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DISCUSSION

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Speculative and circular design applied to oceanic health and wellbeing – Envisioning possible futures with OZEAPON project

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ABSTRACT

Oceans are vital for the planet, regulating climate and producing oxygen, and are crucial for human health and wellbeing. Rapid advancements are occurring in marine-derived biomaterials and bioactivities, offering sustainable solutions for industries such as medicine, food, and cosmetics. The problematic addressed is that valuable knowledge about ocean, technologies, and algae research, is fragmented and not easily discoverable. There is currently no unified digital platform for information, learning, content sharing, and funding to inspire people and develop solutions related to oceanic health and wellbeing, despite the increasing need due to environmental and health concerns. Through following speculative and circular design approach it is aimed to envision possible futures for oceanic health and wellbeing with OZEAPON project. This paper addresses, through an empirical approach how to bridge science and imagination using participatory methods and a innovation-focused ecosystem.

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Introduction

Oceans and seas cover more than 70% of the Earth, supplying us with food, regulating our climate, and producing at least 50% of the oxygen we breathe (Regaudie-de-Gioux et al. 2014). The ocean plays a vital role in regulating our planet's temperature, several climatic parameters such as atmospheric circulation, precipitation patterns, and carbon cycling are significantly impacting global climate systems, and maintaining a global balance for citizens' health

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and wellbeing (Richardson 2022). There exists an opportunity to develop further sustainable and adaptable foundations for society through creating economic growth (Costanza 2013) that is environmentally sustainable and regenerative with green growth. By absorbing and sequestering carbon dioxide from the atmosphere, the global oceans play a critical role in modulating climate change. Oceans are critical to key economic sectors such as tourism and fishing, as well as providing habitats for organisms from whales to bacteria and viruses, with all the other forms of biodiversity.

The health of our oceans is increasingly under threat due to climate change, ecosystem degradation, and pollution – posing serious risks to the wellbeing of people worldwide. Scenarios such as the COVID-19 pandemic underscored the consequences of mismanaging our delicate relationship with nature, revealing deep vulnerabilities in both public health and global economic stability. It also exposed the long-term damage caused by the relentless over-exploitation of natural resources and unsustainable practices that continue to harm Earth's ecosystems (Vincent, Stanley, and Ring 2020).

The last decade has seen an increasing number of innovative biomaterials produced from marine organisms, with the science behind new biomaterials developing rapidly and ranging from coralline bone grafts to polysaccharide-based biomaterials. Several stages of discovery and development have taken place in the field of marine biopharmaceuticals. These include the discovery and development of chitin and chitosan, marine collagen, and other composite materials comprised of marine organisms (Kim 2013). These materials are simple to get and are excellent in terms of biocompatibility, biodegradation, and bioactive characteristics because they are abundantly available, reasonably priced, and biologically compatible with us humans. Besides, many marine compounds show valuable bioactivities that can be used as antibiotics. Drug delivery agents and anticoagulants are also being used to prevent metabolic diseases like diabetes and cardiovascular disease. These biomasses are being used for food, feed, agriculture, cosmetics, and other industrial purposes as well as for medical treatments in specialised fields (Wan et al. 2021).

The world has reached a stage in which everything needs to be eco-friendly and sustainable. This is the need of the hour, as our planet is grappling with several environmental issues such as climate change, deforestation, pollution, sustainability, and so on. To tackle these problems effectively, there is a surge in the demand for industries that are eco-friendly and sustainable, like regenerative ocean farms and sustainable farming practices on land. Introducing algae into the world of agriculture, such as regenerating soil for healthy food production in carbon-neutral, neutral, regenerative organic and zero-waste ways, can help to solve soil degradation, and adding seaweed supplements to cattle feed can reduce emissions from livestock by up to 80% (Roque et al. 2021).

In addition to being an irreplaceable part of the earth's ecosystem, oceans have an underestimated economic value because of their unique biodiversity.

There has been much talk recently about how design will play a crucial role in the future by inspiring the development of bio-based materials (Bos et al. 2024; Sandak and Butina Ogorelec 2023; Sørensen and Rosén 2021). They possess a wide range of potential in medical applications, including between design and the research and development of bio-alternatives to synthetic materials, which suggests a promising future for biomaterials derived from the ocean (Bell et al. 2022).

Addressing the context explained previously, the study presented in the paper is a part of research started in 2021 during a master's degree in Design for Health & Wellbeing from ESAD.CR, Portugal. Initially we started by discovering that the need for sustainable development combined with benefits in health and wellbeing and ecosystem services could be focussed with regenerative ocean farming innovations (Smith and Baske 2021). We learnt that developments in health foods, cosmetics, medicines and biomaterials from the ocean and algae science industries have been progressing at a rapid rate with numerous recent discoveries from algae, and other species like fish and shellfish, sea snails, sponges and a plethora of other oceanic organisms (Kim and Wijesekara 2010). From this stage, we wanted to understand how a complex system for optimizing and promoting the health and wellbeing of individuals and society should be addressed. In doing so, we believed that it would require a lot of secondary research trawling through academic and scientific research papers connecting them together to figure out how a digital system would optimize and promote the health and wellbeing of individuals and society through oceanic resources.

This initial phase (Flynn 2023) helped us to understand as we were trying to educate ourselves on a broad range of topics, that to fully realise and develop solutions for health and wellbeing, we would require numerous years of scientific research and study.

It became our belief that these benefits are the greatest and most sustainable solutions to many ongoing problems around the world. We realised that this needed to be recognised amongst more people and the proliferation of ocean and algae knowledge should become mainstream and popularised for the public to easily access. To do this would require developing a way of making that possible.

The paper presents, through a narrative approach (Byrne 2016), how speculative and circular design applied to oceanic health and wellbeing could envisioning possible futures to the problematic addressed through OZEAON Project. This empirical study briefly identifies the landscape of oceanic health and wellbeing to understand the different social challenges: A section where speculative and circular design are discussed as an approach for thinking about disruptive design projects. And a section that speculates on the role of design as integration and mediation, bridging science and imagination. The last two sections, discussion and conclusion and future work.

Oceanic health and wellbeing landscape

The health and wellbeing of a society can be largely put down to the ability to manage several different variables, including but not limited to their surrounding environment, social determinants, food availability, quality of medicine and healthcare, economic sustainability, and education (Marmot and Wilkinson 2006). Whilst trying to understand the wellbeing of individuals, we must also consider the relationship humans have with ecosystem services. The relationship between environmental change and human wellbeing was assessed in a critical review from the perspective of people in developing nations whose wellbeing is most dependent on ecosystem services, where the frameworks analysed drew upon environmental sciences, economics, psychology, sociology, and anthropology with their occurrence in real-world applications (Agarwala et al. 2014). The study presented by these authors renews 'emphasis on the importance of interdisciplinary or even trans-disciplinary collaboration among social anthropologists, economists, psychologists, and political scientists has broadened the scope of the human condition' with the relational dimension capturing the psychological need for rewarding connections to others in the conceptualisation and understanding of changes in wellbeing. This is a hybrid approach and may be useful for understanding the existing relationship between wellbeing and ecosystem services and identifying how natural environments are contributing to the wellbeing of individuals (Agarwala et al. 2014).

True development and growth can be understood by what the American/Australian ecological economist and professor at the Institute for Global Prosperity (IGP) from University College of London (UCL), Robert Costanza defines as 'Sustainable Wellbeing' (Costanza et al. 2014). This definition involves a healthy balance requirement among thriving natural, human, and cultural assets and sufficient and well-functioning produced or built assets. In other words, 'We need a new model of the economy based on the worldview and principles of ecological economies starting by recognising that our material economy is embedded in society, which is embedded in our ecological life-support system and that we cannot understand or manage our economy without understanding the whole interconnected system' (Costanza 2013, 39–40). Since the end of World War II, economic development has been predominantly measured by continuous growth in production and consumption. While the emergence of 'green growth' represents a step toward more environmentally conscious economic models, it remains rooted in the same growth-oriented paradigm. For a more oceanic health and wellbeing landscape a transformative approach requires moving beyond the presumption that perpetual economic expansion is the ultimate objective. Instead, economic systems around the oceanic stuff must be restructured around the goal of sustaining human and ecological wellbeing as the primary indicator

of progress, which is an essential shift for fostering peace, equity, and long-term planetary health (Cisneros-Montemayor et al. 2016).

Regarding this consciousness, Costanza's (2013, 39–40) description of a new economy presents four dimensions is presented in Table 1.

The project's goals aim to assist in the development of sustainable ocean-based innovation for renewable and regenerative infrastructure, biodegradable and recyclable materials and consumption, with governance abilities for the direction of the platform itself available to the users. Incentivising and inspiring educational resources and content creation through featuring user made articles for open science, videos and Do-It-Yourself (DIY) (Damoah and Botchie 2021) tutorials can help people to learn about sustainable innovations and grow their interest in education and learning new skills, thereby reducing national and global inequalities by increasing access to easily digestible knowledge. Incorporating the use of blockchain technology allows for transparent transactions within the distributed ledger that anyone can freely access and account for ensuring prices reflect social and environmental costs with the various abilities to invest in, fund and donate to projects for sustainable development and innovation. Promoting education and accessible information for a sustainable economy is at the core of the project.

Motivation

The environmental problems we are all currently facing with climate change can cause a long list of problems for the health and wellbeing of societies around the world, an event that made this issue immediately clear were the bushfires of Australia in 2019/2020, causing a serious health emergency that was proven to be triggered by the effects of climate change (Yu et al. 2020). The concerns for climate change are also evident here in Portugal, where temperatures have increased in the past decade and are projected to do so, with precipitation decreasing by 30% in the southern portion of the country and around 15% in the northern portion of the country by 2100. With

Table 1. Four main dimensions of a new economy (Constanza 2013, 39–40).

Sustainable scale – respecting ecological limits	Establish effective governance for natural commons. Implement cap-and-auction systems based on planetary boundaries. Balance consumption of non-renewables with renewable development. Invest in sustainable infrastructure. Dismantle incentives for materialistic consumption. Linked policies to address population and consumption.
Fair distribution – protecting capabilities for flourishing	Share work for balanced leisure-income trade-offs. Reduce global and national inequalities. Establish equitable governance for social commons.
Efficient allocation – building a sustainable macro economy	Use full-cost accounting to internalize externalities. Implement fiscal reforms promoting sustainability. Establish cooperative investment in stewardship. Promote financial and fiscal prudence. Ensure information availability for a sustainable economy.

climate change affecting sea levels, they are calculated to rise more than 0.4m increasing coastal erosion and flooding in relative sea level in the period 2081–2100 compared with 1986–2005 under a scenario where global warming reaches about 2.5°C by 2100. Severe heat waves, storms, and droughts are already affecting the country, and with climate change, they are expected to increase in frequency and intensity (Schleussner et al. 2020).

Problematic

While the benefits of ocean technologies, algae research, and marine innovations are significant, they remain difficult to access due to fragmented information and limited public awareness. To address this, open educational resources (OERs) can serve as a vital tool for making this knowledge more discoverable and actionable. There is no unified digital platform where education, collaboration, content creation, and funding intersect to inspire meaningful innovation in oceanic health and wellbeing. A unified platform that integrates education, content sharing, and project funding is essential to inspire and incentivise broader engagement in regenerative and sustainable solutions. As environmental degradation, public health challenges, and economic instability continue to rise, interdisciplinary innovation is increasingly vital. Curated and synthesised learning materials can support individuals new to these topics, offering accessible entry points into sustainable innovation at the ocean–climate nexus.

Research questions

1. What is the most appropriate form that an open educational resource should take according to the design research in consideration of speculative and circular design theories?
2. Would this be helpful for society in developing sustainable innovation?
3. What information will be most useful in summarising key scientific research in the specified categories, and will the platform be able to inspire users to create further innovations, add their own knowledge to the educational resources and create funding opportunities for real world solutions in this field?

Speculative and circular design approach in a project development

Speculative design is a research method that, rather than focusing on direct problem-solving, uses imagination and broader societal challenges as a platform to propose alternative futures through critical, discursive, and often fictional design interventions (Dunne and Raby 2013). The process is to design proposals that debate critical issues that may happen in the future for

example, from the concern of ecosystem collapse and climate change to create open and freely available solutions that could alter the course of the future of the world itself for the benefit of environmental and human health and wellbeing. Future consequences of what may happen in the world are considered with the implications of the existing relationship society has between science, technology, the environment and economy. Imagination for what could happen and how to best prepare for possible problematic scenarios are played out to present alternative products, systems or worlds. Proposed ideas are meant to trigger debate regarding future challenges and can seem disruptive or be irreverent towards existing systems or products to enact positive change rather than conforming to the status quo (Auger 2013).

The A/B manifesto (Table 2) introduced by Dunne and Raby in their book 'Speculative Everything: Design, Fiction, and Social Dreaming'. The differences between affirmative design and speculative design are highlighted below (Dunne and Raby 2013).

In speculating on a design, we can take our current position in time and what we currently know about, there here and now, and imagine what may occur in the future resulting in several different possibilities. Given that an idea of a preferable future is guided by the decisions of government and industry as opposed to the users of industrially produced consumer goods, speculative design proposes a way to address this and influence people to consider their own role as potential decision makers. Being that the future is not predetermined, can be quite unpredictable, and can be influenced by present choices; through analysing past and present developments and/or problems, it is possible to envision probable futures. In this we can use the concept of 'future cones' (Figure 1) to forecast possible outcomes and their

Table 2. The A/B manifesto, Dune and Raby (2013).

A	B
Affirmative	Critical
Problem solving	Problem finding
Provides answers	Asks questions
Design for production	Design for debate
Design as solution	Design as medium
In the service of industry	In the service of society
Fictional functions	Functional fictions
For how the world is	For how the world could be
Change the world to suit us	Change us to suit the world
Science fiction	Social fiction
Futures	Parallel worlds
The 'real' real	The 'unreal' real
Narratives of production	Narratives of consumption
Applications	Implications
Fun	Humour
Innovation	Provocation
Concept design	Conceptual design
Consumer	Citizen
Make us buy	Make us think
Ergonomics	Rhetoric
User-friendliness	Ethics
Process	Authorship

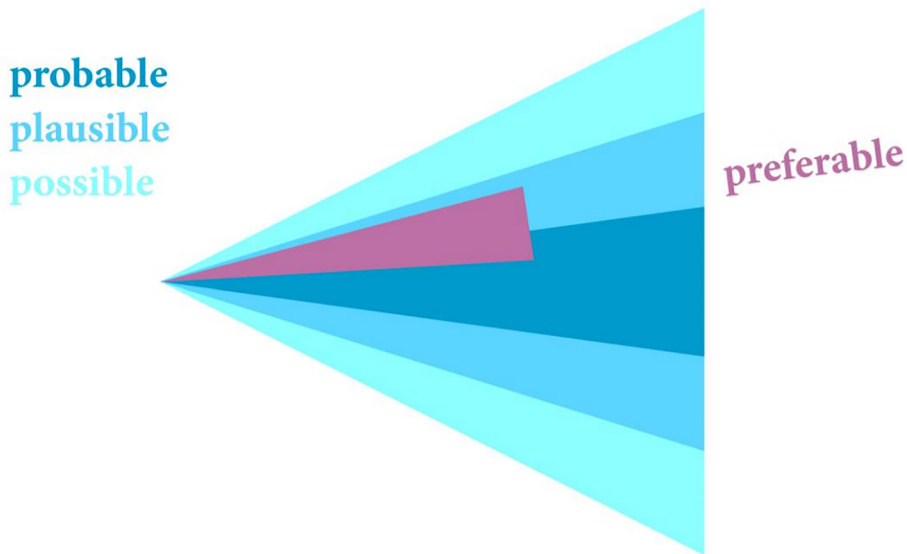


Figure 1. Future cones (Jakobsone 2017, S4259).

level of probability, with an addition of the concept of a preferable future that can be placed anywhere within the cones. Logically, if we can understand probable, plausible, and possible futures, we can eventually create a preferable one (Jakobsone 2017).

A lot of design has been taught and practiced with a 'take-make-dispose' model of resource use because following The Great Depression, a strategy for stimulating the economy was devised and implemented into the design of consumer goods by industry known as planned obsolescence (Slade 2006). Planned obsolescence helped companies to increase their profits and continuously develop new and improved designs for products. These products could be easily replaced by consumers and were produced in large quantities, therefore the established and traditional habit of reusing, repairing and recycling old goods became unnecessary as replacements became cheaper and more accessible. Due to the amount of pollution and waste these discarded products created and their damaging effect on the environment, alternative design frameworks needed to be developed by academics, designers and practitioners with a new understanding of how their work effects society (Moreno et al. 2016).

In consideration of this, new frameworks were developed towards the goal of creating more eco-friendly products from the inception of the design process. Green design came about in the 1970s focussing on recyclable materials, eco design in the 1980s with environmental considerations for each step of the design process, sustainable design in the 1990s by including social, economic and environmental factors, and design for sustainability in the 2000s in which designers strive for a sustainable future with radical designs. The most recent

concept in the step towards sustainability is that of a circular economy, which is envisioned to stop waste being produced in the first place (Geissdoerfer et al. 2017). An industrial economy that is restorative or generative by intention and design as defined by the Ellen MacArthur Foundation with three principles, driven by design (Ellen MacArthur Foundation 2013):

1. **Eliminate waste and pollution**

- 'The first principle of the circular economy is to eliminate waste and pollution. Currently, our economy works in a take-make-waste system. We take raw materials from the Earth, we make products from them, and eventually we throw them away as waste. Much of this waste ends up in landfills or incinerators and is lost. This system cannot work in the long term because the resources on our planet are finite' (Ellen MacArthur Foundation n.d.);
- Educational resources and DIY tutorials can inspire users to initiate activities such as beach clean-ups or community-led recycling projects (Damoah and Botchie 2021). For instance, individuals or groups might collect ocean plastic and repurpose it into new objects through design workshops or personal creative practice.

2. **Circulate products and materials (at their highest value)**

- 'The second principle of the circular economy is to circulate products and materials at their highest value. This means keeping materials in use, either as a product or, when that can no longer be used, as components or raw materials. This way, nothing becomes waste and the intrinsic value of products and materials are retained' (Ellen MacArthur Foundation n.d.);
- Making knowledge and research more accessible can spark greater engagement and innovation. Easy access to existing patents can also support best practices and sustainable manufacturing, helping to circulate materials at their highest value.

3. **Regenerate nature**

- 'The third principle of the circular economy is to regenerate nature. By moving from a take-make-waste linear economy to a circular economy, we support natural processes and leave more room for nature to thrive' (Ellen MacArthur Foundation n.d.).
- We support the circular economy principle of regenerating nature by promoting ocean-based solutions like algae cultivation, regenerative aquaculture, and ecosystem restoration. By incentivising community-led projects and curating educational resources, it shifts innovation toward practices that restore natural systems and allow marine ecosystems to thrive.

Bridging science and imagination – A role for design as integration and mediation

The OZEAON project

The OZEAON project stands at the intersection of design, science, ecology, and technology, proposing not only new systems of knowledge distribution but also new imaginaries for regenerative futures. In doing so, it bridges the often-separated spheres of empirical science and speculative creativity by positioning design as both a translator and a catalyst (Markussen 2017).

In traditional research environments, scientific knowledge is validated through observation, testing, and peer review. However, its dissemination often remains siloed, fragmented, or inaccessible to the broader public. Design intervenes by materializing data, embodying futures, and making complexity approachable (Dunne and Raby 2013). This bridging role is carried out through visual storytelling, speculative design, open-source educational resources, and gamified knowledge systems, which are synthesised from real-world ocean science and sustainability research, data and information collected to form a simplified and comprehensive catalogue for the public and a starting point for learners.

Speculative design plays a particularly critical role here. Rather than designing only for what is probable, using imagination to engage with preferable futures can be particularly useful (Dunne and Raby 2013). Propositions that provoke critical thinking and invite users to imagine alternative paths for oceanic health, climate resilience, and community wellbeing. Through participatory methods such as user-created articles, projects, videos, DIY tutorials and NFTs, we can explore what could be and how we might get there using open science, biotechnology, and circular practices.

Inviting multidisciplinary input

The purpose is to create a platform that is inherently transdisciplinary, drawing insights and practices from a wide range of fields: Marine biology, oceanography and environmental science provide the empirical foundation; identifying urgent ecological needs, combined with eco-industrial and biotechnological opportunities.

Design for health and wellbeing frameworks bring a human-centred approach that considers the psychological, ecological, and social dimensions of sustainability (Lupton 2013). Blockchain engineering and Web3 development enable new organizational forms (DAOs), ownership structures (NFTs), and incentive mechanisms through regenerative finance and cryptocurrency (tokenomics) that challenge existing economic hierarchies (Hassan and De Filippi 2021). Educational resources and open pedagogy help structure content and learning pathways that are accessible, interactive, and inclusive

(Hodgkinson-Williams and Trotter 2018). Art, design and speculative fiction inform the narrative dimension of the project, giving cultural form to scientific insight and enabling a broader affective engagement (Candy and Dunagan 2017). 'Experiential scenarios make the implications of data-rich trends and speculative analyses more tangible and culturally legible. They open affective pathways to engagement with long-range possibilities' (Candy and Dunagan 2017). By weaving together these domains, the project is designed to become not just a platform, but a prototype of a collaborative knowledge commons, and a space where interdisciplinary contributions are not only welcome but necessary. The integration of storytelling with scientific research, data visualization with ecological systems, and co-design along with actively engaging local and/or indigenous knowledge traditions enhances the cultural and environmental relevance of the project. 'Collaborative relationships that include traditional ecological knowledge can produce new forms of environmental understanding that are more socially and culturally relevant, especially when Indigenous peoples are equal partners in defining the problems and shaping the solutions' (Whyte 2013, 3).

Co-creation, not communication

'Publics must be enrolled not only as audiences of science but also as participants in framing the questions, interpreting the answers, and defining the scope of responsible action' (Jasanoff 2003, 240). Rather than seeing the public as passive receivers of information, OZEAON frames them as active co-creators of futures. The platform is designed not only to disseminate curated knowledge but also to encourage user-generated content, allowing designers, scientists, entrepreneurs, artists, educators, and technologists alike to contribute articles, DIY tutorials, concept designs, and speculative scenarios. This participatory model supports the idea that meaningful change is not imposed; it is composed, collaboratively and contextually (Jasanoff 2003; Björgvinsson, Ehn, and Hillgren 2012).

Results from the first stage

User surveys: Gauging perceptions and needs

Two sequential surveys were conducted to inform the design and development of the OZEAON platform. The first research survey (Annex 1) was design to support in creating an educational resource that enhances public understanding of algae. The goal is to make information about innovative ocean farming techniques and recent algae-related research – spanning healthcare, ecosystem services, the economy, food, and design – more accessible and easier to grasp.

Results gathered input from 134 global participants, predominantly from Portugal, the United Kingdom, Australia, and the United States, with a wide

range of professional backgrounds including researchers, designers, students, and environmental advisors. Results ([Annex 2](#)) reveal that 78.4% of participants believe the health of the ocean is directly linked to their personal health and wellbeing. Additionally, 84.3% agreed that an accessible educational resource on oceanic innovation would be valuable.

A significant 91.9% emphasized the importance of design intervention in advancing the field, and 84% support the idea that a Decentralized Autonomous Organization (DAO) could help long-term development. This reflects a strong openness to innovation and Web3 solutions. However, trust in blockchain technology remained moderate – most respondents rated their trust in such systems at 3 out of 5 or lower, indicating cautious optimism.

The second ([Annex 3](#)), more targeted survey refined thematic categories and user interface preferences for the educational platform. While direct mentions were limited, biotechnology was referenced once, and climate change appeared once, suggesting emerging but not yet dominant themes. Surprisingly, terms like ‘ecosystem services,’ ‘food systems,’ ‘biomaterials,’ and ‘world hunger’ were not explicitly mentioned in the responses, indicating a need for clearer framing or terminology alignment in future surveys. The user interface feedback was more robust: Design was mentioned 7 times, and layout appeared 4 times, showing strong user interest in visual and structural aspects. Navigation was mentioned twice, suggesting moderate concern for ease of use. Functionality and content were not directly mentioned, but user ratings provide deeper insight ([Annex 4](#)).

These findings guided the prioritization of UX design elements and content architecture, revealing an appetite for content that is accessible, trustworthy, and diverse in form, ranging from documentaries and video explainers to DIY tutorials and interactive articles.

Benchmarking: Comparative analysis to inform platform design

Benchmarking was conducted across a variety of existing platforms including:

OER Commons (educational resources and group collaboration tools); Materia (DIY regenerative material recipes and AI-enhanced material databases); Kickstarter (crowdfunding infrastructure); WORMS (World Register of Marine Species); Parley for the Oceans (public engagement, activism, and course-based education); SCINET (decentralized platform focused on scientific research and finance); SPIRALS (decentralized platform focusing on financing projects that fight climate change).

These platforms were compared using a UX benchmarking matrix across key features such as: Free to access; Public user contributions; Funding ability; User-friendly interface; Educational content; Tutorials or courses; Social interactivity; Collaborative community; Data-base powered; Blockchain technology; Environmental action.

No single platform fully encompassed all desired features. OER Commons had the most robust educational framework and user-generated contributions. SCINET and Spirals demonstrated promising use of decentralized technologies for scientific impact and funding, but were still in early stages of development. Parley for the Oceans offered strong aesthetics and storytelling appeal but lacked interactive user contribution mechanisms.

This comparative analysis validated the need for a hybrid model like OZEAN. One that combines the accessibility and structure of an OER, the community-building and project funding of a DAO, and the regenerative ethos of organisations like GreenWave. It also confirmed the feasibility of a Learn-to-Earn tokenomics layer, enabling engagement-based incentives while promoting scientific knowledge.

Prototyping and testing

Low and high-fidelity wireframes were created based on initial research and refined through iterative user testing ([Annex 5](#)). Participants responded positively to the categorized layout of content (e.g. Health and Biotechnology, Ecosystem Services, Economy and Industry, Food, Design Applications), with emphasis placed on visuals, usability, and accessibility across devices.

Prototypes included: A modular OER landing page; Cross-platform desktop and mobile applications; User profile interfaces for publishing content, earning tokens, and participating in research projects.

User testing revealed ([Annex 6](#)) revealed several key insights for improving the educational platform. While onboarding and incentive mechanisms were not explicitly flagged in the responses, broader feedback indicated moderate familiarity with blockchain concepts – most participants rated their understanding at 3 out of 5 or below. Despite this, interest in developing a Decentralized Autonomous Organization (DAO) was strong, with 30 participants expressing support and 16 indicating cautious interest.

Engagement features such as storytelling, gamified quizzes, and open research articles were not frequently mentioned directly, but qualitative responses emphasized the value of simplified, visual, and narrative-based formats. The concept of ‘learn and earn’ through content contribution or curation was not explicitly referenced, though the overall enthusiasm for DAO-based incentives suggests potential appeal, especially among early-career researchers and creatives.

These findings informed a redesign of the User Interface (UI), focusing on clarity, accessibility, and multi-format content delivery to better align with user expectations and technological comfort levels.

Discussion and conclusion

The platform’s mission (to popularize oceanic science, catalyse regenerative development, and redistribute opportunities through open technology)

resonates across a diverse global audience. By integrating speculative and circular design methods into platform development, OZEAON doesn't just disseminate knowledge; it invites co-authorship of future narratives – [Figure 2](#). It serves not only as an archive or library, but as an ecosystem of innovation; where design becomes both medium and message in addressing ecological, economic, and cultural challenges at the ocean-climate nexus.

The OZEAON project exemplifies how design can serve as a powerful integrative force between scientific knowledge and imaginative speculation. Rather than presenting ocean science as a static repository of facts, OZEAON

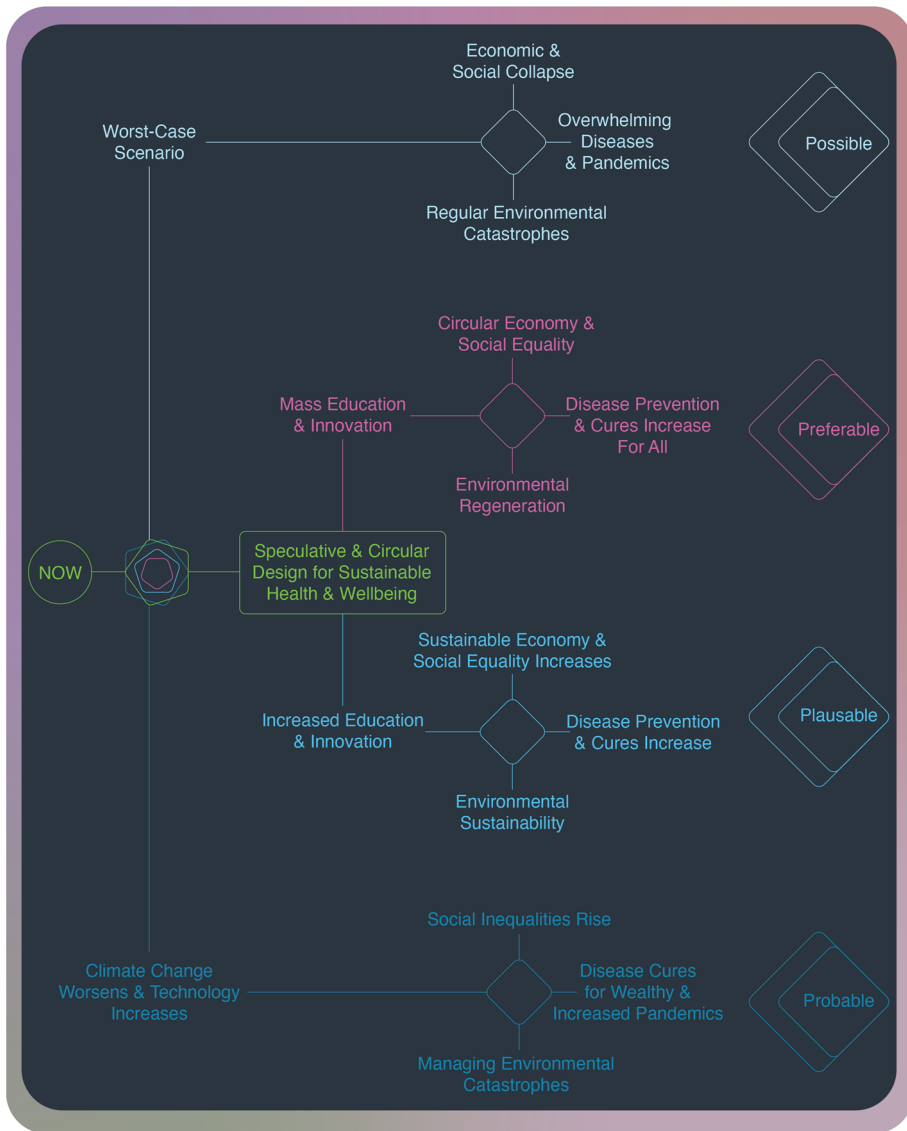


Figure 2. Materialise the scenario to provoke an audience (Flynn 2023).

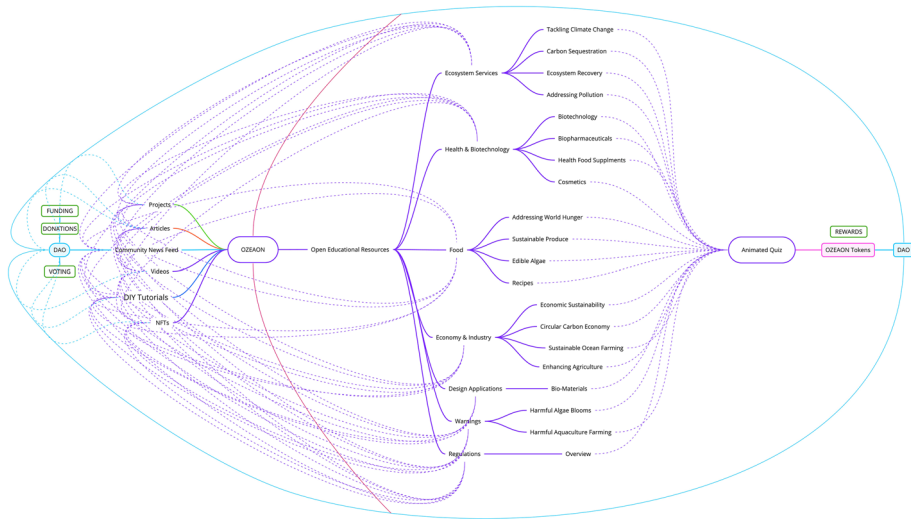


Figure 3. OZEAON mindmap.

repositions it as a living, evolving field that gains strength through collaborative exploration and public engagement. The platform's design foregrounds the role of speculative thinking in imagining regenerative futures, while grounding those visions in practical, circular strategies that address material and ecological realities. This dual focus enables users not only to understand scientific concepts but to reframe them as tools for innovation, storytelling, and real-world transformation.

Through extensive user research, benchmarking analysis, and iterative design, the project reveals a strong understanding of platforms that are at once educational and inspirational. By incorporating features such as project funding, article submissions, videos, tutorials, NFTs, OERs, and decentralized governance, OZEAON enables a participatory learning environment that is adaptable to multiple contexts and audiences. In bridging science with imagination and facilitating multidisciplinary dialogue, OZEAON demonstrates how design can move beyond aesthetics or problem-solving alone to act as a form of critical infrastructure; one capable of cultivating new forms of agency, creativity, and care for planetary systems (Figure 3). It proposes not only a platform, but a shift in how we relate to knowledge, one another, and the more-than-human world.

Future work

As the OZEAON platform continues to evolve, its development roadmap is oriented toward deepening its capacity for collaborative knowledge production, regenerative and sustainable innovation, and ecological impact. Several core areas of future work are currently in focus, each aimed at enhancing the platform's functionality, accessibility, and sustainability.

The integration of AI into the platform will move beyond summarisation and basic content curation toward more context-aware tools that support both research and learning. Planned developments include natural language querying of scientific literature, AI-assisted translation to expand multilingual accessibility, and generative learning modules capable of producing customised educational pathways based on user goals or learning history.

As part of OZEAON's future platform architecture, an evidence of the future protocol is being developed to integrate learning, contribution, and funding activities into a transparent, incentive-driven ecosystem. This protocol will underpin the Educational Resources, Project funding area, and the creation of articles, videos, and DIY tutorials by linking user engagement directly to platform governance and rewards. A dual-token blockchain system ([Figure 4](#)) is being designed to support this functionality: the \$OZEAON token, which is tradable and represents the primary economic layer of the platform, and the Progress token, a non-transferable token earned through meaningful participation. Users gain Progress tokens by submitting verified contributions, such as original articles or tutorials, to the Educational Resources or by funding projects hosted on the platform.

These tokens function as a staking and voting mechanism, allowing users to influence DAO decisions, such as which user-created articles are approved as contributions to the Educational Resources or for voting on proposed modifications to the platform itself. Additionally, Progress tokens can be staked to earn \$OZEAON tokens, creating a positive feedback loop that rewards consistent engagement and reinforces the value of collective knowledge production and regenerative action. The proposed evidence of the future protocol aligns with current token engineering frameworks that prioritise transparent, participatory governance and incentive models for knowledge production and collective decision-making (Token Engineering Commons [2022](#)).

Future versions of OZEAON will expand the use of blockchain beyond content governance to include bounty-based mechanisms for data collection, validation, and funding of research projects. Additionally, blockchain will support traceability and provenance of educational content and intellectual property. Smart contracts may be implemented to allow for licensing and attribution of user-generated content, facilitating ethical knowledge-sharing while protecting creators' rights (De Filippi and Wright [2018](#)).

A key area of future work involves the integration of a blockchain-based Digital Monitoring, Reporting, and Verification (DMRV) system. This will allow user-led projects (particularly those that receive funding or recognition through the platform) to be transparently tracked, verified, and connected to broader environmental impact frameworks (World Bank [2022](#)). Every funded or registered project within OZEAON would be assigned a unique digital identity, potentially in the form of a non-fungible token (NFT). This identity

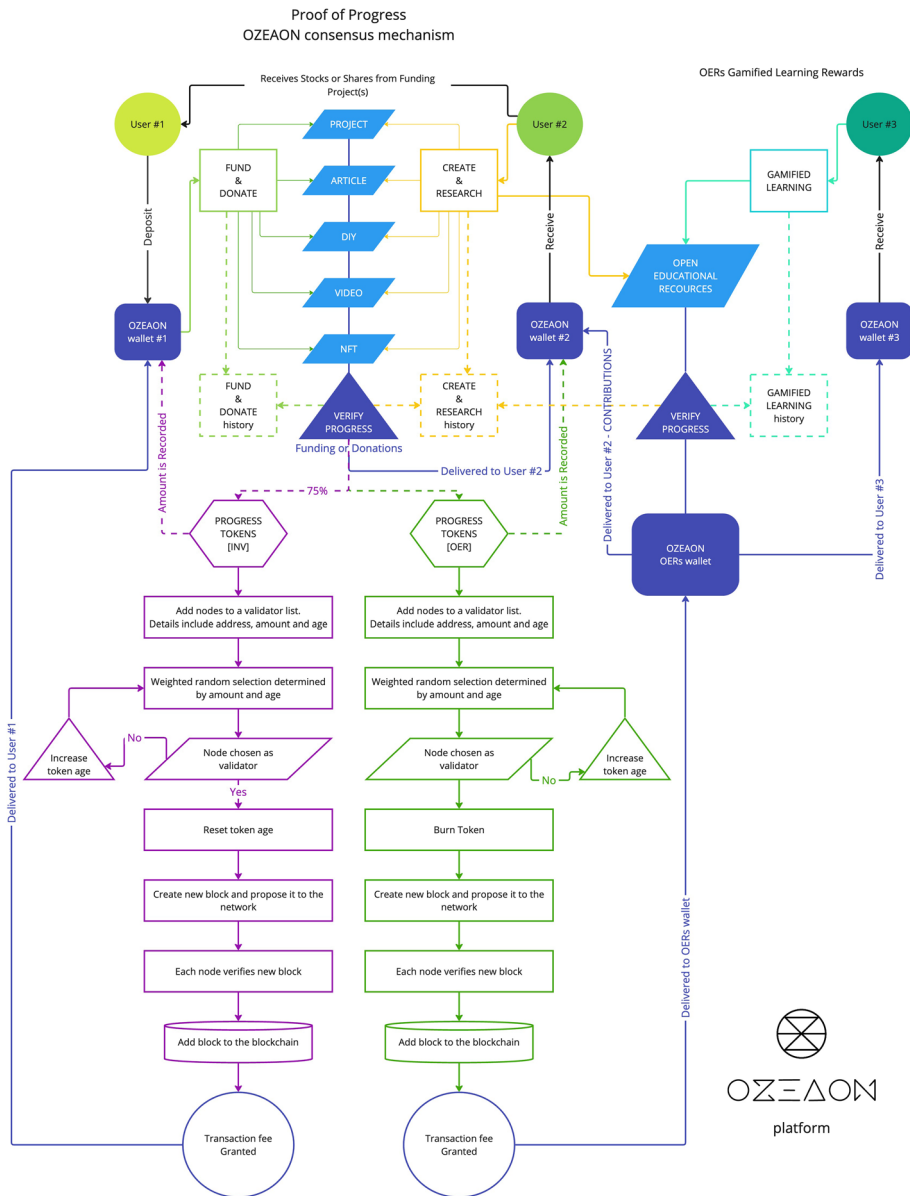


Figure 4. Proposed evidence of the future consensus mechanism (Flynn 2023).

serves as a traceable container for all project metadata, evidence, and impact reporting. As projects progress, contributors would be able to upload data, media, field reports, sensor outputs, or satellite imagery, which would be anchored immutably on-chain. These entries would form a living, time-stamped ledger of impact, accessible to funders, communities, researchers, and governance bodies.

An important dimension of this DMRV infrastructure is its future interoperability with carbon markets and emerging nature credit systems (World

Economic Forum 2023). Projects verified on OZEAON could eventually be integrated with: Carbon credit frameworks, particularly those tied to blue carbon ecosystems such as kelp forests, mangroves, or seagrass meadows; Biodiversity credits, measuring habitat quality improvements, species presence, or ecosystem services restoration; Ecosystem service valuation, such as nutrient cycling, water purification, or shoreline protection.

We also seek to investigate the long-term potential of quantum computing, particularly in tandem with AI and blockchain technologies. As quantum processing capabilities advance, they offer the possibility of dramatically reducing the energy consumption and computational costs associated with large-scale data analysis, cryptographic operations, and integrating AI as a tool for scientific inquiry and synthesis. This convergence could enable the platform to deliver powerful scientific simulations and real-time research support with a lower carbon footprint (Angerami and Nielsen 2023; Peterson and Rajuroy 2025).

Author contributions

CRediT: **Joseph Flynn**: Conceptualization, Investigation, Methodology, Resources, Visualization, Writing – original draft; **Teresa Mouga**: Formal analysis, Supervision, Writing – review & editing; **Cláudia Pernencar**: Formal analysis, Supervision, Writing – review & editing.

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