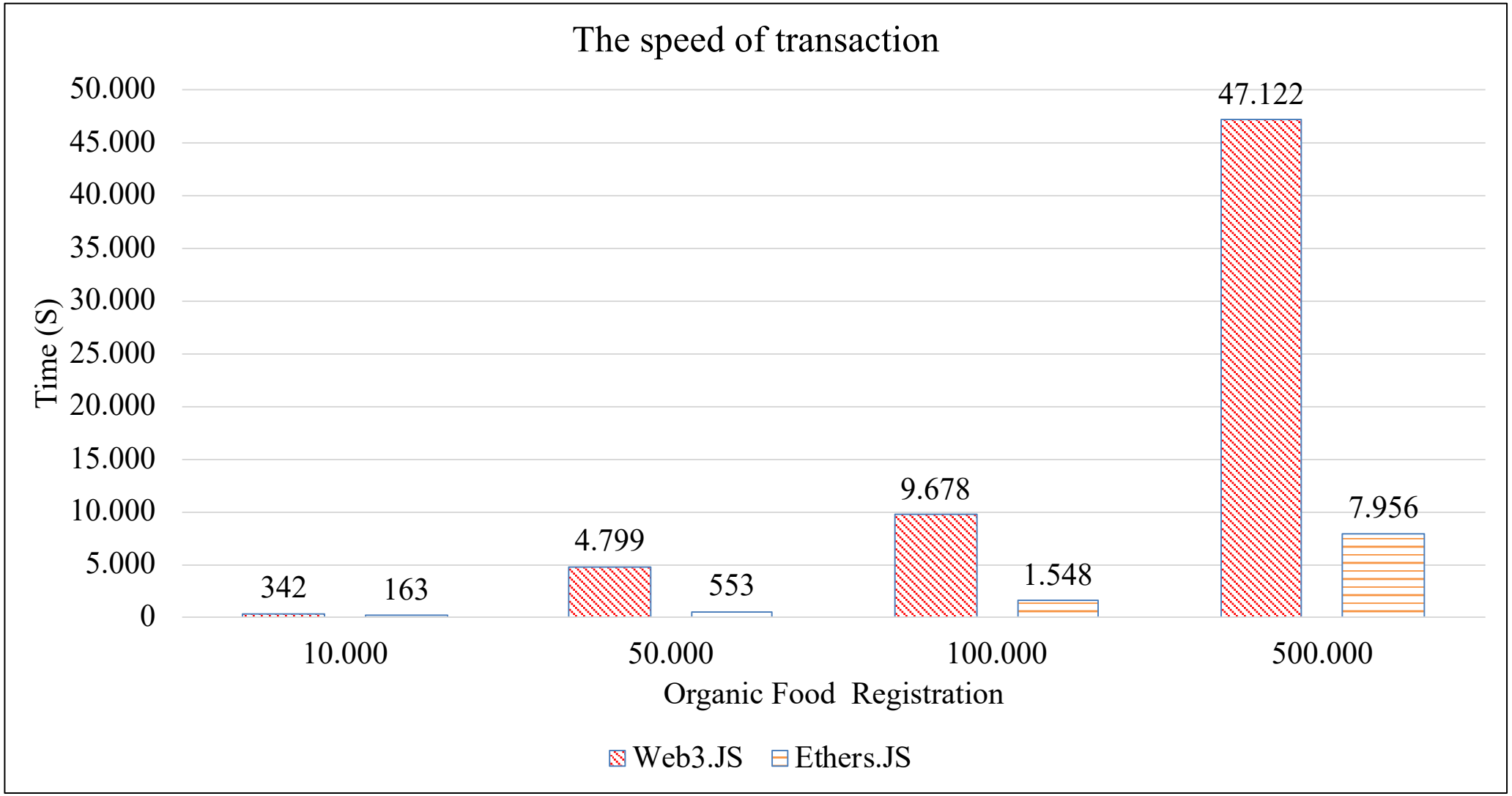

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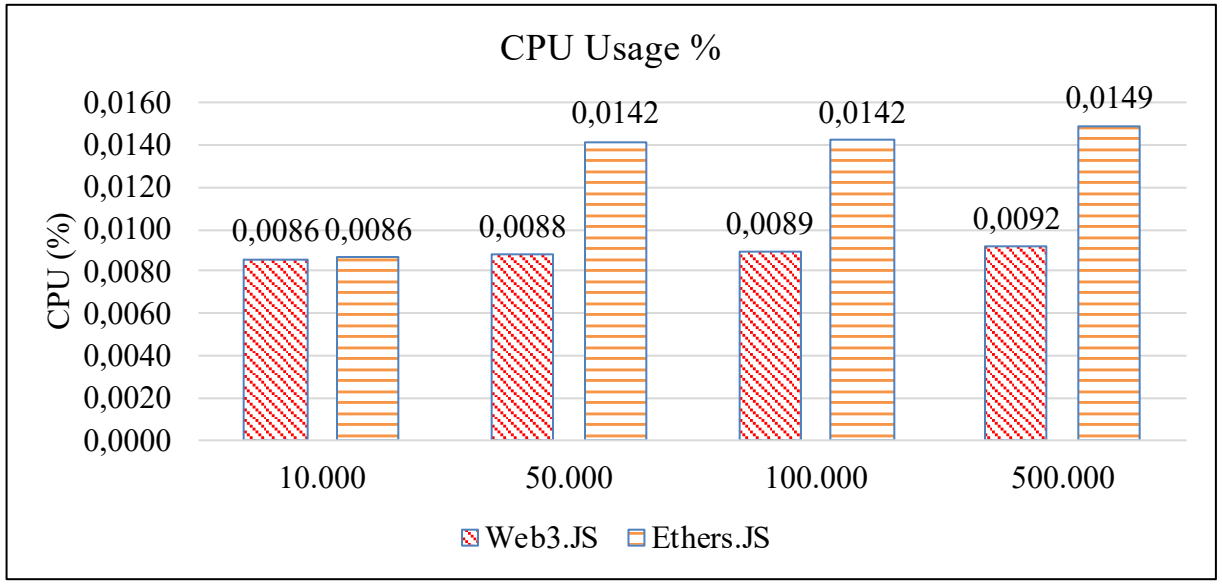
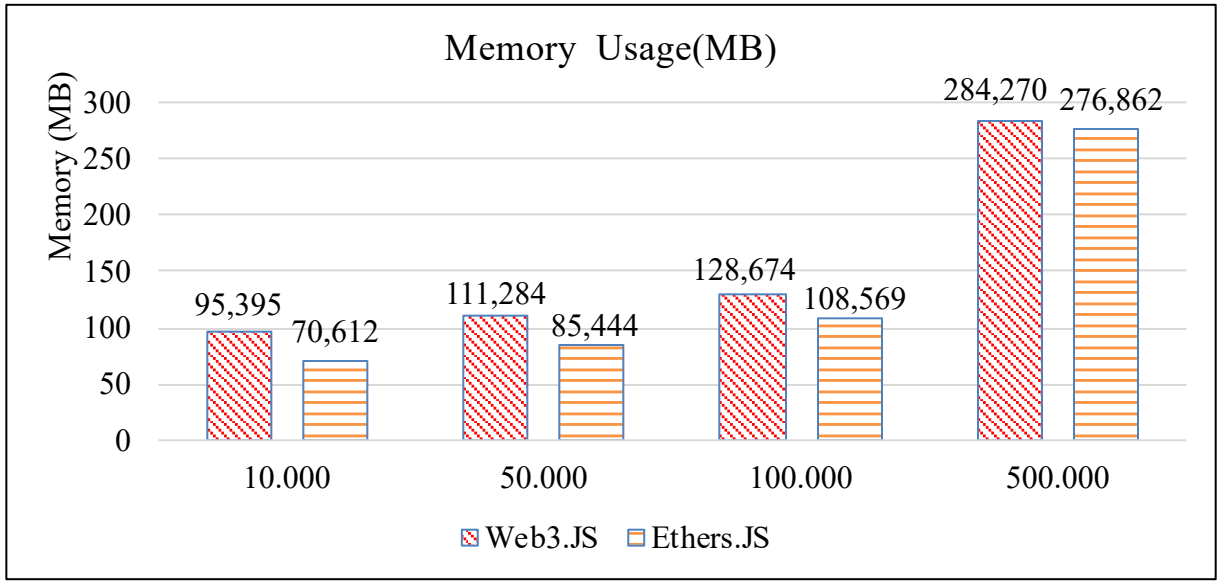
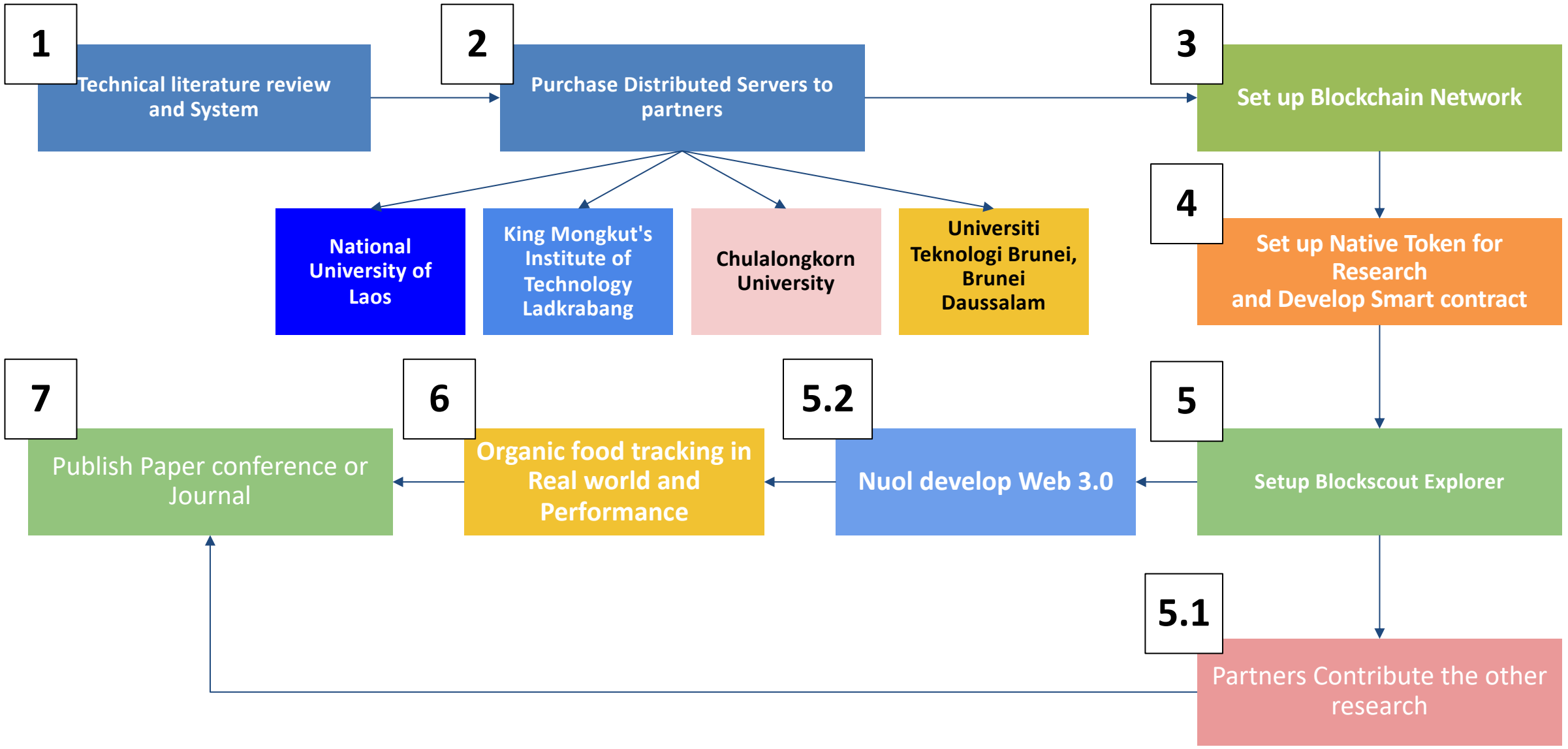


# Overview of Implementation



# Technical Plan AUG-DEC (More Detail)

- Initial Task for Server Setup 24-25/7/2024 (Main Site NUOL) - DONE
- Task Define the Information of Blockchain 29-30/8/2024 (HAE) - DONE
- Task for Server Setup 1-15/8/2024 (Main Site NUOL) - DONE
- Task for Server Setup 16-25/8/2024 (Partners Site) - DONE
- Task for Explorer Setup 1-10/9/2024 (Main Site NUOL) - DONE
- Performance testing for Ether.js and Web3.js 15 - 30/9/2024 (Main Site NUOL) - DONE
- Draft the first Journal and prepare to submit (1-15/10/2024) - DONE
- Deploy the Smart contract to apply Organic Architecture (Selected Case) (16-30/10/2024) - DONE
- Develop Web 3.0 for Front-end Application . (16-30/10/2024)- Developing
- Submit Journal Paper (1/11/2024 – 31/12/2024) - Pending

# Scientific Contribution:

Published Journal Papers:

| No: | Paper title: | Author names | Affiliation | Journal name: | The publisher of the Journal | The volume number and Pages |
|---|---|---|---|---|---|---|
| 1 | Exploring Performance of Web3.JS and Ethers.JS for Ethereum Blockchain-Organic Food Registration | 1. Phonepadith PHOUMMAVONG.<br>2. Vimontha Khieovongphachanh<br>3. Senglathsamy Chanthamenavong,<br>4. Sompasong VONGTHAVONE2 | Souphanouvong University Journal of Multidisciplinary Research and Development | The SUJMRD online publication has been recorded permanently in the ISSN register as ISSN 2521-0653. | Souphanouvong University Journal of Multidisciplinary Research and Development (SUJMRD) | ( Waiting ) |

# Societal Impact:

**1. Promoting Consumer Trust and Food Safety:**

**Transparency for Consumers:** By providing a system where consumers can verify the authenticity and journey of organic food products, the application builds consumer trust in organic labels. This is crucial in an era where mislabeling and counterfeit organic products are common.
**Public Access to Traceability Data:** The system gives the public access to information about the origin of food products, promoting informed decision-making. Through scanning a QR code, consumers can trace back every step in the food production and supply chain, ensuring it meets organic standards.

**2. Supporting Organic Farmers:**
**Fair Trade Opportunities:** Small-scale organic farmers, who are often overlooked in traditional supply chains, can gain visibility and prove the authenticity of their products. This can lead to better market access and potentially higher prices for genuine organic products.
**Empowerment through Technology:** By integrating blockchain technology, farmers are empowered to adopt modern, transparent systems, which could provide them a competitive advantage. This could help them secure certifications and partnerships more easily.

# Societal Impact:

**3. Improving Regulatory Compliance and Governance:**

**Standardization in Organic Certification:** By working with relevant bodies and regulators, this project can contribute to creating a standard framework for organic certification that is verifiable on the blockchain. This could serve as a model for other countries or regions, helping to improve global organic food standards.
**Collaboration with International Standards Organizations:** The blockchain system's framework can be shared with international organizations and governments, contributing to the global conversation on organic food traceability and regulatory compliance. It could also lead to partnerships with international standard-setting bodies to further enhance and standardize practices in organic food tracking.

**4. Environmental and Sustainability Benefits:**
**Encouraging Sustainable Farming Practices:** By providing visibility into farming practices, the system encourages more farmers to adopt organic and sustainable methods, which can reduce harmful environmental impacts, such as pesticide use and deforestation.
**Public Awareness Campaigns:** As the system makes data available to the public, it could be used in campaigns to promote awareness of sustainable farming practices and their benefits for health and the environment.

# Societal Impact:

**5. Creating a Knowledge Base for Research and Development:**
**Public Data for Researchers:** The application will provide anonymized data sets, available for public use, that can support academic and governmental research on organic farming, blockchain technology, and supply chain management.
**Contributions to Academic Literature:** The journal papers and documentation created during the project will contribute to academic and professional discourse, supporting other teams and organizations that are developing similar systems in different regions.

**6. Economic and Social Development:**
**Boosting Local Economies:** By increasing trust in locally produced organic products, the system could lead to greater demand for Lao organic products in both local and international markets, helping to strengthen the local economy.
**Job Creation in Technology and Agriculture:** The development and maintenance of the blockchain system will create jobs in technology, agriculture, and logistics, particularly in rural areas. As more farmers and supply chain participants adopt this technology, it will also create demand for training and support services.

# Conclusion:

**Conclusion of the Blockchain-Based Organic Food Tracking Project.**

**Scientific and Technological:** Successfully integrated blockchain and IoT for secure, transparent tracking of organic food, ensuring data integrity and authenticity.

**Application Development:** Developed a scalable system with smart contracts and a user-friendly explorer, although challenges remain in Web 3.0 front-end integration and user adoption.

**Experiments & Field Testing:** Performance testing confirmed Ether.js as more efficient for transactions, while field tests highlighted connectivity challenges in remote areas and positive farmer reception with proper training.

**Social & Economic Impact:** Increased consumer trust, empowered small farmers, promoted sustainable practices, and contributed to discussions on standardizing organic certifications.

# Future works:

**Scientific and Technological:**

**Data Analytics Integration:** Leverage AI and machine learning to analyze collected data for trends in organic farming and supply chain efficiency. (Led by Mr. *Senglathsamy Chanthamenavong* )

**Hybrid Blockchain Solutions:** Explore hybrid blockchain models for improved scalability and offline capabilities in areas with poor internet access. (Led by Dr. Phonepadith PHOUMMAVONG)

**Application Development:**

**Web 3.0 Front-End Finalization:** Complete the development of a user-friendly Web 3.0 application for easier consumer interaction and real-time product verification. (Led by Dr. Khamphet Bounnady )

**Mobile App for Farmers:** Build a mobile interface for farmers to easily input and track their data, enabling better integration into the blockchain. (Led by Dr. Khamphet Bounnady )

**Experiments & Field Testing:**

**Expanded Field Testing:** Test the system across more diverse regions to assess performance in varied farming and supply chain environments. (Led by Mr. Senglathsamy Chanthamenavong )

**User Training Programs:** Conduct workshops and training for farmers and supply chain participants to boost adoption and understanding of the technology. (Led by *Dr. Vimontha KHIEOVONGPHACHANH* )

# Thank you
# Q & A