SAFE

SECURE

EFFICIENT

SUSTAINABILITY

> " **Safe, secure and efficient shipping on clean oceans** "

IMO

CONTENTS

Chapter I Background

Chapter II

	E	S	G
Problem	Outdated business processes and efficiency limitation	Environmental Issues	Information Asymmetry
Resolution	Efficiency	Stewardship	Global Balance
Blockchain	Security	Smart Contracts	Accessibility

Chapter III Conclusion & Proposal

Chapter 1.
Background

01. Blockchain

02. Anticipated Points

Blockchain is a distributed database technology that stores data in a chain of blocks

Attributes

Decentralization

Smart Contracts

Immutability

Transparency

Security

Consensus Mechanism

AGENDA

10th Session
The 2024
Mock IMO Assembly

The 2024
Mock IMO Assembly
A P P A - D A

SD 2: Integrate new and advancing technologies in the regulatory framework

17   As technological development accelerates, new and advancing technologies will significantly affect shipping, creating a more interconnected and efficient industry more closely integrated with the global supply chain. New and advancing technologies have already brought about changes at all levels in the way ships are designed, constructed, equipped and operated,

SD 2 Integrate new and advancing technologies in the regulatory framework

PI 2.1	# of proposals submitted to IMO to incorporate new and advancing technologies into the regulatory framework
PI 2.2	# of outputs to include new and advancing technologies (as specified in PI 2.1) on the agenda of IMO organs
PI 2.3	# of amendments adopted to incorporate new and advancing technologies into the regulatory framework

19   The Organization's regulatory framework will be continually adapted to the challenges and global developments facing the shipping industry, with a view to ensuring safety, security and environmental protection. The Organization will strive towards a legal framework that accommodates new and advancing technologies and approaches; it will do so by being technology neutral, developing IMO instruments and performance standards without preference or hindrance of one technology over another.

SD 5: Enhance global facilitation and security of international trade

26   Shipping moves around 80% of world trade, making it an integral part of the global economy and supply chain. The prevention of disruption to international shipping is therefore in the interest of all. Continued effort is needed to ensure that ships move from port to port

SD 5 Enhance global facilitation and security of international trade

PI 5.1	# of Contracting Parties to the FAL Convention submitting notifications pursuant to article VIII of the FAL Convention
PI 5.2	# of Member States issuing electronic certificates
PI 5.3	# of Member States with a system for the electronic exchange of information
PI 5.4	# of piracy incidents per geographical area of incident reported to IMO
PI 5.5	# of stowaway incidents reported to IMO
PI 5.6	US$ expenditure on technical cooperation activities and capacity building allocated to facilitation matters
PI 5.7	US$ expenditure on technical cooperation activities and capacity building allocated to security matters

30   To achieve this, IMO will seek further international consensus on reducing, simplifying and standardizing the information required. It will develop global solutions that reduce the burdens by facilitating electronic information exchange and that balance the needs of authorities ashore with the interests of the shipping industry.

Anticipated points

Chapter 2.
Problem Statement & Resolution

E for Efficiency

S for Stewardship

G for Global balance

Source: Pinterest

E

Problem	Outdated business processes and efficiency limitation
Resolution	**E**fficiency
Blockchain	Security

Hanjin Shipping logistics crisis

Information intermediary function cut off

IBM Analysis

Cost of Paper-Based Document Processing

IMO's cyber risk management

Solution in Blockchain

Transaction History Public – Visibility

P2P transaction,
Simplification of administrative procedures,
Digitalization

Information security

BLOCKCHAIN

Blockchain ? 🔗 Storing cryptocurrency transaction records in **blocks** and **linking** those blocks to form a chain

☝🏻 Reliability(or trust)

✌🏻 Security

We got 2 big points of blockchain and we made a code to prove it

Interpretation of Hash function code ; Hash compression function

```
string sha256(const string& str) {
    static const char hex_chars[] = "0123456789abcdef";
    uint32_t state[8] = {
        0x6a09e667, 0xbb67ae85, 0x3c6ef372, 0xa54ff53a,
        0x510e527f, 0x9b05688c, 0x1f83d9ab, 0x5be0cd19
    };

    // 계산 과정 : 메시지 길이 자체를 비트단위로 추가
    vector<uint8_t> padded_message;
    size_t original_byte_len = str.size();
    size_t original_bit_len = original_byte_len * 8;

    padded_message.reserve(((original_byte_len + 8) / 64 + 1) * 64);
    for (char c : str) {
        padded_message.push_back(static_cast<uint8_t>(c));
    }
    padded_message.push_back(0x80);
    while ((padded_message.size() % 64) != 56) {
        padded_message.push_back(0x00);
    }

    for (int i = 0; i < 8; ++i) {
        padded_message.push_back((original_bit_len >> ((7 - i) * 8)) & 0xFF);
    }

    // 위에 압축함수 호출해서 64바이트 블록 단위로 해시 계산
    for (size_t i = 0; i < padded_message.size(); i += 64) {
        sha256_compress(state, padded_message.data() + i);
    }

    // state 배열의 값을 최종적으로 16진수로 출력
    ostringstream result;
    for (auto value : state) {
        result << hex_chars[(value >> 28) & 0x0F];
        result << hex_chars[(value >> 24) & 0x0F];
        result << hex_chars[(value >> 20) & 0x0F];
        result << hex_chars[(value >> 16) & 0x0F];
        result << hex_chars[(value >> 12) & 0x0F];
```

👉 first for loop

: Store the input data in the w[32]

———

👉 second for loop

: Further scramble the input data

and create new data fragments

Interpretation of Hash function code ; Hash transformation function

Summary of Hash function

Input

Padding

Data Scrambling

Result Calculation

Final Hash values

👉 We create a unique key (like fingerprint) for the block by complexly scrambling the data to distinguish it from other data.

Interpretation of Proof -of-Work function code   ; Hash transformation function

```
// 작업 증명 함수 : 이전 해시랑 맞는 지 안 맞는지 확인
int proof_of_work(int last_proof) const {
    int proof = 0;
    while (!valid_proof(last_proof, proof)) {
        proof++;
    }
    return proof;
}

// 증명의 유효성을 확인 (해시의 접두사가 "0000"인지 확인)
bool valid_proof(int last_proof, int proof) const {
    string guess = to_string(last_proof) + to_string(proof); //last_proof와 proof 문자열로(to_string)
    string guess_hash = sha256(guess); //두개 문자열 반환한걸 합쳐서 해시 값으로 변환
    return guess_hash.substr(0, 4) == "0000"; // 그 해시값의 접두사가 0000인지 확인
}
```

👉 Require for adding a new block

👉 Find a nonce value that matches the block's hash

👉 Increment the nonce by 1 and repeat the calculation until they match

제네시스 블록 해시: 7fa451ad4d8632120c4ecd5053ed87ef3f941c7c7078ad4b4e249f8b34a0169d

이전 블록의 해시를 입력하세요 : |

**Screen recording of the entire code execution results
The process of block creation and the process of data input

Significance of blockchain in shipping industry

- 💻 Visibility

- 💻 Saving the time and cost

- 💻 Reduction of security incidents and risks

Problem

Resolution

Blockchain

Environmental Issues

Stewardship

Smart Contracts

<u>**Challenges Posed by IMO's
Environmental Regulations**</u>

Strengthened IMO strategy on GHG reductions
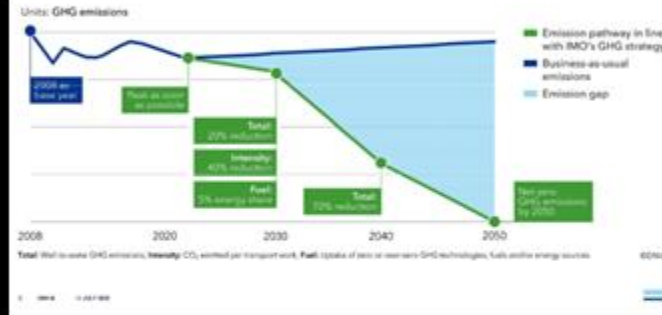
Units: GHG emissions

- Emission pathway in line with IMO's GHG strategy
- Business-as-usual emissions
- Emission gap

2008   2020   2030   2040   2050

Issue 1
Strengthened Regulations
from IMO

" The IMO has raised a goal"

CARBON TAX

Issue 2
Introduction of **Carbon Taxes**
in 2027

"Carbon tax will be imposed
on gas emissions
from vessels worldwide"

Issue 1 : Strengthened Regulations from IMO

" The IMO has raised a goal"

The 80th Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO) has mandated a low-prospect target for greenhouse gas emissions from international shipping by 2050.

Another important object to look at among the results of this 80th meeting is that the time frame for the IMO's mid-term request to reduce the 2050 net (net zero carbon emissions) target is independent of '2027'.

On the 23rd, there is a possibility that Korea Register Para will inquire about the possibility and economics of IMO for the future from May 2027.

Source: Yonhap News (23.07.2023)

Issue 2 : Introduction of carbon taxes in 2027

"Carbon tax will be imposed on gas emissions from vessels worldwide"

International Maritime Organization Leads Decarbonization
Reduce ship fossil fuel use
the imposition of a greenhouse gas levy

...

A carbon tax will be introduced in the shipping sector in 2027. This means that a certain charge will be imposed on the amount of greenhouse gases emitted by international ships worldwide. This is expected to be the first case of taxing greenhouse gases in accordance with international standards.

...

Global large shippers such as Amazon
Demand for 90% reduction of greenhouse gas emissions from ships

Source: Korean Economy (20.05.2024)

Paradox of Sustainability

"Impact of environmental regulations on business"

No effect
Somewhat none : 9.0%
Very none : 3.8%

n = 133

Very present : 38.3%
Somewhat : 48.9%
Affected

very present   somewhat   very none   somewhat none
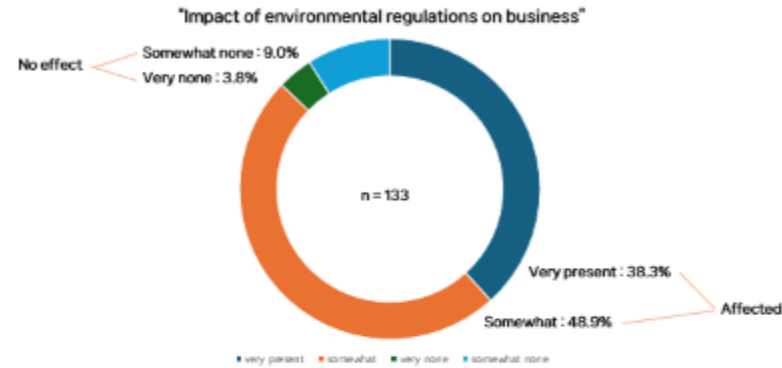
Challenges for Developing Countries
and Small Enterprises

Burden on Developing Countries

Increasing barriers to entry Inefficiency in
Logistics Processes

25

Problem solving by using Blockchain_1

1.Smart Contract in Charter Contract
  : Streamline CER(certified emission reduction) trading within charter contracts.

2. Automated Monitoring

  : Reduce Transaction Costs

Charterer   **Charter**

CER

Features of Charter Party

Problem solving by using Blockchain_2

1.Smart Contract in Charter Contract
 : Streamline CER(certified emission reduction) trading within charter contracts.

2. Automated Monitoring

 : Reduce Transaction Costs

Cost Reduction

$

Process 1

Carbon Emissions Prediction (based on simulated data)

```python
1개의 사용 위치                                              ⚠8 ✓3 ∧ ∨
def generate_carbon_emissions_data(start_date='2004-01-01', years=20):
    date_range = pd.date_range(start=start_date, periods=years * 52, freq='W')
    np.random.seed(12)

    # 장기 트렌드 및 계절성 반영
    seasonal_effect = 50 * np.sin(2 * np.pi * date_range.to_series().dt.isocalendar().wee
    trend = 0.5 * (date_range - date_range[0]).days / 365  # 연도별 변화
    noise = np.random.normal( loc: 0,  scale: 5, len(date_range))  # 노이즈

    emissions = 300 + seasonal_effect + trend + noise

    data = pd.DataFrame({'Date': date_range, 'Emissions': emissions})
    data.set_index( keys: 'Date', inplace=True)
    data.index.freq = 'W-SUN'
    return data


# 2. SARIMA 모델 훈련
1개의 사용 위치
def sarima_forecast(data, steps=8):
    # 모델 파라미터 조정
    model = SARIMAX(data['Emissions'], order=(1, 1, 0), seasonal_order=(1, 1, 0, 52))
    model_fit = model.fit(disp=False)

    forecast = model_fit.get_forecast(steps=steps)
    forecast_index = pd.date_range(start=data.index[-1] + timedelta(days=7), periods=steps
    forecast_data = pd.Series(forecast.predicted_mean, index=forecast_index)
```

Insert Code for Real-Time Data

Update on Website (app.py)
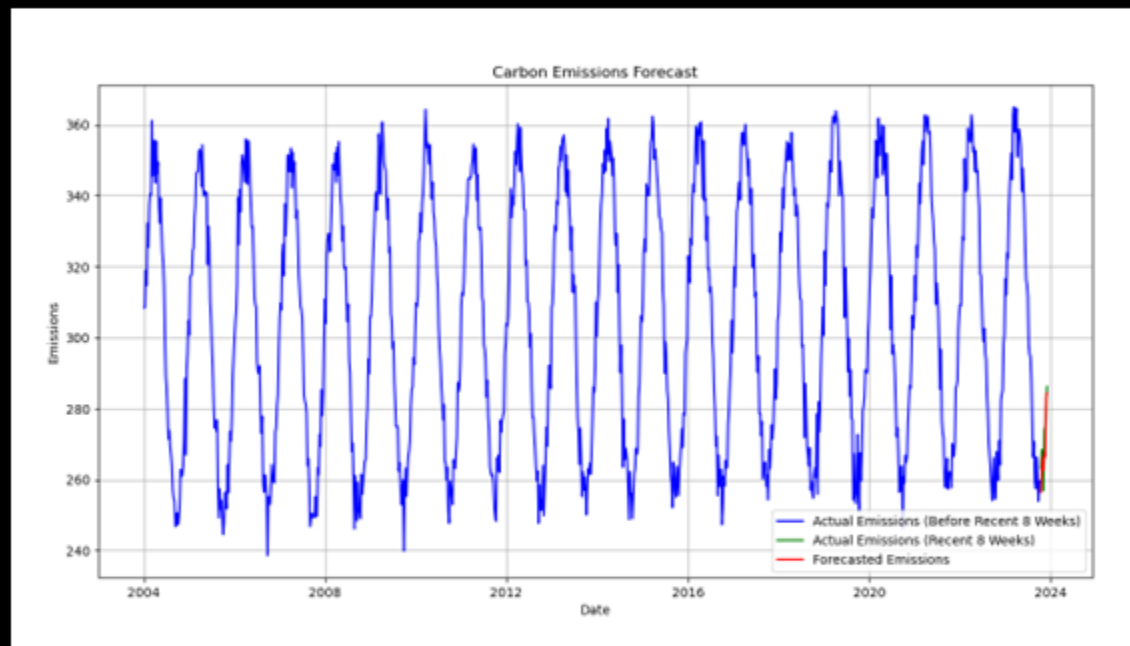
Carbon Emissions Forecast

Process 2

Data & Transaction real-time update (Local Website, Local IP)

```
1개의 사용 위치
41  def perform_transaction(value):
42      try:
43          if value > 500:
44              print(f'값: {value:.2f}이 500을 초과하여 구매를 진행합니다...')
45              tx_hash = contract.functions.purchase().transact({
46                  'from': account,
47                  'value': w3.toWei( param: 0.01,  param1: 'ether')
48              })
49              receipt = w3.eth.wait_for_transaction_receipt(tx_hash)
50              print(f'구매 완료! 거래 해시: {receipt.transactionHash.hex()}')
51          elif value < 300:
52              print(f'값: {value:.2f}이 300 미만으로 판매를 진행합니다...')
53              tx_hash = contract.functions.sell().transact({'from': account})
54              receipt = w3.eth.wait_for_transaction_receipt(tx_hash)
55              print(f'판매 완료! 거래 해시: {receipt.transactionHash.hex()}')
56          else:
57              print(f'값: {value:.2f}은 거래 기준에 부합하지 않습니다.')
58      except Exception as e:
59          print(f'거래 중 오류 발생: {e}')
```

Predicted Rule

Result
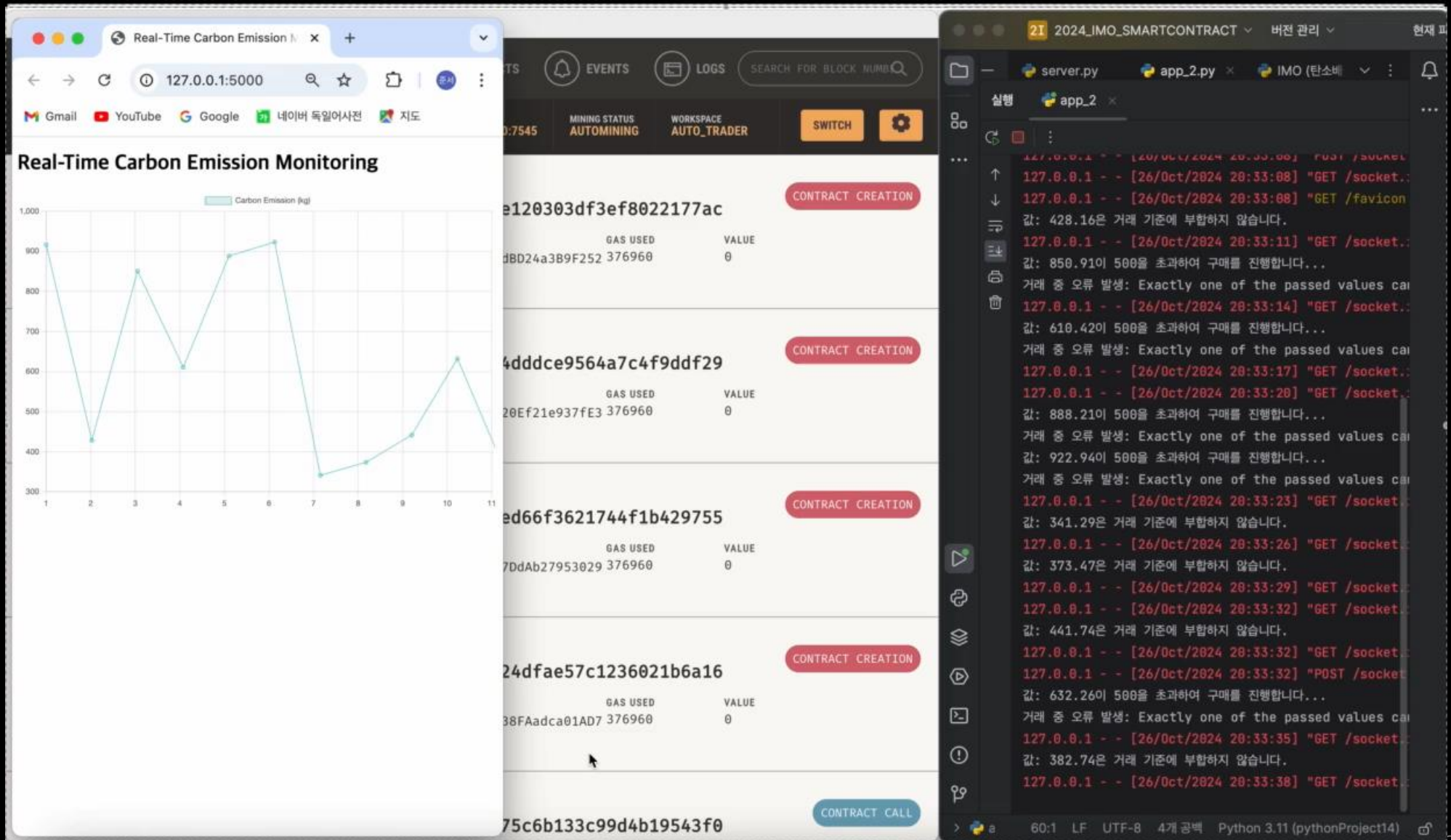
Significance

💻 Data-driven <u>transaction tracking</u> and notifications(real-time)

💻 <u>Expanding the scalability</u> and application areas of Blockchain

💻 Implementation of an <u>automated CER trading</u> System

Increased <u>active control efficiency of individual companies</u>

The 2024
Mock IMO Assembly

IMO
APPA-DA

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Problem	Information Asymmetry
Resolution	**G**lobal Balance
Blockchain	Accessibility

International trade — Maritime transport

inseparable

Deepening of Digital Trade

Information Asymmetry

IMO
INTERNATIONAL
MARITIME
ORGANIZATION
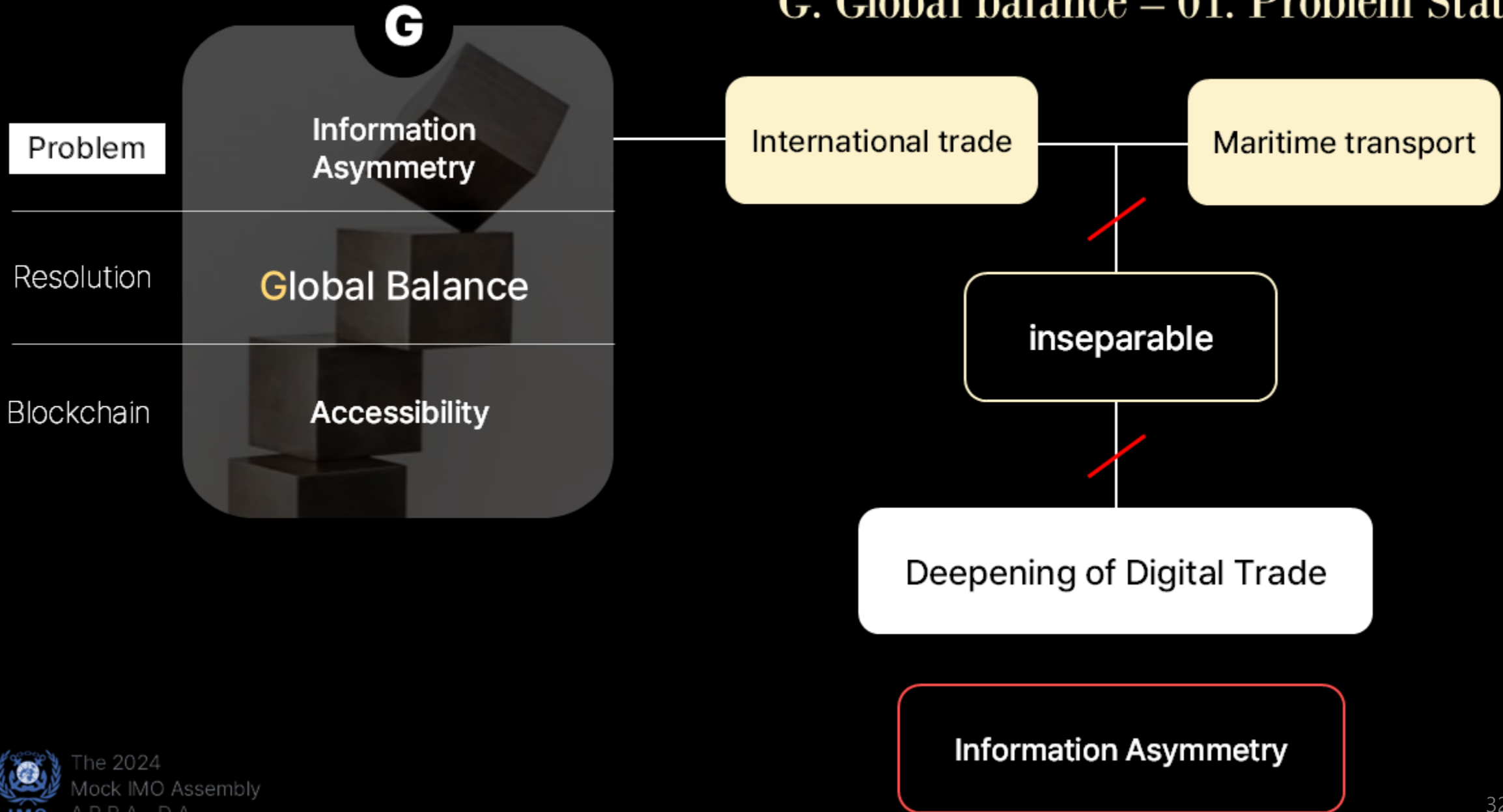
E

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611   Fax: +44 (0)20 7587 3210

Circular Letter No.4025
6 September 2019

To: IMO Member States
             Intergovernmental organizations
             Non-governmental organizations in consultative status

Subject: **Blockchain for Maritime Decisionmakers Programme
             (14 and 15 October 2019)**

General

1   The Secretariat has invited the Nautical Institute in partnership with Navozyme to
deliver their maritime industry specific educational two-day programme titled "Blockchain for
Maritime Decisionmakers" (BMD) at IMO Headquarters, 4 Albert Embankment,
London, SE1 7SR on 14 and 15 October 2019.

2   The BMD programme's objective is to raise the awareness of maritime leaders of
digital transformation issues and specifically the application of blockchain technology in the
maritime industry. The programme's larger goal is to equip the global community of maritime
changemakers with knowledge, confidence, skills and mindsets that can act as a catalyst to
transform and futureproof the maritime industry. For more information, please refer to the draft
programme set out in annex 1.

3   The event is open to all IMO Member States and international organizations and will
be conducted in English without interpretation.

Registration

4   With a view to facilitating the registration as well as visa applications of those
participants who require United Kingdom entry visas, the instructions on registration at IMO
meetings and the procedure governing IMO support for visa applications are set out in
annexes 2 and 3, respectively.

***

**IMO
EVENTS**

IMO

Blockchain for Maritime Decisionmakers Programme

33

UNCTAD 14th Session

United Nations

TD/B/C.II/52

United Nations Conference on Trade and Development

Distr.: General
19 February 2024

Original: English

Trade and Development Board
Investment, Enterprise and Development Commission
Fourteenth session
Geneva, 29 April–3 May 2024
Item 6 of the provisional agenda

Harnessing blockchain technologies for sustainable development

Note by the UNCTAD secretariat

accelerate progress towards achieving the Sustainable Development Goals. However, there are several challenges to the realization of its full potential, including issues associated with scalability, privacy concerns, uncertain regulatory standards and difficulties posed by the integration of blockchain technology into existing applications.

2. In this note, blockchain technology and its key features are explained, highlighting how the technology might contribute to achieving the Goals. Challenges faced by developing countries in the application of blockchain technology are highlighted, along with solutions to building capacities for blockchain innovation according to the level of development of a country. Finally, potential areas for international collaboration, to harness blockchain technology for inclusive and sustainable development, are addressed.

D. Blockchain as the new Internet

13. In this scenario, blockchain technology is considered a general-purpose technology on the scale of and comparable in scope with the Internet, complementing other industry 4.0 technologies, such as artificial intelligence, robots and the Internet of things, that drive a new technological and economic revolution and affect the options available for countries in pursuing sustainable development. Blockchain technology is currently in the installation phase, dominated by radical innovations led by suppliers, experimentation and new technological solutions and standards and competing technical specifications. The next phase is deployment, in which the emphasis is on the exploitation of technical solutions and changes in demand and lifestyles. Governments are generally behind the curve of the latest innovations, yet it is important to remain informed of developments in blockchain technology and the innovation ecosystem, to build national capacities. Many innovations are global in nature and it is therefore critical to strengthen international cooperation, to address emerging issues in a globalized environment. A new technological and economic revolution driven by blockchain and other industry 4.0 technologies presents a window of opportunity for some countries to catch up and others to forge ahead, if they can strategically diversify their economies into sectors associated with the new paradigm.

14. Under each of these scenarios, there are three potential drawbacks that require consideration. First, one of the main issues with regard to blockchain technology is the high level of energy consumption. For example, estimates suggest that, in 2022, the level of electricity consumption of bitcoin was higher than that of Chile, and consumption has been growing.[7] Such high levels of consumption generate carbon dioxide emissions that pose a threat to the environment. Second, blockchain technology may foster financial inclusion, yet cryptocurrencies may be appealing to criminals given their semi-anonymous and decentralized nature. Cryptocurrencies have been exploited for money laundering and illegal fundraising; in 2022, illicit activities amounted to $20 billion.[8] Third, the benefits from the opportunities provided by cryptocurrencies are fully available to only a few, due to the cost of access, complexity and other factors. Inequality among cryptocurrency holders is high, with 82 per cent of bitcoin held by only 0.3 per cent of all addresses.[9]

III. The role of national policies and international collaboration

15. In this chapter, actions that countries at different levels of development may take to strengthen national innovation systems are suggested, to harness blockchain technology for sustainable development, recognizing that different systems have characteristics that require targeted policy advice. In addition, the role of international collaboration in supporting national efforts to capture the benefits of blockchain technology is discussed.[10]

A. Low-income and lower middle-income countries

16. Low-income and lower middle-income countries usually face the challenges of weak and costly Internet services and the lack of digital know-how, which hinder the adoption of blockchain technology. To harness blockchain technology, Governments need to improve digital infrastructures and create opportunities for skill development through pilot projects, to kickstart blockchain diffusion.

still remaining at the stages of analysis and recommendation
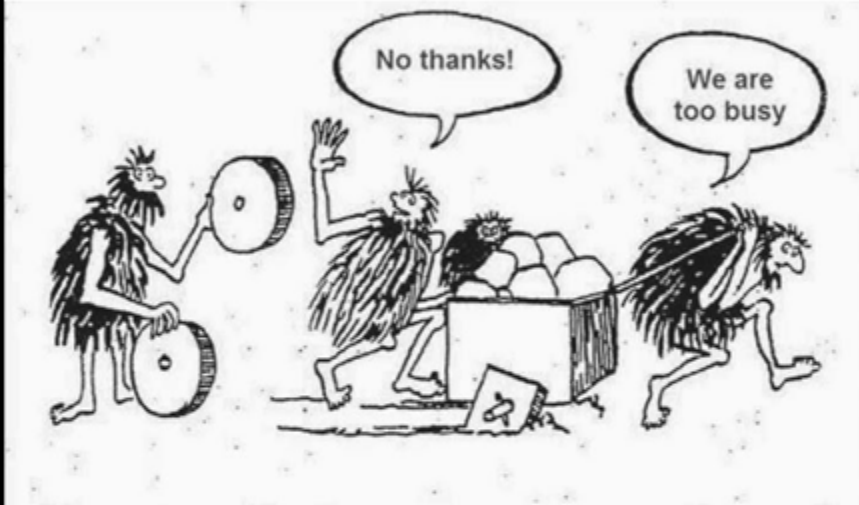
APPA-DA

APPA-DA application

"The Public Ledger"

The app "APPA-DA" pulls together
Blockchain | Smart contracts |
Real-time data analysis | IMO regulations

Reduce information gap

APP "APPA-DA"
Recording the app execution window

Innovation Resistance

Resistance to innovation is when users actively decide not to adopt the innovation

The PLS study

INSIGHTs

✅

Innovation resistance is determined by the perceived risk of consumers before purchasing an innovative product.

✅

People's feelings toward technology are influenced by social factors.

Innovation Resistance (2)

The more familiar a technology is and
the more people use it the lower resistance to adopt technology.

Our Proposal

Companies & Governments

should actively promote education and
workshops on blockchain technology

Scholars

should actively use blockchain to
form a consortium using blockchain

Higher Accessibility

Application APPA-DA

Compared to existing documentation operations

Friendly mobile app

Reduce innovation resistance

Resolving Information Disbalance

Chapter 3.

Conclusion

Summary

Last words

Proposal

Strategies for Utilizing Blockchain to Stabilize Sustainable Maritime Transport Systems

IMO INTERNATIONAL MARITIME ORGANIZATION   **E**

FACILITATION COMMITTEE   FAL 48/20
48TH SESSION   26 OCTOBER 2024
Agenda item 20   Orinial: English

GUIDELINE OF THE APPA—DA FOR THE BLOCKCHAIN

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1	INTRODUCTION – USING BLOCKCHAIN
2	APPLIES TO · CONTRACTING STATE · SUBCATEGORY: DEVELOPED COUNTRIES–DEVELOPING COUNTRIES
3	ALLOWABLE RANGE · PROOF OF WORK / EMISSION TRADING / APPLICATION DEVELOPMENT
4	INVESTMENT METHOD · CREATION OF JOINT FUND · FUNDING METHOD: GOVERNMENT SUPPORT/PRIVATE DONATION / FUNDARAISING · CAMPAIGN / CROWDFUNDING
5	REGULATIONS ON ROLES AND RESPOSIBILITIES BETWEEN DEVELOPED AND DEVELOPING COUNTRIES · THE ROLE OF DEVELOPED COUNTRIES · THE ROLE OF UNDERDEVELOPED COUNTRIES
6	INVESTMENT TARGET · ABSOLUTE COMPUTER USAGE · A COUNTRY THAT MEETS THE REQUIREMENTS FOR AN ADVANCED COUNTRY PRESENTED BY INTERNATIONAL ORGANIZATIONS SUCH AS THE UNITED NATIONS

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