



Orvium

## Whitepaper

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### Accelerating Scientific Publishing

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Connecting researchers and publishers with trusted reviewers to accelerate publishing along with incentivized peer review.

# Executive Summary

## Problem Overview

The scientific publishing industry is one of the most profitable in the world. The top five publishers account for 50% to 70% of all publications, and their profit margins have been reported to exceed those of companies such as Google, Amazon and Apple. In 2015, the global market for scientific, technical, and medical (STM) publications was an estimated \$25 billion.

In contrast to any other publishing industry, private scientific publishers have pushed the publication efforts and costs to the research community. Scientific publishers have created an awkward triple-pay system: (1) governments fund most of the research, (2) volunteer scientists—usually paid by the government or research institutes—review the work, and (3) publishers sell the product back to governmental institutions and universities. Scientists and research institutions regularly criticize this outrageous economic model, which compromises the dissemination and growth of scientific knowledge, a process responsible for some of the most revolutionary changes in human history.

Moreover, the current publication model has several problems affecting the research community, including high publication costs; copyrights held by publishers rather than authors; long, opaque and biased process; lack of rewards and recognition for researchers; and a proliferation of low-quality journals.

## Solution

Orvium works to eliminate market inefficiencies and improve the quality and effectiveness of scientific publishing. The ultimate objective is for Orvium to be the leading publication platform for the research community while returning the benefits of science to the society.

## Product

The Orvium platform features:

- Proof of ownership for manuscripts.
- Copyright and licenses are owned and transferable by authors.
- Optimal publication and access costs.
- Create decentralized journals with low maintenance and operational costs.
- Integration between research data and results.

- Public recognition and economic reward for peer reviewers.
- Journal subscription freedom. No journal subscription model is enforced.
- Accommodates gray literature and its validation.
- Calculation of quality metrics such as impact factor and peer review quality.
- Eliminates current “predatory” practices and conflicts regarding plagiarism, idea ownership and registration.
- Social platform.

## Business Model

Orvium establishes a transparent, comprehensive and competitive business model to obtain and increase revenue while supporting global research. Orvium’s business model is built on top of two of the most important areas in research: review of manuscripts and scientific journals management.

These two areas lay at the centre of research publishing and, once they are fully operative in the platform, evolution to new streams of revenue becomes natural like professional career progress and talent finder, science patronage, data storage, etc.

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## Introduction

### Scientific Publication in the Digital Age

In 1989, Tim Berners-Lee, a British scientist at CERN, the European Organization for Nuclear Research, created the World Wide Web (WWW). After years of development, the core software of the WWW was made public in 1993, in accord with CERN's open nature. CERN made the next release available via an open license to ensure and maximize its dissemination and applications.

The WWW was originally designed and developed to meet the demand for automatic information sharing between scientists at universities and institutes around the world. Since then, the WWW has become ubiquitous in everyday life, making achievements far beyond its initial expectations.

In this environment, the scientific publication industry has used new technologies to increase revenues and benefits, but their business model has not evolved. Rather than becoming more open, to help move academic research, it has become more restrictive, keeping information behind paywalls. This model also introduced biases, publication delays, barriers to science dissemination and left researchers and research institutions increasingly frustrated with the status quo.

### Science and Its Impacts on the Society

The limitations of the current publication model are not only affecting the scientific community, they have significant negative implications for everybody. Science has a major impact on society, it is the force behind some of the most revolutionary changes in human history. Science drastically changes the way we live, communicate and work, it even changes the length and quality of life itself.

### The Research Cycle and the Importance of Dissemination

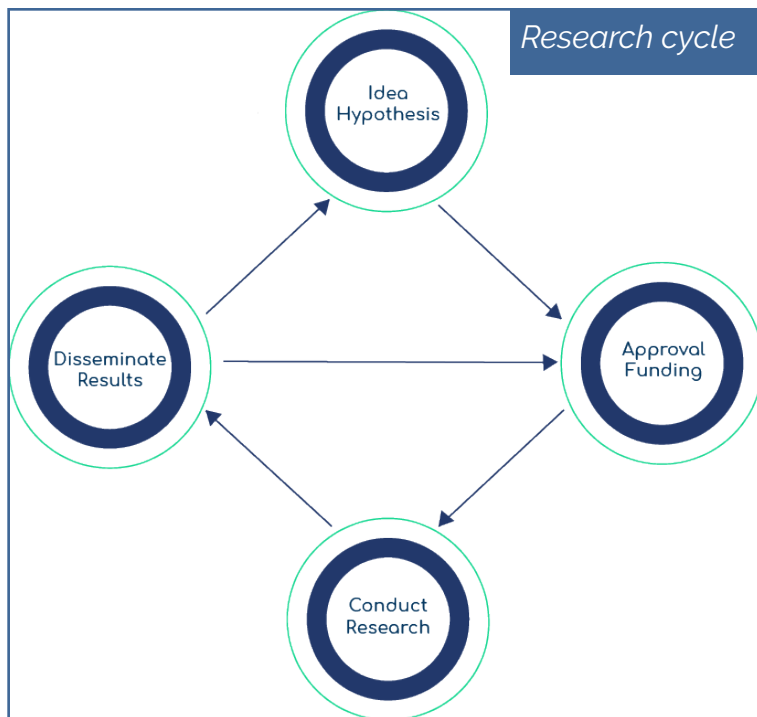
The remarkable achievements of science have been made possible thanks to many factors. One of the most important is the definition of a structured production process, which has been progressively depurated over the years. This process creates a highly collaborative cycle where researchers are inspired to generate new ideas based on the results and work of other researchers. This cycle can be summarised in four main phases, which are strictly correlated and interdependent<sup>1</sup>:

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<sup>1</sup> The future of research (science & technology); Presentation to British Library board. <http://www.slideshare.net/dullhunk/the-future-of-research-science-and-technology-presentation>

- Idea discovery and hypothesis generation
- Approval and research funding
- Conduct research
- Dissemination of results

The dissemination of results one of the core phases. Scientists find the fundamentals of new ideas in existing work, base the funding and approval process on literature review and awareness of the problem, and finally, the research method replicates or builds on previous methodologies already published and validated. Therefore, how scientists disseminate their results and discoveries plays an essential role in the science cycle.



Dissemination has been seriously compromised by the current scientific publication industry. Recently, this has caused a reaction in the scientific community, which is reflected in the surging number of articles published using open access initiatives (e.g., arXiv and its variants, PLOS ONE and IOP Publishing). This trend strongly suggests a takeover of the publishing market by open access platforms and journals during the next decade<sup>2</sup>. Nevertheless, to make this takeover possible we believe that a complete model and technology disruption is absolutely required.

## Blockchain and Science Dissemination

Blockchain technology allows building new infrastructures that enable open and trustworthy decentralized environments. People can submit entries into public records of information and the community of users can control how those records are amended and updated. Blockchain networks exist in a state of continuous consensus and automatic consistency checks. In addition, it is transparent and it is almost impossible to corrupt or hack. These properties represent an unprecedented

<sup>2</sup> Laakso M, Björk B-C, [Anatomy of open access publishing: a study of longitudinal development and internal structure](#), 2012.



opportunity to disrupt the scientific publication industry and return the control of science dissemination to scientist, while improving the way it impacts society.

## The Orvium Solution

Orvium introduces a disruptive business model into the research publication market through a unique combination of four core technologies: 1. blockchain and smart contracts; 2. decentralized storage 3. cloud computing; 4. big data analytics and machine learning.

Using blockchain technology and a decentralized storage approach will allow a public, fully traceable, and trustworthy record of the publication process at a minimal cost. Meanwhile, cloud computing technologies will provide flexibility, global availability and scalability to the platform and services. Finally, big data analytics and machine learning will enable advanced analyses to enhance life cycle automatization, facilitate peer review accuracy (e.g., identify plagiarism), classify papers based on their content and identify emerging trends and topics, among other goals.

Our objective at Orvium is to help the scientific community share its publications, eliminate existing inefficiencies and biases of the publication market and improve the quality and effectiveness of the publication life cycle. Orvium's model focuses on the following areas:

### ***Help to enhance science to human heritage***

***“Science is a beautiful gift to humanity; we should not distort it” - A.P.J. Abdul Kalam.***

Science is not just a beautiful gift to humanity but also one of the most important components of human heritage. As such, science and associated research activities need to be protected and preserved in their purest state while open access to the scientific knowledge needs to be ensured. Efforts to chain the business sales model with consortia licensing and attempts to change the business model by introducing open access journals and archives have had positive impacts, but they have not solved the main problems.

In this sense, Orvium proposes an open and transparent framework that will eradicate existing access barriers to scientific knowledge by aligning the publication model with research objectives. Orvium will empower the scientific community to fully own and control all aspects of dissemination.

### ***Offer a business model that returns benefits to science***

In contrast to any other publishing industry, scientific publishers have successfully foisted the cost and effort of publication onto the community that they serve. Governments fund most of the research and once research results are ready for

publication publishers acquire them for free. Then, the bulk of the editorial burden — checking the scientific validity, evaluating the experiments and judging the scientific worth of the research — is done through the process of peer review<sup>3</sup>. That burden is borne by working scientists on a volunteer basis; their salaries are normally paid by the government and research institutes. Finally, the publishers sell the product back to government-funded institutional and university libraries, to be read by scientists, who, in a collective sense, created the product in the first place. This outrageous economic model has been criticized by numerous scientists and research institutions as a perverse and needless business as well as a public scandal<sup>4</sup>.

Orvium intends to stop this drain of resources by offering a fair model which brings costs to a minimum and ensures authors and research institutions retain full ownership of copyrights and licenses. In addition, Orvium provides mechanisms to cycle back the benefits generated by the scientific community to scientists and funding institutions.

### ***Make science more transparent, universal and open access than ever before***

All Orvium source code will be published under an open source license, but the commitment to openness and transparency extends much further. Every single action, task, and transaction in the system (e.g., submissions of manuscripts, revisions, publications, peer reviews, citations checks, author acceptances) will be accessible to anyone. This is supported using blockchain and smart contract technologies at the core of the system.

### ***Truly recognize researchers' work and its impact***

Currently, the perceived quality of an article, and therefore the researcher's work, is largely determined by the journal in which the manuscript is published. In essence, the journal impact factor is used as a proxy for the quality of the research. Unfortunately, this approach lacks statistical robustness, alters editor and researcher choices and incentivizes the addition of extraneous citations<sup>5</sup>.

Orvium proposes an evolution to the model to evaluate scientific results. At the core of this model is a set of metrics directly derived from public blockchain records. These metrics determine the quality and importance of a given manuscript. In this sense, journals no longer exist as a core entity. Instead, manuscripts take the central role. Orvium calculates the impact of a given manuscript by a fair and transparent use of factors that are all publicly available in the blockchain: peer reviews accepted, the importance of the reviewers within the field, quality of references and citations used, author previous work, and so forth.

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<sup>3</sup> [https://en.wikipedia.org/wiki/Scholarly\\_peer\\_review](https://en.wikipedia.org/wiki/Scholarly_peer_review)

<sup>4</sup> [Is the staggeringly profitable business of scientific publishing bad for science?, 2017.](#)

<sup>5</sup> Arnold D N, and Fowler K, [Nefarious numbers](#), 2011.

### ***Maximize scientific validation and collaboration***

At Orvium, we believe that independent peer reviews are an excellent manner to validate scientific results. However, we are aware that it has biases and problems. Orvium introduces an innovative integration between blockchain and big data analytics technologies which will leverage an unprecedented framework to detect and avoid most of those biases and problems.

Orvium aims to go much further than that. Sharing the research data, code, etc., that has led to the results and conclusion published in a manuscript will clearly improve the scientific validation and potential scientific collaboration.

Our vision is to allow the entire community to have access, not only to the results of the study, but also to the study itself.

### ***Incorporate society in the scientific process and its evolution***

Orvium aims to open science to society and incorporate the public into the scientific process and its evolution. Orvium will support that using a disruptive business model focused on scientists and enhancing the participation and involvement of society.

## Market Overview

### Opportunity

In 2015 there were an estimated 9 million active researchers. They published between 1.8 and 2 million articles per year, which collectively produced more than 2.5 billion full-text downloads. These numbers grow by 3 to 3.5% yearly<sup>6</sup> and do not consider open access models. To give context on those numbers, 3 billion downloads is the total number of apps downloaded from iTunes Apple store during its first 3 years of existence<sup>7</sup>.

The scientific publishing market size is \$32 billion<sup>8</sup> and grows steadily at 4% yearly with some publishers reporting margin profits higher than companies like Apple or Google<sup>9</sup>.

### Entry Barriers

The nature of the current publishing system introduces important market entry barriers<sup>10</sup> to new disrupting entities. Those arise from different false perceptions promoted by the existing industry and is associated with different factors:

- **Social and scientific factors:**
  - Fear of ideas being stolen or not being properly credited.
  - Fear of reputational risks from trying new things.
  - Lack of trust in citizen science, perception of lower quality.
  - Established researchers are less likely to change.
  - Perception of the impossibility to establish a fair benefits system for researchers for sharing data or making papers accessible.
- **Technological factors:**
  - Unnecessary idea, forced by the industry, requiring long-term investment in digital infrastructure for storing data and publications.
  - Lack of integrated data infrastructure across disciplines and organizations.
- **Policies and costs factors:**

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<sup>6</sup> <http://www.markwareconsulting.com/the-stm-report/>

<sup>7</sup> <https://www.statista.com/statistics/263794/number-of-downloads-from-the-apple-app-store/>

<sup>8</sup> Ware M, & Mabe M, *The STM report: An overview of scientific and scholarly journal publishing*, 2015.

<sup>9</sup> Larivière V, Haustein S, Mongeon P, *The Oligopoly of Academic Publishers in the Digital Era*, 2015.

<sup>10</sup> Drivers and barriers of open science (<https://ec.europa.eu/research/openscience/index.cfm?pg=drivers&section=monitor>)

- Perception that open science activities, such as preparing data for sharing, are time-consuming.
- Opaque decisions about fees and policies that are driven by private interest rather than public good.
- Current forced copyright and licensing model perceived as the only viable option.

## Go-to-market

Orvium introduces an efficient and simple strategy to overcome market entry barriers. The strategy is based on promoting open and transparent access to scientific knowledge while supporting the required technological evolution. The core of the strategy is described in the following areas of action:

- **Break publication cost barriers:** The publication process on Orvium allows for a fundamental reduction of publication cost through participation of the community or by defining custom licenses. For instance, helping to improve the quality of the science and/or validating the science through peer review is rewarded in the form of Orvium tokens. Nevertheless, Orvium will support researchers by covering publication associated costs under certain conditions.
- **Improve knowledge dissemination:** Currently, public research institutions and universities are publicly rewarded based on the number of papers published in high impact journals, which are mostly private. This leads to the triple-pay loop, while also creating a barrier to open access and limiting the dissemination of knowledge. Orvium will allocate part of its budget to create, promote and leverage Orvium's publication model. This will help to break the loop and eliminate the barriers while maximizing dissemination.
- **Support research:** Orvium will fund research areas with a clear impact on society. The awarding process will be transparent and open to any member of the Orvium community.
- **Enhance R&D collaboration frameworks:** Orvium's core is formed by leading-edge technologies. Big data analytics, blockchain, smart contracts, and machine learning are rapidly and continuously evolving. The Orvium team is committed to fostering public R&D activities. In this sense, Orvium LTD will have a role in establishing collaboration and funding frameworks for R&D with universities and research institutions. Orvium will also ensure that the results are made publicly available and open source.
- **Open source development:** Orvium is committed to open source coding. All the software developed is, and always will be, open source, facilitating the required technology evolution.

## Current Model Inefficiencies

### High Costs to Access Scientific Results

During the last few decades, which have included developments such as the digitization process and the internet, scientists and scientific institutions have tried to re-engineer the publishing of scholarly peer reviewed journals by creating digital Open Access journals. Nevertheless, the high costs to develop, maintain and operate the required services and infrastructure have hampered the continuity and longevity of operations. Approximately 50% of Open Access journals survive long-term<sup>11</sup>. In addition, authors directly experience high publication costs (3,000–5,000 USD per publication<sup>12</sup>), which precludes the submission of manuscripts from researchers with fewer resources. Their only option is to target standard private journals.

Aside from the publication costs, another problem for libraries is subscription packages that bundle hundreds of journals of widely varying quality. Bundling is a strategy used by publishers to sell journals that few libraries would subscribe to if they were to be selected individually. Libraries are unable to select specific journals while refusing others. Consequently, to get the desired journals they must also accept poor-quality journals with few readers. Related to the subscription packages, some publishers require libraries to sign nondisclosure agreements that forbid them from disclosing the cost and terms of journal package subscriptions.

### Lack of Transparency

Peer review is at the heart of science. It is the method by which grants are allocated, papers published, academics promoted and Nobel prizes won. Through the process of peer review, a manuscript is evaluated by experts in a specific field, revised and improved by the authors and finally accepted for publication. Despite the rigor of peer review, its defects are obvious<sup>13</sup>: the process is slow and expensive; it is inconsistent across reviewers, journals, and time; it suffers from bias because reviewers are competing for the same recognition and resources and it is sometimes abused (e.g. plagiarism<sup>14</sup>)

These flaws are not an argument for abandoning peer review. In the Publishing Research Consortium survey, the large majority of researchers agreed that peer

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<sup>11</sup> Bo-Christer Björk, Cenyu Shen, Mikael Laakso, A longitudinal study of independent scholar-published open access journals (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4867697/>)

<sup>12</sup> Morris S., The true costs of scholarly journal publishing. Learned Publishing, 2005

<sup>13</sup> New World, Same Model | Periodicals Price Survey 2017 (<http://ij.libraryjournal.com/2017/04/publishing/new-world-same-model-periodicals-price-survey-2017/>)

<sup>14</sup> <http://retractionwatch.com/2016/12/12/dear-peer-reviewer-stole-paper-authors-worst-nightmare/>

review greatly helps scientific communication and improves the quality of published papers<sup>15</sup>. However, the problems highlight the need for improvement. Many ideas have been advanced, but their outcomes are uncertain or even contradictory<sup>16,17</sup>: i.e. standardizing procedures, blinding reviewers and/or authors, reviewing protocols, training reviewers, using electronic reviewers, rewarding reviewers and checklists.

## No Link Between Research and Data

Just a minority of publishers allow authors to link the results of the study with the data used and/or process followed to achieve them. That clearly inhibits the scientific validation and collaboration process.

## Scientists Work is not Fully Recognized

Most publishers do not recognize or reward by any means the work done by scientific reviewers. In most cases, the identity of the reviewers is not made public.

## Long Delays from Submission to Publication

Despite spectacular advancement in information technologies, the time from submission to publication still largely depends on the human factor. Once a journal receives a manuscript, an editor needs to screen the work and assign it to peer reviewers. Then, if the process between authors, editors and reviewers is successful, the manuscript is marked for publication. At this point, it is not necessarily published; it is only slotted for publication in the print edition as space becomes available. This time-consuming and complicated process entails long delays from submission to publication. Depending on the journal, the publication time varies significantly, but the average time is 12 months<sup>18</sup>. In addition, the process is opaque and none, or very little, information regarding a manuscript's status is given to authors, apart from the peer reviews.

Once a research manuscript is rejected by a journal, authors have to resubmit to a different journal. This process coupled with the long publication delays multiplies the cost of editing (i.e., adapting to the new journal's format and style) and peer review. Some publishers have acknowledged this problem and have implemented

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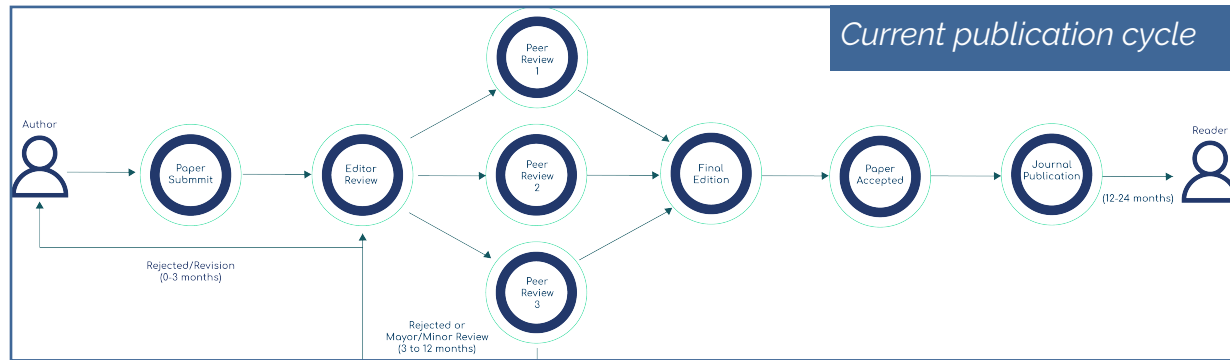
<sup>15</sup> Mark Ware, Mike Monkman, *An international study from the perspective of the scholarly community*, 2008, (<http://publishingresearchconsortium.com/index.php/prc-documents/prc-research-projects/36-peer-review-full-prc-report-final/file>)

<sup>16</sup> Jefferson T, Wager E, Davidoff F, *Effects of Editorial Peer review - A Systematic Review*, 2002.

<sup>17</sup> Smith R, *Peer review: a flawed process at the heart of science and journals*, 2006.

<sup>18</sup> Björk B-C, Solomon D, *The publishing delay in scholarly peer-reviewed journals*, 2013.

cascading submissions in which the editorial history is passed to the next journal. This solution partially solves the problem because authors can adapt the manuscript contents to the new journals and because cascading is usually implemented with a subset of all the existing journals (e.g., belonging to the same publisher).



## Copyrights and Licenses Owned by Publishers

With traditional publishers, copyright under the current intellectual property rights regime is enforced by the owners of the journal. Authors grant copyright to exploit their content commercially without any retribution. In theory, the permission is granted in return for services provided, such as editing, peer review, publishing and advertising. However, a large proportion of the editing and peer review costs are already paid or done on a voluntary basis by the research community.

## Low Quality Journals and Predatory Practices

Alarmingly, during the last years, fake and low-quality journals have proliferated. According to Beall's list<sup>19</sup>, the number of predatory journals doubles every 2 years and the number of articles appearing in them has exploded, reaching more than half a million low-quality articles per year<sup>20</sup>. This trend is driven by increasing numbers of researchers (2%–3% annually) who need to publish in order to access grants and obtain recognition and awards leading to career advancement.

<sup>19</sup> Beall J, [Criteria for Determining Predatory Open-Access Publishers](#), 2015.

<sup>20</sup> Shen C, Bjork B-C, ['Predatory' open access: a longitudinal study of article volumes and market characteristics](#), 2015.



## Orvium Disruption

***“Nothing is more powerful than an idea whose time has come.” - Victor Hugo.***

Orvium disrupts the current publication business model by establishing a decentralized and competitive market, separate from the current oligopoly, to manage the life cycle of research publications. The idea is simple: authors and research institutions hold the copyright and the license for use of their publications. They are free to establish the terms and prices for the rights to print, redistribute, download, translate or re-use the publications. In short, researchers and research institutions have full control over the life cycle of the publications. This publication process allows for its own self-improvement.

Orvium will align the goals and incentives of the publication market, researchers and research institutions toward more efficient and effective science.

### Orvium Properties

#### Optimal Publication Costs

Orvium's publication and access costs are not biased or influenced by any single entity. In addition, the platform supports open infrastructure and makes the creation, management and operations of journals with minimum operational costs sustainable.

#### Continuous and Transparent Peer Reviews

Orvium takes the stance that peer reviews must be open and publicly accountable. That is, the research community itself directly determines the validity and soundness of the research, and having all the information about the process allows it to self-regulate.

In addition, Orvium's peer reviews are continuous; they never end. This long-term perspective will decrease the tension between competing researchers and increase their willingness to provide a good and accountable service for science.

#### Multi-Authors Peer Reviews

The peer review model proposed by Orvium also allows multi-author reviews. Several reviewers can work together and be accountable and responsible for a common review of the paper. That will positively impact the quality of the review and also will reduce the risk of rejection.

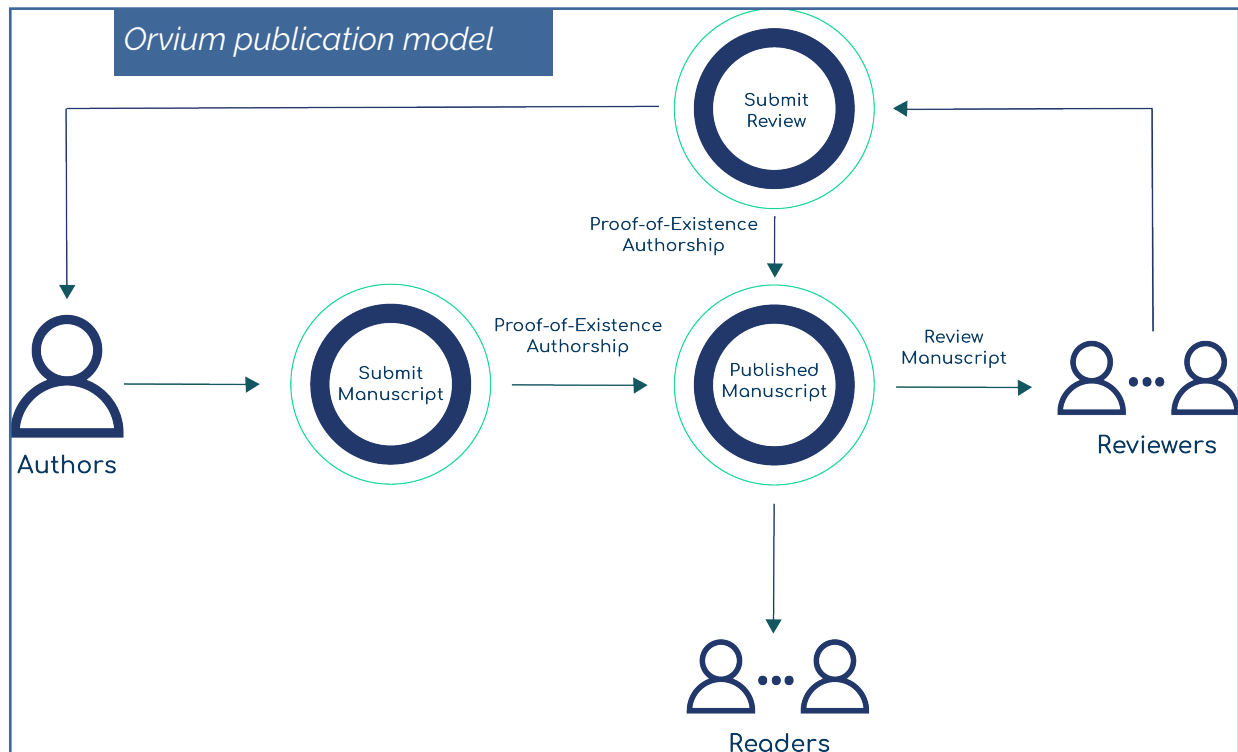
## Recognition and Reward of Peer Reviewers

Through proper analysis and exposure of the results, the reviewers will obtain the recognition and therefore reputation that they deserve. In addition, once the review is accepted by the authors, the reviewers receive a number of ORV tokens as a reward. Therefore, Orvium allows both public recognition of reviewers' work and a reward in the form of ORV tokens.

## Zero-Delay Publication

Orvium follows the lead of services like arXiv in having a zero-delay model. That is, the manuscripts are available from the moment they are submitted to Orvium, which can even be in early draft status. Orvium establishes an independent, decentralized and immutable time-stamped proof of existence, authorship and ownership.

With Orvium, in a few minutes, the submitted manuscript appears online for all the world to see, allowing an unlimited number of downloads, peer-reviews, tweets or online comments. This will not only enhance scientific efficiency but also bring immediate recognition to researchers and open doors for new professional opportunities.



## Full Life Cycle Traceability

The blockchain enables Orvium to keep a public trace of all the activity pertaining to a given document, including first submission, revisions, accepted and rejected peer reviews, copyright and user license changes, among other activities.

Owing to blockchain technology and the zero-publication delay, the Orvium model eliminates current “predatory” practices as well as conflicts regarding plagiarism, idea ownership and registration and transparency of the peer review process.

In addition, Orvium provides meaningful and real-time analytics to help the research community easily spot common problems such as citation and peer review rings and plagiarism.

## Support for Manuscript Versioning

Orvium introduces support for manuscript versions. Initially, any changes in a manuscript will be first treated as a work in progress and only the authors will see those modifications. Once the new version is ready and the authors confirm it in the system, and this action triggers a new submission that creates a new version of the manuscript, which becomes publicly available. These versioning capabilities enhance the complete life cycle traceability by attaching a new version to the history of the manuscript.

## Research Data and Process is Available

Orvium allows sharing published research data, code, etc. with the whole community. Also, it allows sharing unpublished data with a specific set of scientist to move the research forward. Orvium adds the necessary security layers to give authors full control over who can access and share their research data or code.

This will create a new model where not just manuscripts can be cited but also research data and code.

## Custom Copyright and User Licenses

Orvium fosters and encourages Open Access to unlock the full potential of unbiased scientific publications. However, Orvium is agnostic about licensing models by design. Orvium provides the framework to enable choices, but it does not have any control over them. The decisions are always made by the authors or their research institutions.

In short, researchers and research institutions can seamlessly define sales channels and license models for their content under author-defined conditions. For instance, it is possible to grant free access to public institutions or nongovernmental

organizations, while also implementing a subscription or license access model for private initiatives.

## Decentralized Journals

Orvium will allow the community to create and manage scientific journals following a Decentralized Autonomous Organization (DAO) approach. Authors, institutions or anyone else can initiate a Decentralized Autonomous Journal (DAJ) and define its governance rules.

### *Community Driven Journals and Governance Rules*

Orvium is agnostic regarding the definition of governance rules, and its mission is to empower Orvium's community with a framework that defines the governance rules that best fulfill the requirements of each specific DAJ case.

The governance rules are enforced by Smart Contracts. The governance rules are a key aspect of the process in that they make up the framework that allows DAJ owners to set agreements regarding the operation of the journals in fields such as licensing or subscription-based models, which content to publish, and agreements with authors or third-parties.

Some examples of the governance rules owners, classified by type, which can be defined are:

#### • **Governance Rights:**

- **Equal voting rights:** this DAJ gives each contributor the same amount of influence. An important disadvantage with this model is that a user can simply register with multiple ETH addresses. A couple of potential solutions can be applied: contributors of this model need to have an active ORVIUM account validated with ORCID or have a certain level of reputation gained by being active and doing work within the platform.
- **Proportional voting power:** Based on the participant's contribution, this model offers a voting power proportional to the contribution of the participant.
- **Reputation Based:** The voting power among the contributors is determined by the reputation of individual contributors.
- **Hybrid Schemas:** The rights are given based on a combination of several factors, such as the user's contribution and reputation.
- **Quadratic Schemas:** Each contributor can purchase votes for or against a proposal by paying the square of the number of votes that are acquired.

The contribution made is added to the common stake of tokens.

- **Contribution Limits:** DAJs can also be protected against being fully controlled by big contributors. The DAJs creator can define rules to determine limits to individual contributions. This enforces democracy within the governance of the DAJs when governance rights are determined by the contribution amount.
- **Contributors Restrictions:** DAJ creators can define rules concerning the participation of contributors. For instance, by defining whitelists or blacklists or conditions required, such as a certain level of ORVIUM reputation or an ORCID validated account.
- **Exit Conditions:** Governance rules related to exit conditions of the contributors are also an important aspect that can be considered and defined by the DAJs creators. For example, the DAJs smart contract can determine that the exit of a given contributor needs to be approved by a given majority of contributors' votes.

### ***DAJs a new paradigm***

The DAJ is a totally new paradigm for science dissemination and participation, which introduces unique advantages:

- **Reduce costs:** Unlock low maintenance, highly flexible and cost-effective operations, this increases their viability.
- **Improve science categorization and dissemination:** Completely autonomous way of handling and categorizing scientific literature while enhancing the dissemination of results
- **Enhance science participation and democratization enhancement:**
  - Represent a new economy model for science, introducing further lines of business for authors, owners and other participants.
  - Leverage the network effects of the Ethereum blockchain and other Dapps on Ethereum, allowing collaboration and inter-operability among the different actors in the dissemination process, for example, in the storage and analysis of data .
  - Democratize scientific publishing enabling small universities and research institutes with few resources to collaborate in a seamless manner and be at the same level as institutions with more economic resources.
- **Consolidate an everlasting and unbiased platform for science**

- Enable the creation of communities built on the platform that will enhance scientific collaboration and communication, increasing the satisfaction of the users and mitigating the probabilities of a project fork.
- Thanks to the full decentralized and autonomous organization, no single person or entity, including Orvium itself, can interfere or bias the decision-taking of the journal
- The existence of a dedicated and separated token gives protection to the platform in case a malicious actor gains control over the network. This is especially critical for science since it should not be monopolized.

## Subscription Freedom

Orvium's model is agnostic about subscription models. In other words, no subscription model is enforced. This will lead to a competitive and open market which will overcome the current model limitation in this sense.

## Secure Author Authentication

Uniquely identifying authors and their work among the rest of researchers presents several problems such as researchers with identical names, transliterations or researchers changing names (e.g. marriage or others). In some case, these weaknesses on the researcher authentication mechanism have been used by fraudulent researchers to fake peer-reviews<sup>21</sup>.

Orvium integrates with ORCID and the properties of the blockchain. ORCID is a not-for-profit organization that provides a registry and a unique identifier for individuals and institutions participating and contributing to research activities<sup>22</sup>. The author can obtain their own IDs and manage their record free of charge.

## Unnecessary Multiple Submissions

Orvium does not require the resubmission of manuscripts and removes the requirement to resubmit the manuscript every time the manuscript is rejected. Orvium optimizes the editorial and review costs faced by the research community, while improving the dissemination of manuscripts.

## Journals Quality Improved

Orvium let the research community decide about the quality and soundness of the research. and helps the community by providing tools to asses the validity of research and the relevance of peer reviewers, researchers and journals.

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<sup>21</sup> Ferguson C, Marcus A, Oransky I, [Publishing: The peer-review scam](#), 2014.

<sup>22</sup> <https://orcid.org/>

## Gray Literature is Accommodated

Gray literature includes materials and research that do not pass through the traditional commercial or academic publishing and distribution channels. Common gray literature publication types include reports (annual, research, technical, project, etc.), working papers, government documents, white papers and evaluations.

Generally, gray literature lacks any strict or meaningful bibliographic control. Basic information such as authors, publication dates, and publishing or corporate bodies may not be easily identified. Similarly, the nonstandard layouts and formats, low print runs and nonconventional channels of distribution make organizing a collection of gray literature a challenge compared to journals and books.

Orvium provides a framework to accommodate gray literature, putting it on equal footing with other scholarly publications. The research community is thus empowered to also evaluate the quality of gray literature. In this sense, a whitepaper or report can also be peer reviewed and be subject to equal quality standards.

## Collaborative Environment

Orvium will support collaborative environments for any single process related to the paper life cycle.

Usually, papers are written by several authors and in some extreme cases, like High Energy Physics papers produced by CERN's collaboration, this number may grow to thousands of scientists<sup>23</sup>. In these cases, offering collaborative edition and discussion tools will be essential assets for Orvium. In addition, Orvium interfaces will also support collaborative peer reviews.

## Social Platform

Orvium platform will unlock the participation of any societal actor in science evolution. Orvium's business model supports this by opening the definition of journals, the creation of challenges or rewards for reviews to increase scientific validation, the promotion of patronage campaigns and the funding of research lines to the general public.

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<sup>23</sup> <https://www.nature.com/news/physics-paper-sets-record-with-more-than-5-000-authors-1.17567>

## Orvium Business Model and Token Mechanics

The ultimate objective is for Orvium to become the leading platform for researchers, research institutions and scientific editors to manage the life cycle of scholarly publications. Orvium offers numerous advantages to accomplish this goal, while drastically reducing the costs associated with publication, thanks to its global decentralized platform.

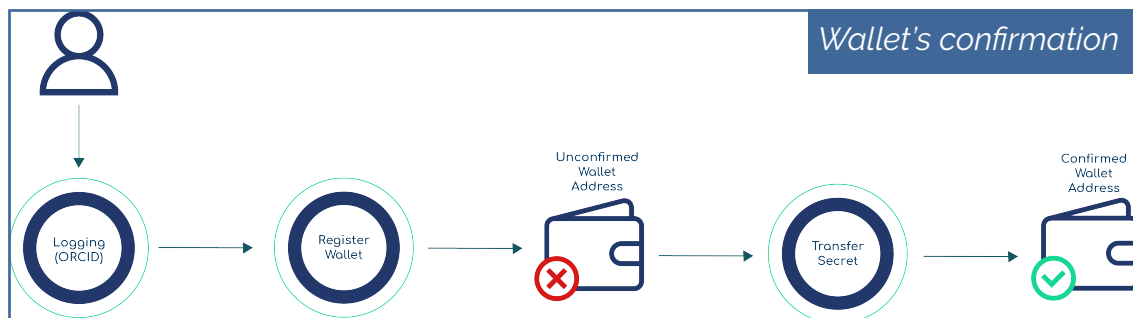
Disrupting the current publication model requires a simple and transparent business model. Orvium establishes a transparent, comprehensive and competitive business model which is aligned with its custom ORV token to ensure a continued evolution of the platform while supporting global research. Orvium's model and the ORV token introduce a fair cost distribution model to authors and research organizations, ensuring recognition for all participants, enabling journals to become viable and sustainable at a low cost, and more importantly, help to incorporate the society as a whole.

### User Registration and Identification

Any individual can create an account to access the system. Orvium will support popular authentication methods such as single sign-on integrated with google or facebook.

In addition, researchers will use ORCID as an authentication method. In order to prevent identity impersonation in the blockchain, researchers should confirm their wallet ownership. To do this, researchers have to send a transaction to the blockchain using a random key provided by the platform. Orvium will listen for a transaction with this key to verify the wallet's ownership.

Accounts for research institutions and companies will follow an additional verification process.



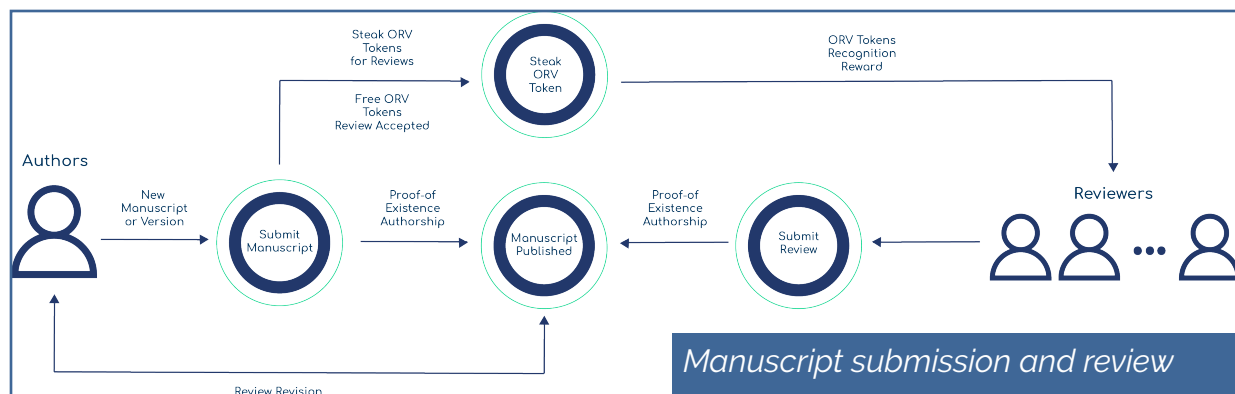


## Manuscript Submission

Authors submit their manuscripts to Orvium, creating a public proof-of-existence and authorship which is stored in the blockchain.

At the moment of manuscript submission (initial or new version) authors can stake a number of ORV tokens to encourage and challenge the community for peer reviews. The number of paid reviews and the number of ORV tokens staked for each review will be determined by the author. These ORV tokens can be claimed by reviewers after their reviews are accepted.

Depending on the current market price for reviews and other factors such as the expected quality of the reviews or time required, authors will decide on the quantity of ORV tokens to stake per review. Reviewers will submit reviews based on factors such as reputation, but also on the ORV token that they will obtain. In addition, this model eliminates entry barriers in the system derived from the ORV token because anyone doing work for the community will receive ORV tokens that they can later use for services in the platform, i.e. submit new manuscripts or contribute to patronage campaigns.



## Peer Review

Researchers acting as peer reviewers will submit their reviews to Orvium. This represents a change in the life-cycle of the manuscript reviewed, therefore it will also create a public proof-of-existence and authorship of the review in the blockchain. The review proof and content will be attached to the history of the manuscript and will be public and accessible to the whole community. Orvium also introduces tools for the community to validate and act as an independent oracle for the review itself.

## ORV Token for Peer Reviews Rewards

Reviewers are free to submit reviews to any manuscript at any time. If there is a remaining stake in a manuscript submission, the reviewer may claim the specified

amount. If no stake is available, then the author may or may not reward the reviewers.

In addition, any other user (scientists, institutions or anonymous actors) can stake ORV tokens to reward additional reviews for a given manuscript. This will create a new extended market where third-parties can be involved in increasing scientific validation.

## Publish Research Data

Generating the research data is very costly in time and resources. The platform allow to share the data used in the research. Authors can select the licensing and copyright model of their choice. This will create a data market possible that can help to share the cost of data generation and serves as economic benefit.

## Copyright and License

User licensing is completely determined by the authors or owner. That is, they determine the rights to print, redistribute, download, translate or re-use, and they can alter these rights at any time. Depending on the license chosen, downloading or re-using the manuscript may or may not require an Orvium transaction. Authors and research institutions are free to change and exchange the copyright and licenses through the life cycle of the manuscript. Some examples of license models that will be available among others are:

- *Attribution 4.0 International (CC-BY)*<sup>24</sup>.
- *Attribution-NonCommercial 4.0 International (CC-BY-NC)*<sup>25</sup>.
- *Attribution-NoDerivatives 4.0 International (CC-BY-ND)*<sup>26</sup>.
- *Attribution-NonCommercial-NoDerivatives 4.0 International (CC-BY-NC-ND)*<sup>27</sup>.
- *No Reuse.*

## ORV Token and Paid Licensing Model

If a paid licensing model is chosen by the author, journals and/or readers will have to pay for accessing, downloading, using or reproducing the content. These payments will be done using ORV tokens. The quantity of ORV tokens paid will be directly sent to the author. Orvium will deduct a small percentage as a transaction fee in form of ORV tokens.

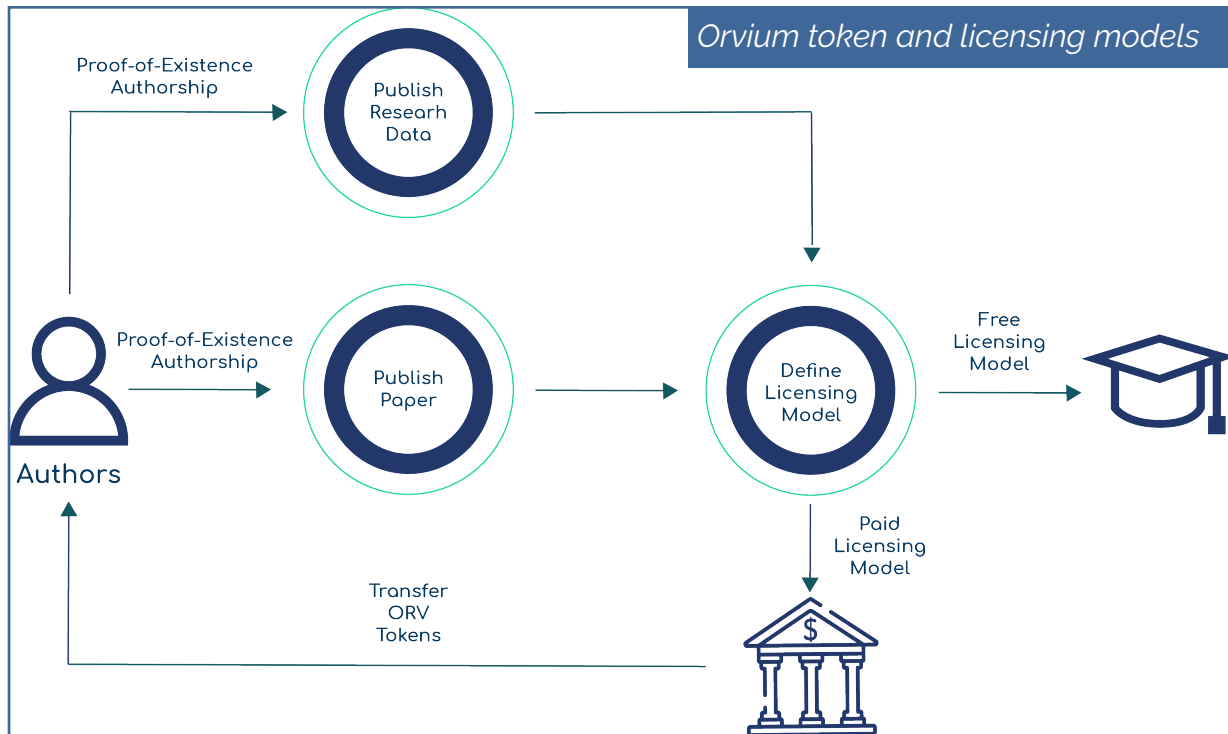
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<sup>24</sup> <https://creativecommons.org/licenses/by/4.0/>

<sup>25</sup> <https://creativecommons.org/licenses/by-nc/4.0/>

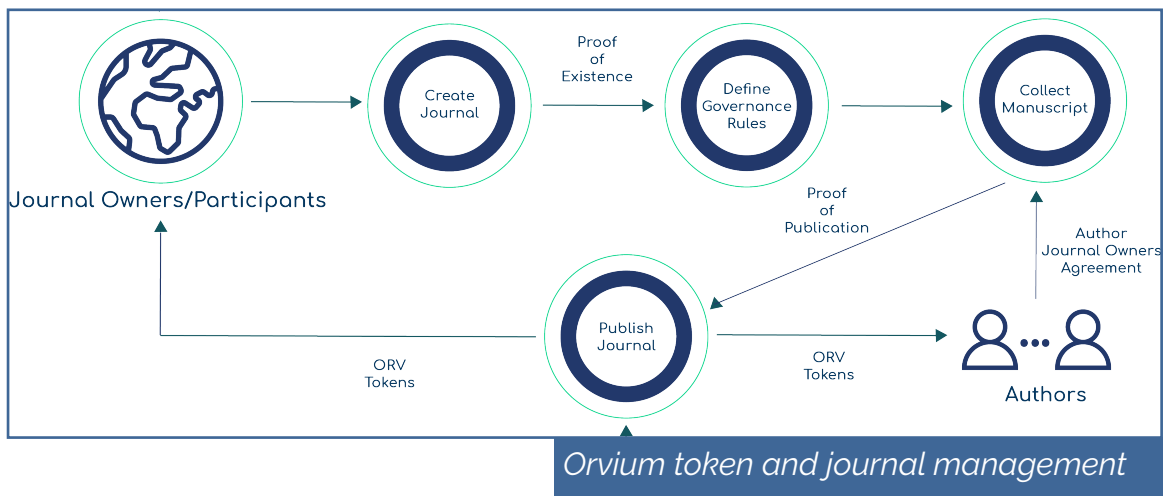
<sup>26</sup> <https://creativecommons.org/licenses/by-nd/4.0/>

<sup>27</sup> <https://creativecommons.org/licenses/by-nc-nd/4.0/>



## Decentralized Journals

Institutions, individuals, and communities both individuals and institutions can create their own decentralized journals with ease. The journals will be hosted in the Orvium decentralized infrastructure, reducing costs significantly. However the core functionality and the governance reside in the Ethereum blockchain ensuring in this way its total independence from the Orvium platform and its decentralized autonomous nature.



## ORV Tokens for Journal Management

Orvium users can contribute to the creation and operation of DAJs by staking ORV tokens into DAJs smart contracts. DAJs issue specific journal tokens (JTs) and allocate them to the participants. The amount of JTs are proportional to the stake sent by the contributor.

The ORV tokens staked by the participants in the DAJs will be used to cover the operational costs of the DAJs:

The creation is free and no tokens are involved. Nevertheless, owners of the DAJ will pay a license to operate in the platform using ORV tokens. This will be based on the amount of data (fluctuating by usage) or a flat rate (periodic payment).

- Depending on the licensing models selected by the author, DAJs will have to acquire rights to publish the paper. This transaction will be carried out using ORV tokens.
- When paid licensing models are involved, readers will have to use ORV token to pay for accessing, downloading, using or reproducing the content in the DAJs. In this case, the ORV tokens paid by readers or subscribers will be staked in the DAJs. Orvium will also deduct a fee in form of ORV tokens from these transactions.
- The JTs can be sent back to the DAJ smart contract to redeemed a proportional part of the remaining ORV tokens staked in the DAJ.

It is important to mention here that JTs tokens are independent of ORV tokens and they do not provide or represent any kind of voting/governance rights in Orvium OU. JTs will only allow access to the governance rules for managing the specific DAJ, which has issued them. For instance, participants can use those tokens to select content, impulse publication lines and reward authors or reviewers, etc.

## Science Patronage

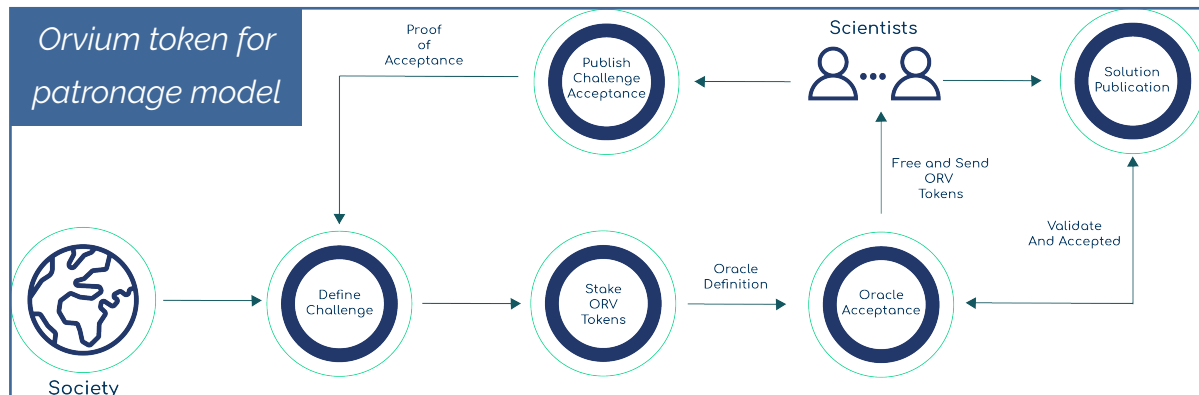
Any person or entity can challenge the scientific community to solve specific problems and/or challenge the society to contribute to research programs. An example which Orvium could seamlessly accommodate are the findings of formal proof for the Mathematics Millennium Problems promoted by Clay Mathematics Institute<sup>28</sup> or crowdfunding support of science.

This will be supported by smart contracts, which, among other properties, makes the definition of ending conditions and a decentralized validation of the challenge

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<sup>28</sup> <http://www.claymath.org>

solution by the whole community or specific oracles such as recognized institutions or researchers possible.



## ORV Token for Science Patronage

When a challenge is created, individuals or institutions will stake ORV tokens. These challenges may accept additional contributions where anyone with ORV tokens can send and increase the amount ORV tokens staked for the challenge.

These ORV tokens will remain in this status until:

- The challenge is solved, the solution is published and validated by the oracle (community or institutions) then the ORV tokens will be released and the scientists in charge of the published solution may claim the corresponding ORV tokens.
- A solution is not found and the ending condition is reached. In this case, the original contributors may reclaim their staked ORV tokens.

## Big Data Analytics and Machine Learning Integration

Orvium platform will use big data and machine learning to effectively join heterogeneous data sources such as transactions in the blockchain, existing research literature and connections between researchers to unlock valuable insights:

- **Calculate the impact factor in an optimal way:** Transparent, public transactions in the network empowers optimal calculation of the impact factor for authors, reviewers and papers. Common concerns about impact factor calculation can be avoided. For instance, the system will use a graph analysis to determine the degree to which cited papers and reviewers are related and assign an impact factor increment ratio based on that information.

- **Identify citation and peer review rings:** The current publication model incentivizes cross-citations and peer reviews among close peers to improve their impact factors as well as speed up (and sometimes circumvent) the research validation process. With cross-citation, for example, authors force citations on colleagues with little justification, to artificially increase the impact factor of their papers. Orvium analytics will detect such situations.
- **Suggest the right peer reviewers:** Based on relation network analytics, Orvium will suggest and automatically notify the right reviewers for the paper submitted.
- **Facilitate peer review accuracy:** Identify important facts to be considered by peer reviewers. For example, reviewers could be prompted to consider how close citations are to the author or be given support for detecting plagiarism.
- **Identify and suggest keywords for the manuscript:** Finding the right keywords for a given manuscript is a critical decision. Most searches will be driven by keywords and therefore they will play an important role in ensuring that a paper is read, reviewed and disseminated to the appropriate community.
- **Identify indirect relations between publications:** Navigating through scholarly publications by jumping from one citation to another is the most common way. Nevertheless, researchers can easily miss an important contribution to state-of-the-art science. Orvium analytics and machine learning will detect indirect relations and forward the information to researchers as they are navigating through the system.
- **Classify papers by field based on their content:** Determine the best target field for a given paper based on its content and information extracted from other publications.
- **Identify the journal that best fits a paper:** If an author wants to target to an Orvium open decentralized journal, Orvium analytics will support the decision by determining the best fit.
- **Identify emerging trends and topics:** Researchers need to be constantly up to date with research in their field. Orvium will help by identifying emerging trends and topics and sending personalized notifications and alerts.