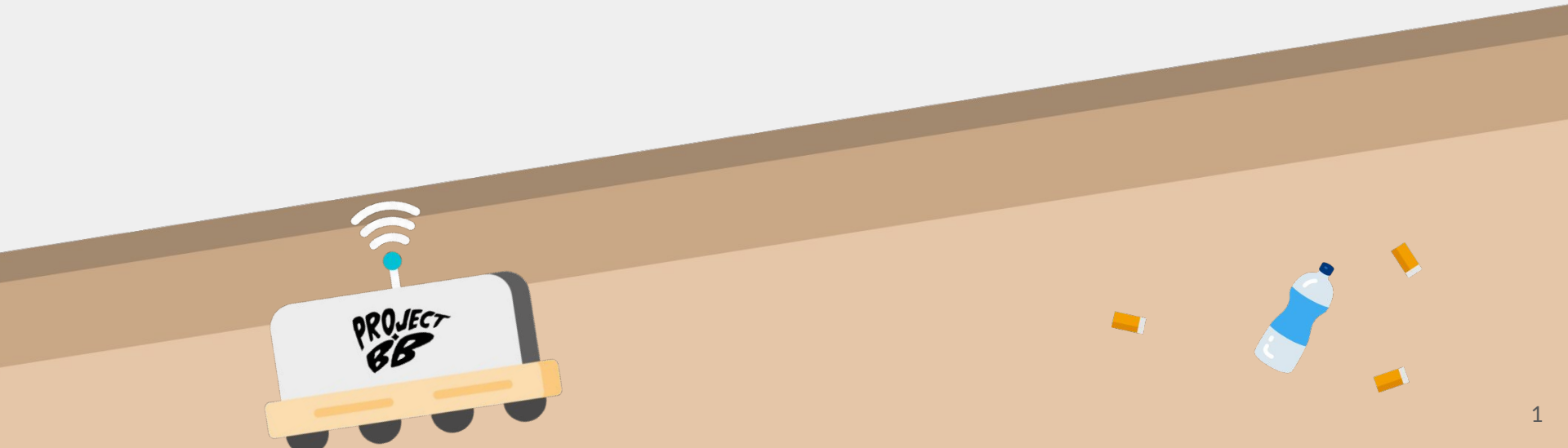
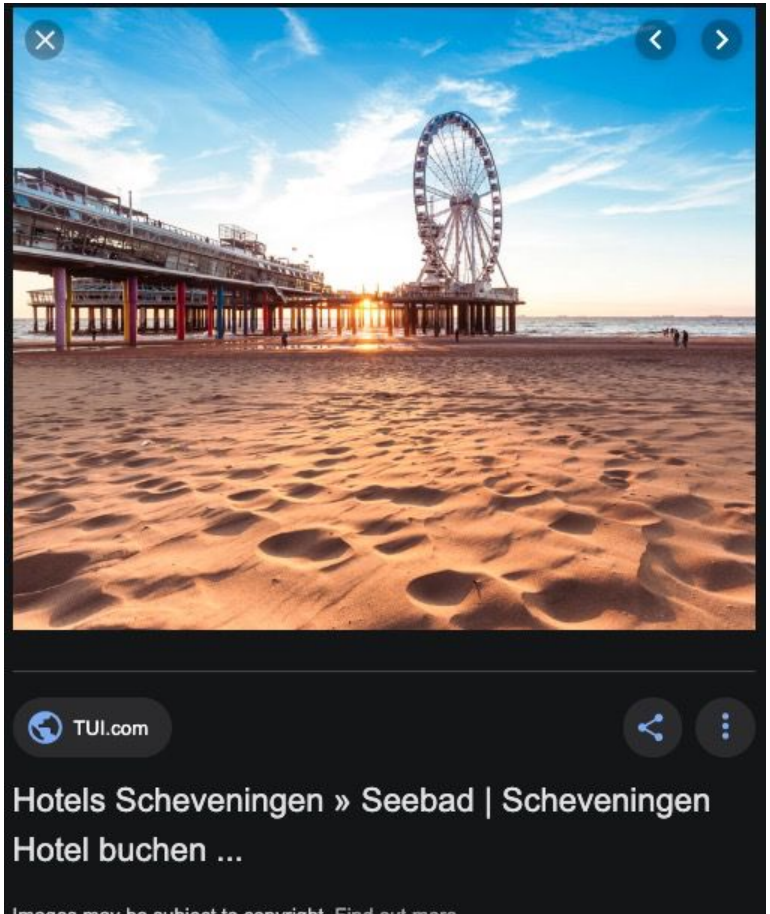
A beach robot ecosystem - on the Blockchain?



Stunning, right?



The reality

What is a beach?

"Beaches are **natural resources** that significantly enrich the tourist offer. […] Beach management is mainly **entrusted to authorities**"'

Where is the problem here?

- Beaches are considered as **public good**, but beach management is mainly entrusted to authorities = **centralized**
- Different strategies / focus per country
- **But:** The waste problem is global, as it affects the oceans

So, the conditions on our beaches depend on central planning ?

The Tragedy of the Commons

- Describes, that commonly used shared resources are used with different individual objectives
- Some people are solely following their short-term interests
- **Examples:** Deforestation, overfishing, pollution without recycling strategy
- Back then: **Central planning** was the go-to solution proposed by Garrett Hardin in 1968

What about tomorrow?

Sustainable Self-Governance

Water irrigation in Nepal

High alpine forests in Switzerland

Why those communities are successful...

- They are flexible in decision making
- They monitor social and environmental behaviour in an efficient way
- Judicial instances are fast and cheap in case of dispute
- No outside authorities interfere with their rule-making

But could this work on a larger scale?

Design Principles for a sustainable governance

- Elinor Ostrom designed eight design principles for sustainable cooperation

Source: https://medium.com/@daviddao/decentralized-sustainability-9a53223d3001

Principles translated to Smart Contracts

1. Token-based membership
2. Rules enforced via Blockchain Governance / Smart Contracts
3. Proposal system for members (vote / implement changes)
4. Monitoring & Machine Learning
5. Rising stakes for rule violations
6. Conditional dispute resolution
7. Censorship-resistance

The Idea behind DAOs

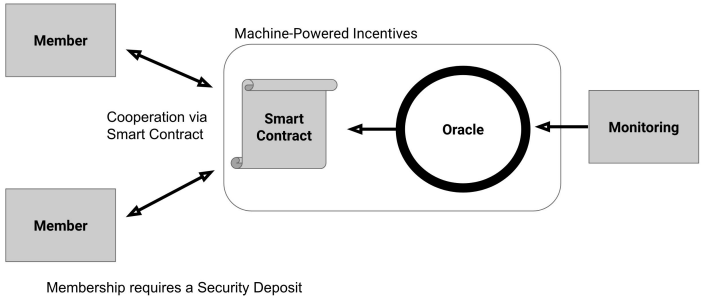
- DAOs are **Smart Contracts talking to each other without human intervention**
- Smart Contracts are **agreements** or **if-then-statements** manifested in code

But: Rigidity is a problem

- the rules of a company are set in stone before the company is incorporated and **cannot be changed in the future**

DAO requirements

- System is **able to run autonomously** (Set of Smart Contracts, no influence from outside should be able to stop it)
- Smart Contracts require “oracles” as an objective source of observation
- Should have a fungible asset / token that can be used to pay contractors (energy providers, insurance, developers, maintenance, reward community)
- Consensus model (PoW / PoS / Hybrid)



Flexibility of DAOs

- Changes in code (e.g. new rules in the system) require a hard fork
- Decentralized Applications need an organization to trust to fork contracts and development of the code
- dApps not yet fully decentralized (hosting)
- Development process can be slow

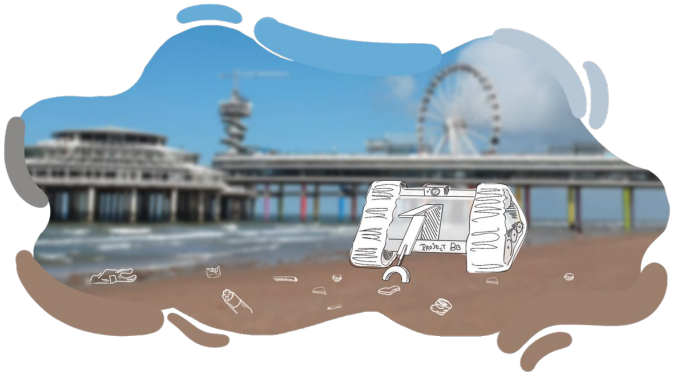
💡 DFO (Decentralized Flexible Organizations) could bring vast improvements

But do we really need a DAO (yet)?

- Robo.Foundation (and partners like T-Mobile) could fulfill all the requirements of a successful community:
  - They are flexible in decision making
  - They can monitor social and environmental behaviour in an efficient way
  - Judicial instances are fast and cheap in case of dispute
  - No outside authorities interfere with their rule-making (or e.g. censorship)
- Unless the robot itself is not fully autonomous, the so called “autonomous organization” would need to rely on many external factors
- Development process would carry too many obstacles and constraints in the testing phase

Client questions

- Could B.B be controlled as a Decentralized Autonomous Organization? **YES**
- Can we create a “trash coin” or a share for people that help to recognize litter? **YES**
- Could we combine this with the 5G test lab in The Hague? **YES**



But how?

Phase 1 - 5G Test bed without Blockchain

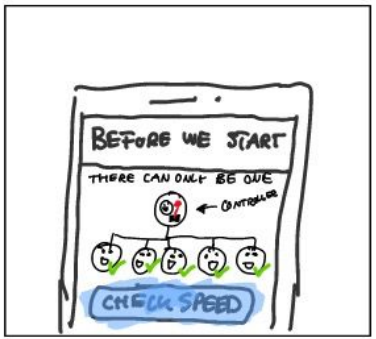
- Users in The Hague area can **sign up and identify** using phone number
- Whenever robot is available, **signed-up users in high speed network cells** get notifications for participation

SMS Notification **Registration** **Verification**

Phase 1 - 5G Test bed without Blockchain

- A **speed test would determine who will control the robot** or validate the collected trash
- Security measure: Users in surrounded cells could be excluded, as they could physically interfere with the robot

Notification for cleaning Challenge



Introduction

Phase 1 - 5G Test bed without Blockchain

- For 5 minutes, one user would be able to **control the robot and collect as many trash as possible** - Scoring system and prizes as incentive
- **Verifying users select, tag and verify single frames** of delivered video evidence and thereby **train the robot's AI model** on common beach litter objects

Controller Mode
(First person)

Verification Mode

Phase 2: Blockchain-based MVP

- Once AI model is trained and robot is autonomous in itself, **no manual controlling would be needed** anymore - Robot might trade AI datasets and algorithms using SingularityNET
- Financing through **local businesses** (those, who take financial profit from the beach as commons)
- Users could contribute to the ecosystem through **Location sharing** and thereby earn “TrashCoin” (robots know, where to go and meet consensus on that)
- Users could spend their “TrashCoins” in those businesses or hold it and propose improvements
  But let’s talk about technical details.

Phase 2: Blockchain-based MVP

- **Ethereum Blockchain** - allows implementation of Smart Contracts and connection with dApps
- Proof-of-Work base security layer summarizing transactions
- 2nd Layer as “real time” consensus layer
- Side chains for connected services
- DFO enables real democracy in the ecosystem
- Hosting of dApps / Micro Services within NFTs

Relevant projects: Aragon, Plasma

Phase 2: TrashCoin

- Fungible asset in the ecosystem
- Value backed by the natural demand on clean beaches by local businesses
- Can be earned by contributing users
- Users can spend their TrashCoins in participating businesses, they pay a discount while TrashCoin is returned back to the ecosystem

Why would businesses participate?

Phase 2: Participants in the ecosystem

Incentives - Local businesses:

- Clean beaches, attracting new customers
- Business exposure could be increased through placement of badge and **robot acting as affiliate** generating leads for local business

Incentives - Beach visitors:

- Interaction with beach robot as engaging experience
- Earn TrashCoins, contribute their part to the environment

Phase 2: Robot Swarm coordination

Beach cleaning through robot swarms would need to be controlled and prioritized in different ways:

- Are local business paying their contribution?
- Where on the beach did users report their locations / crowded places
- Is there actual demand?
- How will the demand develop in the next days / weeks / months?
- Do we need more robots?

Phase 2: dApps and Micro Services

Possible dApps / Micro Services for Business owners

- Manage their contribution
- Track the flow of attracted customers

Possible dApps / Micro services for Beach visitors:

- Location (provide location, help the robots in prioritization and receive TrashCoins)
- QR Validator (feed trash and receive TrashCoins for it)
- Beach guide including map with list of participating local businesses

Possible dApps / Micro services for Maintenance personnel:

- Maintenance tools for trusted external provider (Show last location of robot, possibly confirmed by other observing robots)

Phase 3 - Global roll-out

Decentralization is described as

"the process by which the activities of an organization, particularly those regarding planning and decision making, are **distributed or delegated away** from a central, authoritative **location** or group."

- A real **proof of concept** for the project could only be achieved through global expansion

Phase 3 - Opportunities

Lease robots to other markets in periods of low demands

- People in emerging markets would have smaller entry barrier to crowd-fund their local beach cleaning project

Self-sustainability without local businesses: On-site recycling

- Robots could buy AI models from SingularityNET to learn how to recycle
- They could hire employees to re / upcycle beach waste, sell it on local markets and get financed through the earned profit

Thank you !