SciDex

The SciDex MarketSpace - Decentralized MarketSpace for exchange of Scientific data.

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Abstract

On top of the SciDex Protocol, as a first application, the SciDex Foundation intends to build a decentralized MarketSpace which enables, simplifies and standardizes the exchange of Scientific data (the **SciDex MarketSpace**).

It is designed to be a protocol and ecosystem which subsidizes and incentivizes the creation and sharing of data.

For the first time, isolated data potentially worth billions of dollars will be democratized and traded on a single platform, setting a new paradigm for advancements and collaboration in Science.

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1. The Scientific Data Market: A Unique Opportunity

1.1. Scientific Data and its Exponential Growth

Scientific data is defined as structured information collected using specifically defined methods, for the purpose of research or analysis [1]. A wide variety of entities in every economic sector and academic field produce scientific data on a daily basis.

In the past 30 years, the amount of data produced has increased at an exponential rate, due to technological changes such as the rise of connected devices and the digital transformation.

In 2016, sixteen (16) Zettabytes of general data were produced, and by 2025 it is expected that global data creation will reach one hundred and sixty (160) Zettabytes [2]. A significant part of this data is scientific data. Furthermore, it has been estimated that sales of data analytics will reach $187 billion by 2019, an increase of over 50% since 2015 [3]. PriceWaterhouseCoopers (PWC) states that even with these spending levels, the data will remain under-utilized.

1.2. Untapped Potential in the Scientific Data Market

Scientific advancements in all fields and industries depend on the creation of high-quality data as well as its exchange across fields.Due to technological innovations, the effective use of scientific data has become even more important. However, several shortcomings in the scientific data market set limitations to data collection and sharing.

However, the full potential of scientific data has remained largely unrealized and underutilized. Most organizations do not have a sense of the market value of their collected data or who could potentially acquire it. This leads to the data being forgotten as well as frozen on servers and never used again. To a greater extent, this is attributable to a lack of a streamlined way of exchanging data. A trustable global exchange platform would considerably reduce the creation of similar datasets by different parties. More importantly, it would open the gates to cross-field knowledge sharing and significantly accelerate scientific discoveries.

Another shortcoming of the current data market is that scientific data collection is dominated by large corporations and institutions. This is one of the consequences of the high costs associated with the storage of available data. These costs create an entry barrier for scientists, start-ups, and research labs doing groundbreaking work who often have the skills and ability to develop the technology, but lack sufficient funds to bring them into mass production and mass deployment.

1.3. Shortcomings of centralized data exchanges

Often, Institutions and individuals in possession of valuable data do not take advantage of centralized data marketplaces. The underlying reason is that centralized markets for data do not manage to gain market actors' trust due to the following:

Data Repositories: The need to deposit data can create a major obstacle to participate in centralized data exchanges. The elimination of that step would improve trust in the marketplace.

Compliance: Compliance requirements for the right of use of data are complex, and vary across types of datasets, businesses, industries and regions. These complexities set challenges for data providers to find or identify trustworthy buying parties.

Quality of Data: There exists little to no guarantees for the quality of provided data. As a result, markets fail to establish trust in data quality.

Other minor technical, financial or legal factors contribute to the impracticability of centralized markets for data:

- **Hosting –** It is very expensive to store large datasets.
- **Tracking –** It is impossible to track data usage and distribution once it is out of the hands of the data creator.
- **Pricing –** There are impractical dynamic pricing models for large datasets.
- **Maintenance -** Maintenance costs for updating and licensing data are high.
- **Compliance -** There exist no regulations nor compliance framework for data right of use.
- **Hidden Cost -** Unforeseen transaction fees and complex commission models of centralized exchange platforms create hidden costs.
- **Complexity -** Lack of a complete ecosystem around scientific data exchange and collaboration causes individuals to deal with multiple, overlapping systems to share or acquire data.

2. The SciDex MarketSpace

2.1 A Game Changing Solution

SciDex makes it its mission to unlock the potential of scientific data by making data sharing and collaboration a widespread reality. For this purpose, the SciDex MarketSpace offers members a unique chance to access an unprecedented collection of scientific data, as well as monetize their own data using blockchain technology. In addition, researchers can correlate multiple sources of data in clusters to find trends, knowledge and causalities, allowing for the much more effective use of existing data. For the first time, companies are able to exchange and monetize their data in a secure and simple process which will quicken the rate of scientific progress.

At the core of the SciDex MarketSpace lies the DataDex, a global index for scientific data listings, which, in combination with powerful AI tools of the search engine, enables users to **search and build smart datasets based on the listed data.**

An essential feature of the DataDex (the SciDex Data Index) is that it is bi-directional, offering users the option to **describe their data needs and then issue a call for contributions** or referrals from other market actors. Such contributions are tied to a sophisticated ranking and token incentive system (see section 3.2), which encourage collaboration on the platform. This results in a self-governed market that is driven by the contributions of all actors.

To enable data purchasing, an exchange tool using proprietary Ricardian Adaptive Smart Contracts (RASC) (see section 4.4) is put in place, allowing participants to buy and sell data via the native tokens on the SciDex MarketSpace, the SciTokens (SDX).The tokenization of the SciDex MarketSpace is vital for a thriving organic expansion of the ecosystem as it is used to incentivize and stimulate high trading and engagement levels of community members.

SDX is also used to accelerate data creation and accessibility by incentivizing new and existing data providers; notably by subsidizing providers of free data (governments, research labs, etc.) and making grants to promising scientific data startups. After thorough analysis and compliance due diligence, the SciDex Foundation will propose potential companies. Through the SciDex MarketSpace, the community will be able to vote on the provision of subsidies and grants. For this purpose, the SciDex MarketSpace introduces a unique voting mechanism on the blockchain.

2.2 Functions of SciTokens (SDX)

The native digital cryptographically-secured utility token of the SciDex MarketSpace, SciToken **(SDX)** is a fundamental component of the ecosystem of the SciDex MarketSpace, and is designed to be used solely within the network. SDX will initially be issued as ERC-20 standard

compatible digital tokens on the Ethereum blockchain [5]. SDX is a non-refundable functional utility token and will be employed as a medium to enable or ensure the following core functions of the market:

Exchange: As an internal currency, SDX will be the unit of exchange between actors on the SciDex MarketSpace. The main purpose of introducing SDX is to provide a convenient and secure mode of payment and settlement between participants of the SciDex MarketSpace.

Call for Actions: Market actors can call for data contributions and curations by staking SDX. Community Engagement (see section 3.2.2): SDX will also be released to provide economic incentives for participants to invest resources and time to contribute to the ecosystem of the SciDex MarketSpace. Users of the SciDex MarketSpace and/or holders of SDX who do not actively participate will not receive any SDX incentives.

Quality Assurance (see section 4.2): Data providers of new data are required to stake SDX for a probation period, during which data is validated by other actors. Furthermore, continuous data curation is encouraged through SDX incentives. Both the probation period and data curation will ensure high quality of provided data.

Trusted Membership (see section 3.2.3): Highly engaged community members can attain the Trusted Member title, which grants them certain distinct rights. These members have to stake a defined amount of SDX to maintain this membership.

Voting (see section 3.2.3): Trusted Members have the right to vote on subsidy and grant decisions. For each vote, SDX have to be staked.

These features make the SDX an integral and indispensable element for the functioning and advancement of the SciDex MarketSpace: High levels of exchange and engagement will bring about continued growth of the ecosystem, while quality standards will act as safeguards to inadequate content.

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2.3 Case Study

The following case study, AsthmaTec, illustrates SciDex's ability to promote the exchange and creation of scientific data, and to connect datasets from different domains.

The Customer

AsthmaTec is a medical company working with hospitals in Paris, Munich and Tel Aviv on an Asthma treatment study. The goal of this study is to validate the efficiency of the company's medicines based on patients' undergoing treatment. It is important for the study to consider exogenous root causes of asthma, such as the climate and air pollution levels at all three locations the study is conducted in.

The Challenges

In order to formulate a thorough study, AsthmaTec needs to find:

- A secure way to acquire high quality data
- Relevant meteorology datasets
- Localized air quality datasets from both the residential and work area of each patient

The Solution

Leveraging the SciDex MarketSpace, AsthmaTec can overcome these challenges by:

1. Acquiring secure and trusted data from other entities using smart contracts deployed on the Ethereum blockchain in a transparent and secure way. Additionally, AsthmaTec can choose to purchase only vouched for and curated data, ensuring the highest possible quality.
2. Accessing the meteorological index available to them as a SciDex MarketSpace community member, and purchasing the relevant data.
3. Discovering that there is no dataset of residential air quality data for their targeted area on the SciDex MarketSpace, and placing a Call for Contribution requesting data from other actors on the platform. Aerix, a SciDex MarketSpace community member, is a company that commercializes IoT sensors for air quality. On a large scale, Aerix collects and tracks air quality data from thousands of mobile IoT devices, dispatched in commercial and residential areas. This allows Aerix to collect real time data from the residential areas of AsthmaTec's interest and answer the Call for Contribution. Given Aerix's proven track record and high ranking status on the SciDex MarketSpace, AsthmaTec chooses to acquire their datasets.

In the situation where Aerix could not have completed 100% of the data needs of AsthmaTec, other SciDex MarketSpace members could have joined in the completion of the request.

The Outcome

AsthmaTech overcomes their challenges through the SciDex MarketSpace. They are now able to run their algorithm based on the newly acquired data sources. Meanwhile, Aerix was able to monetize their data whilst simultaneously expanding their sensor network.

Finally, AstmaTec is now part of the ecosystem and can start exchanging data created in this study as well as future studies, thus generating new revenue streams.

3. The SciDex Ecosystem

3.1 The SciDex Products

Besides providing a scientific data index, SciDex offers a wide range of products and functionalities that come to the benefit of all its members. The following features are offered, with the aim to create a complete market:

SciDex	An index describing the data, identifying its provider and price.
SciEngine	A powerful AI and NLP (Natural-Language Processing) based search engine to navigate the SciDex.
Call for References	A mechanism to allow community members to find or add a new entry to the index of an existing dataset.
Call for Contributions	A mechanism for community members to create a new dataset or a metadataset. The requesting party publishes a description of the required dataset and stakes the SDX incentive they are willing to offer. The created dataset does not necessarily have to be indexed.
Call for Services	A portal where members can shop for services such as advanced analysis which need to be performed outside of the platform.
Call for Curation	A way for community members to curate data by checking availability and consistency of the datasets. Upon completion, the curator receives SDX incentives.
The Exchange	A secure tool enabling the exchange of datasets and the SDX based on Ricardian Adaptive Smart Contracts (RASC).
A Subsidy & Grant Model	A self-governed system to subsidize and make grants to groundbreaking projects in science.

A Community Ranking System	A system in the SciDex MarketSpace where actors attain a higher rank by performing actions of high quality, benefitting the community. High ranking actors receive additional privileges, such as voting rights for the subsidy and grant model.

To facilitate the onboarding of small and medium entities lacking IT or legal capabilities to exchange their datasets, the SciDex MarketSpace will provide access to open source peer-to-peer sets of tools which will allow their users to:

- Perform a native integration with SciDex's dashboard and SciDex
- Support of RASC to allow them to describe datasets and contract of usage of the data in an accurate and simple way
- Integrate with COALAIP [6] - a community driven protocol for intellectual property licensing

The Open Systems Interconnection of the MarketSpace Platform

<table>
<tr><td rowspan="3">Integration</td><td colspan="3">Builder</td><td colspan="3">Social</td><td>Transaction</td></tr>
<tr><td>Index</td><td>Role</td><td>Search</td><td rowspan="2">Votes</td><td rowspan="2">Ranking System</td><td rowspan="2">Forum</td><td rowspan="2">Smart Contracts</td></tr>
<tr><td colspan="3">AI & NLP</td></tr>
<tr><td colspan="6">Private Cloud</td><td>Blockchain Network</td></tr>
</table>

3.2 The SciDex Community

The spectrum of organizations in need of the SciDex MarketSpace is broad, and includes;

- Private Companies
- Government Organizations
- Universities
- NGOs
- Start-ups
- Experts (Industry domain specialists and data scientists)

These actors will have different roles in the SciDex community, depending on their needs and contributions:

Actor Title	Role	Benefits for Actors	Benefits for SciDex Marketspace
Data Providers	Provide data	Monetize data	Populate the SciDex MarketSpace
Data Buyers	Purchase data	Fulfill data needs	Monetizes data
Data Curators	Manage and ensure the quality and validity of the indexed content	Advance science and receive incentives	Ensures high quality data in the MarketSpace
Science Experts	Create and publish relevant scientific content, propose professional services	Receive incentives and insights for content, generate potential professional leads	Activate and engage the community

The SciDex Community is self-governing, transparent, and trustworthy. This is achieved by employing Know Your Customer ('KYC') best practices.

3.2.1 Community Ranking system

Allmembers in the community are subject to a ranking system based on performed actions. Upon completion of transactions, buying parties can rate the quality and accuracy of the data. Similarly, community contributions can be rated and discussed by member involved.

Using this rating system, the community members are ranked according to a trust score. The trust score follows the lower bound of the Wilson score interval [7] and is defined as:

$$s = p(\frac{\hat{p} + \frac{z^2}{2n}}{1 + \frac{z^2}{n}} - \frac{z}{1 + \frac{z^2}{n}}\sqrt{\frac{\hat{p}(1-\hat{p})}{n} + \frac{z^2}{4n^2}}) \quad (1)$$

Where p is the score scale, p the fraction of positive ratings of the overall ratings of the market actor, z the (1-α/2)quantile of the standard normal distribution and n the total number of votes received.

With this ranking system design, even a limited number of contributions can accurately represent the performance and behavior of a community member. The value of this Z score represents the confidence level of the distribution. In this case, there is a minimum 95% certainty that users will ultimately reach this score.

3.2.2 Community Incentives

Incentives are key for the organic growth of the community. They not only motivate actors to participate, but also help legitimize the quality and validity of data contributions. Incentives for contribution and loyalty in the form of SDX shall be offered to incentivize community members to invest time, energy and passion, enhancing the data quality and content. An automated incentive system is designed based on the notion of the Trusted Member (see section 3.2.3).

The total release of SDX for the incentive system shall be tightly linked to the availability of curators versus the volume of data in need for curation. In case of a lack of curators, the incentive system will automatically increase the amount of SDX incentives distributed in payment for curation. On the other hand, it will decrease the amount of SDX incentives when there is a lack of data to be curated.

The incentives mechanism is based on the following rules:

- The growth factor of data indexed and data curated directly impacts the released SDX of the incentive system.
- The incentive value is dynamic and dependent on the complexity of the call answered.
- Incentives are escrowed over a predetermined period of time correlated to the ranking of the actor.
- Answered calls that are rated poorly by other community members may have the incentives in escrow annulled.

The total release of SDX for incentives is defined for a fixed allotted time Δt according to [8]:

$$(\frac{\partial I}{\partial t} - \frac{\partial I_{ideal}}{\partial t})\delta_{ref} + (\frac{\partial I_{con}}{\partial t} - \frac{\partial I_{con,ideal}}{\partial t})\delta_{con} + (\frac{\partial I_{cur}}{\partial t} - \frac{\partial I_{cur,ideal}}{\partial t})\delta_{cur} + \bar{T}_{t-\Delta t} = \bar{T}_t \quad (2)$$

where I is the amount of indexed datasets

$$I_{ideal} = (1 - exp(-\frac{t}{0.2})) \times \psi + (\zeta - t) \times p \quad (3)$$

where I_{con} is the amount of newly contributed datasets

$$I_{con,ideal} = \begin{cases} (1 - exp(-\frac{t-t_0}{0.2})) \times \psi_{con} + (\zeta_{con} - t) \times p_{con} & \text{for } t > t_0 \\ 0 & \text{for } t < t_0 \end{cases} \quad (4)$$

and where $I_{curated}$ is the amount of curated datasets

$$I_{cur,ideal} = \begin{cases} (1 - exp(-\frac{t-t_{0,cur}}{0.2})) \times \psi_{cur} + (\zeta_{cur} - t) \times p_{cur} & \text{for } t > t_{0,cur} \\ 0 & \text{for } t < t_{0,cur} \end{cases} \quad (5)$$

Note that with the model above an ideal temporal behavior of the platform is dictated by I_{ideal}, $I_{con,ideal}$ and $I_{curated,ideal}$. The incentives system can be considered as an inherently benevolent actor with nearly unlimited liquidity.

The breakdown for inventive among different categories for different calls shall be following the rule δref ← δcon ← δcuration.

Curation actions are crucial to the success of the platform.Those who perform them are therefore presented with greater incentives than those who perform referencing and indexing actions. Not all curation actions will earn the same incentive; the payments accrued will be affected by the complexity and automation level of the task.

The incentives distributed by the SciDex MarketSpace shall be escrowed after completion of the action. This provides enough time for other market actors to check and approve the service rendered. To reject the work, a minimum of 3 actors who have either performed related tasks or have attained half the rank of the actor in question must rate work poorly.

The duration during which incentives are held in escrow depends on the performing actor's rank R, and the difference between the positive votes p+ and negative votes p- that the data curator receives from other market actors.

The duration time t is defined as,

$$t = ln\, z\ - \frac{Ry}{N}\ + N \quad (6)$$

Where z is the absolute value of x,

$$z = |x| \ \ if\ \ |x| >= 1,\ \ z = 1\ \ if\ \ |x| < 1 \quad (7)$$

And xis defined as,

$$x = p_+\ - p_- \quad (8)$$

Where y takes the following values depending on x,

$$y \in \{-1, 0, 1\}$$

$$y = 1 \quad if\ x > 0, \qquad y = 0 \quad if\ x = 0, \qquad y = -1 \quad if\ x < 0 \quad (9)$$

Where *N* is a weighted integer that is to be adjusted based on the total number of voters (p+ +p-).

3.2.3 Trusted Member

Within the ecosystem of the SciDex MarketSpace, the best actors are awarded the title of Trusted Member.

Trusted Members are the most active and engaged community members.

Trusted Members play a key role in the SciDex MarketSpace and hold the following rights:

- Vote for the subsidy and grant-making decisions of the SciDex Foundation
- Participate in determining regulations for the SciDex community
- Vouch for peer Trusted Members

In order to receive the Trusted Member title, an actor has to hold a defined amount of SDX. In addition, the actor has to perform a certain number of actions and transactions (Proof of Work and Proof of Usage) as well as actively create new forms of content for the community. The Trusted Member status is directly correlated to the seniority and credibility of the member as well as his contribution to the growth and development of the ecosystem of the SciDex MarketSpace.

Additionally, to help a market actor reach the Trusted Member title, other trusted members have the ability to vouch for them. The vouching mechanism provides transparency regarding market actors by having their peers review them. Vouching does not affect their ranking. Every time users perform a transaction, they are able to vouch for each other. In addition, trusted members are allowed to vouch for three other members without having done any transactions with them.

Overall, the Trusted Member status grants a number of rights and distinctions. Note that the title can be revoked for inactivity or negative behaviors towards the community according to the SciDex MarketSpace.

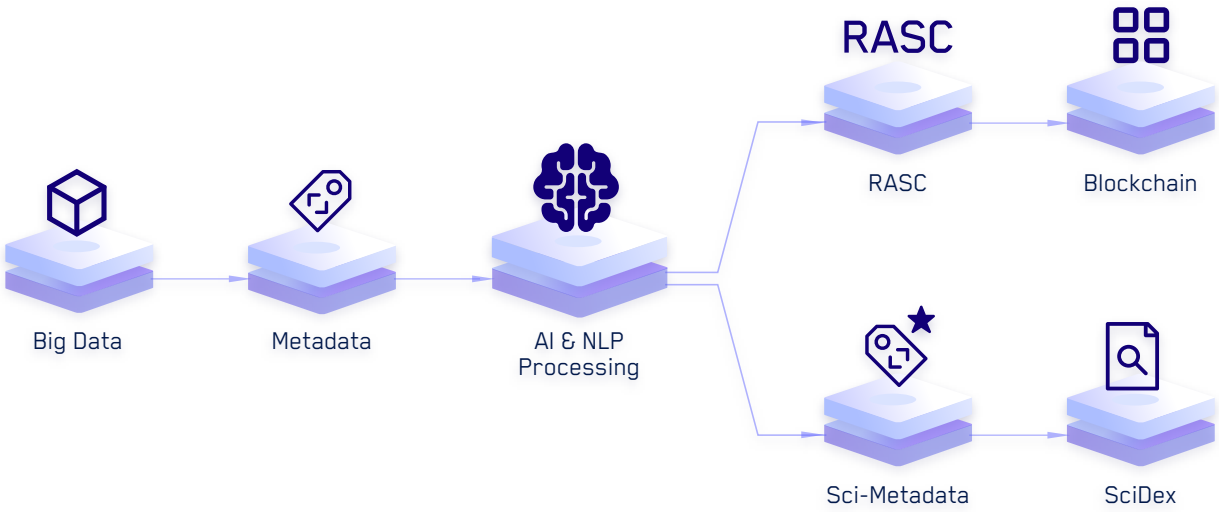
4. Product Implementation

The products described in section 3.1 are equipped with a set of tools and functionalities that ensure an outstanding user experience. Based on a rich metadata framework powered by Artificial Intelligence (AI) and Natural Language Processing (NLP), datasets are described so that data buyers can easily access them, and can use them to build new meta-sets according to their needs [9 & 11].

The SciDex MarketSpace provides the users with the following functionalities:

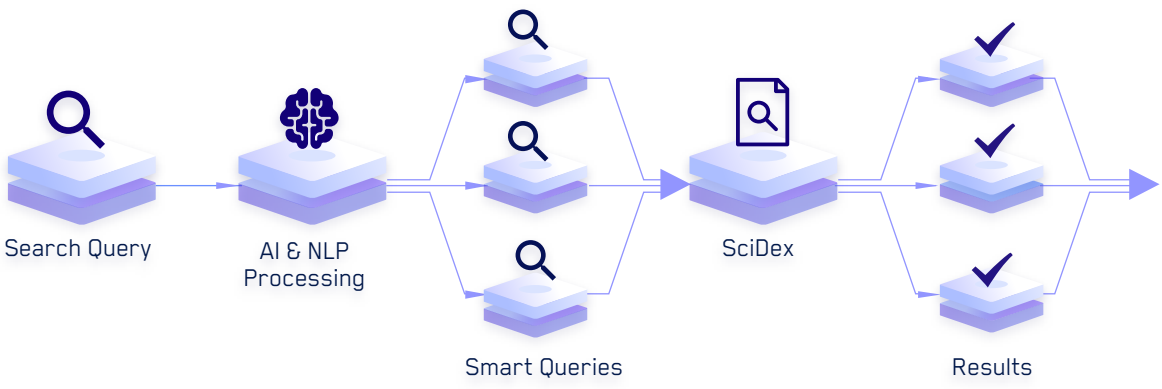
SciDex

An index following a simple metadata template allowing providers to index their data in a standardized fashion. These templates are powered by AI and integration tools which allow smart descriptions and tagging of datasets whilst facilitating their search and manipulation [10].



SciEngine

A search engine allowing to crawl the SciDex, using multilingual NLP and AI capabilities to enhance usage experience (user profiling, anticipation, and related information) [11].
Using advanced user profiling, SciEngine sends suggestions and recommendations to related users who might be interested in the newly indexed data.



SciExchange

A transaction system allowing users to exchange scientific data using RASC (see section 4.4). The SciExchange has the following functionalities

- Provide and purchase data - acquire datasets for free or for SDX
- Call for References - add a request for an entry to the SciDex
- Call for Contribution - add a request for a new dataset in exchange for SDX
- Call for Service - ask experts to structure or analyze datasets
- Call for Curation – ask curators to check availability and consistency of data

Social Functionalities

A set of tools for community management including the ranking system, voting system, and automatic calls for curation.

Compliance

The compliance and security system is embedded in all the platforms' functionalities to prevent inappropriate content or transactions.

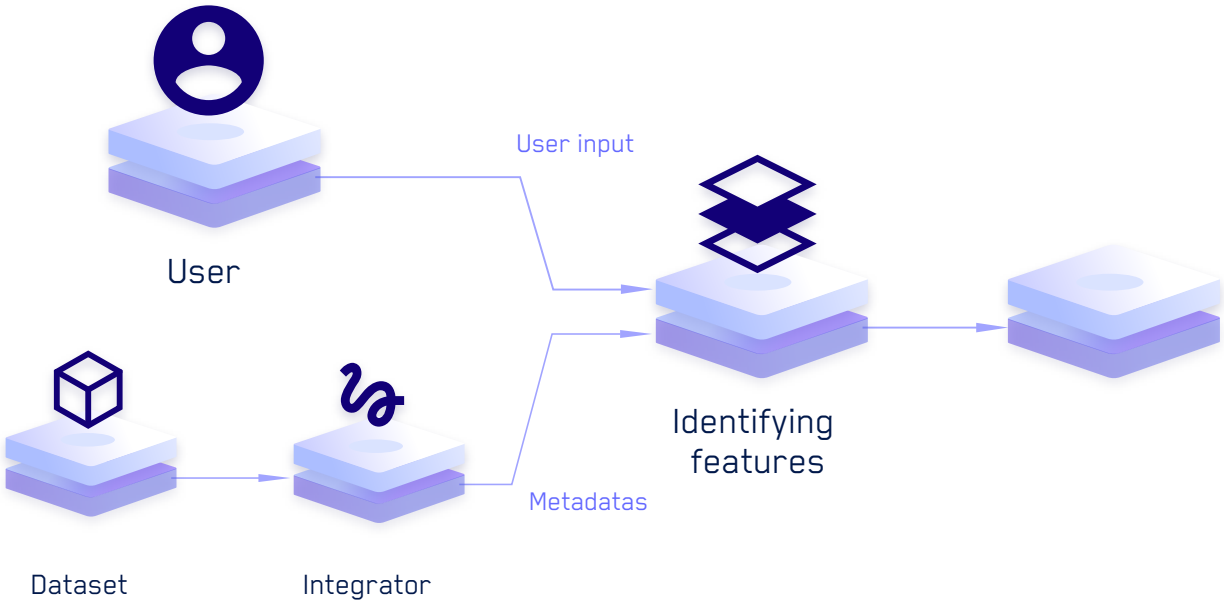
4.1 Meta Representation & Associated Framework

Contracts regarding data usage are sophisticated and must be secured. In order to describe and manage them in the most optimal way, in house versions of smart contracts will be introduced. These smart contracts will be unforgeable and readable by humans and machines. Powered by Metalanguage, AI and NLP, the SciDex, SciEngine, will allow our community to create and search new smart metadatasets which will boost scientific research.

The protocol of the SciDex MarketSpace creates a Scientific Meta Language (SML) inspired by the Ecological Metadata Language (EML) [12] and sharing its main features: modularity, detailed structure, compatibility and strong typing.

The SciEngine supports most data protocols and structures such as the majority of harvesting protocols (including METS and OAI-OMH) and the ProvONE Data Structure Specification.

This tool allows intensive usage of AI training in order to optimize the search as well as the building of new smart (compliant) meta-datasets. Initial features that can be used by classifiers are identified, including content-based and behavioral features identified using a clustering algorithm (OPTICS). A classifier (SVM) is created for data classification and regression analysis. In order to improve search and discovery, a registry for storing arbitrary xml metadata scheme is used and CRUD services are automatically generated.



The protocol framework of the SciDex MarketSpace provides users with sets of smart manual and automated indexing tools which help data providers index and maintain their metadata. The indexing tools support the majority of databases, including those supporting big data and file formats such as proprietary formats (Oracle, IBM, Terradata, etc.), open-source formats (MongoDB, Hadoop, etc) and cloud services (Google App Engine, Amazon EMR, etc).

4.2 Data Contribution

Data Providers Registry

The SciDex MarketSpace maintains a registry of data providers. Those are ranked based on the quality of the data they provide. The rank of each provider is visible to the community of the SciDex MarketSpace.

Probation Period

To avoid filling the platform with compliant but inconsistent or flawed content and to reduce the risk of abuse, data providers have to stake SDX during a probation period.

The probation period is determined automatically according to the seniority and ranking of the data provider. During the probation period, qualified community members can challenge the quality, validity, ownership, and utility of the provided data.

A community member can choose to cast a vote challenging the dataset if and only if the voter meets at least one of the following requirements:

- Has a Proof of Work as a curator on this dataset
- Has a Proof of Payment as a buyer for this dataset
- Is a Trusted Member of the community

During the probation period, data buyers have the right to initiate a call for contribution from high ranking data curators to validate and curate the data. Data buyers can choose to take the risk to purchase the data before the end of the probation period and validate the data on themselves.

Data Curation

Data providers have to grant access to a limited part of their datasets for curators to check data availability and consistency. This access is only shared with curators.
There are two types of categories of curation calls on the SciDex MarketSpace, manual ones and automatic ones.

Manual Curation Calls: Each time a market actor calls for service and requests curation of a specific dataset.

Automatic Curation Calls: There are two type of scenarios in which an automatic curation call is generated:

- Every time a new dataset is indexed on the marketspace.
- Every time a data provider updates their indexed datasets. Note that providers are requested to regularly update the access to the data and the accuracy of its description.

When the call is answered, data curators can begin curating process. Their goal is to validate:

- The availability and consistency of data
- The compliance with the SciDex quality standard

When an automatic action is performed, SDX are allocated to the data curator following the incentive mechanism described in section 3.2.3.

The SciDex MarketSpace provides data curators the required tools to efficiently perform their task, and address most of the data challenges listed by Edward Curry, Andre Freitas and Sean O'Riain [13]:

Discoverability & Accessibility: Data curators help the development of the SciDex and SciEngine by classifying and structuring the data, making it easier for market actors to navigate.

Completeness: Using calls for services, data curators can conduct data audits to improve the completeness of the data or provide more context by linking related datasets.

Interpretation: When datasets are indexed, the metadata entered is automatically scanned by an NLP based interpretation tool which flags ambiguities. Missing fields, typos in tags, irrelevant descriptions etc. are all flagged and made visible to data curators to suggest fixes.

Accuracy & Consistency: Using a call for services, data curators can clean the data, and improve its accuracy, consistency and quality for both data buyers and providers. This significantly helps to improve the overall accuracy and consistency of the SciDex MarketSpace.

Provenance & Reputation: The Probation Period mechanism, described in 4.2, and the Trusted Members, described in 3.2.3, ensures the provenance of data and incentivizes data providers to perform at high standards in order to maintain their reputation and ranking.

Timeliness: Automatic curation calls are created for regular updates to the access of the data and the accuracy of its description. This ensures its timeliness and makes sure it always remains up-to-date.

Similar to Wikipedia or Linux, the protocol on the SciDex MarketSpace builds a self-governing and open community encouraging public contributions and participation. The success of the community is based on the support of talented and driven individuals who are capable of curating data and identifying errors.

4.3 Ricardian Adaptive Smart Contracts

Introduced by Ian Crigg in the mid-1990s, the Ricardian contract is a robust, transparent and efficient method of recording a document as a legal contract and linking it securely to other systems [14]. The use of identification by cryptographic hash function, readable text, and markup language makes it the perfect way to trade digital assets. Ricardian Contracts have been successfully used in blockchain oriented frameworks like Open-Transactions, Commonaccord or Openbazaar.

Contracts of the SciDex protocol are based on a proprietary version of Ricardian contracts supporting peer-to-peer smart contracts, the Ricardian Adaptive Smart Contract (RASC). The RASC is a readable representation of sophisticated contracts and their secured execution on blockchain that adapts to the constraints and requirements of users.

Users can add “tags” to the contracts, allowing a smart hierarchy system for searching and indexing data.

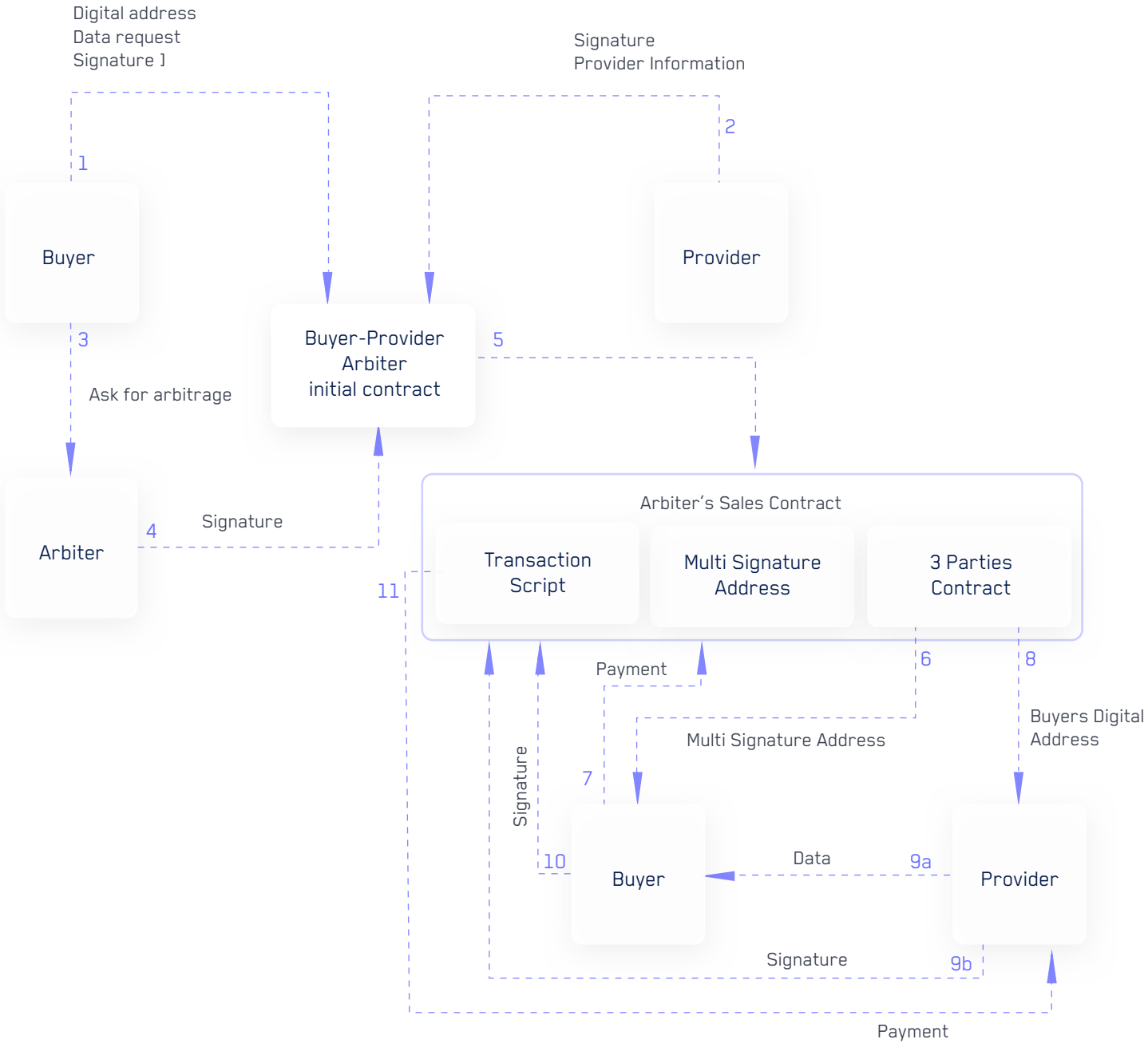
The adaptive contract is a single contract holding all different variations of the item.

Each variation holds the following data:

- Id
- Parent item ID
- Title
- Description
- Amount of times this variation can be sold (-1 is infinite)
- Price
- Restrictions

The smart contract mechanism of the SciDex MarketSpace allows the data buyer to choose any arbiter supporting SDX.

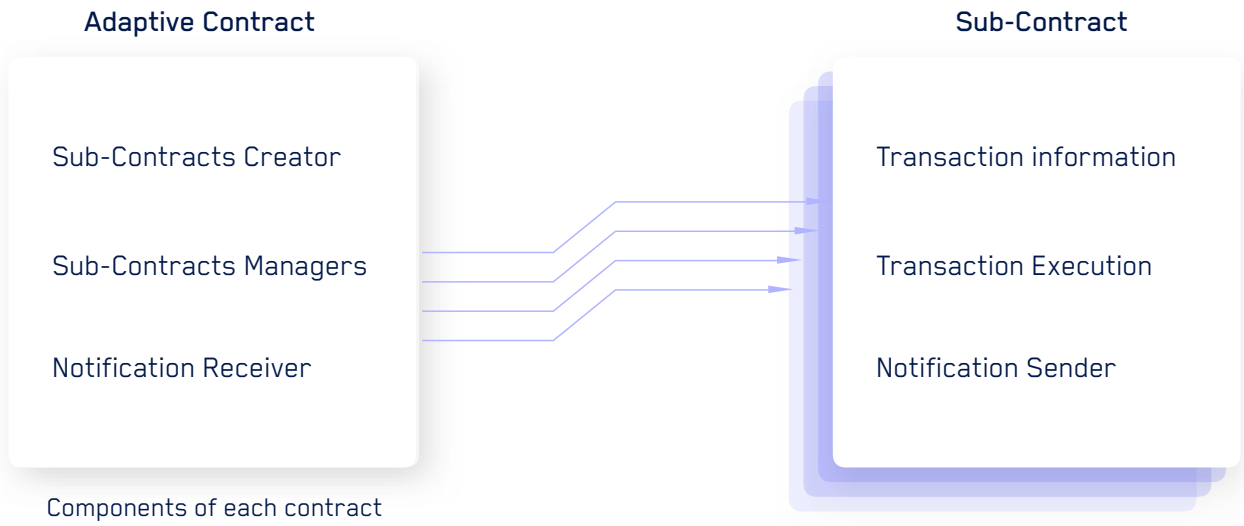
Flowchart of a buying contract based on the SciDex protocol:



Once the embedded parameters are set, a RASC represents a single unit of a usage license of a dataset or a service (for example a call for contribution) sold (potentially for free) from a data provider to a data buyer.

Upon creation of the adaptive contract, the RASC will create all of the sub-contracts, one for each type of sale, and publish them on the blockchain. The sub-contracts are related to the actual sale, but it has to notify the parent adaptive contract about any transaction made.

The adaptive contract is composed of three major components: a sub-contract creator, a sub-contract manager, and a notification receiver. The sub-contracts are also composed of three major components: transaction data, a transaction executor, and a notification sender.



Components of each contract

This approach allows one to manage the MarketSpace and all metadata that populates the index, including each of their specification, requirements and restrictions. More details on the SciDex RASC contract are available here.

4.4. Building a Meta-NLP & Related AI Algorithms supporting RASC for Data Exchange and Domain Correlation

The proprietary SML of the SciDex protocol aims to provide smart meta-descriptors covering, as much as possible, intersections between scientific subdomains. These meta-descriptors improve dataset indexation and reduce noise, while allowing the description of complex hybrid contracts such as RASC and SCT.

The SML engine reads the contracts, understands the text, embeds parameters and automatically creates a set of smart meta-tags and variables to describe them. In addition, it enables the indexation and the execution of the related smart transaction scripts between peers.

A dynamic META-NLP/AI environment will be built to support large domain related meta-frameworks and power the SML framework. This maximizes the user experience in the SciDex MarketSpace by providing the most accurate answers for searches using natural-language processing and by broadening the scope of their search using AI algorithms as well as deep learning.

In addition to setting up a specialized NLP environment for a domain, the SciDex protocol will refine the correct layered structure of algorithms, building up an artificial neural network (ANN) by taking advantage of the dual data type inputs received through our platform by users. These dual data type inputs are the meta-information collected from the data providers during the integration of their datasets through RASC and the search in natural language by the data buyers.

The data sources are enriched by encouraging data providers to provide their Q&A data. Community members are incentivized to participate in the refinement of the Meta-NLP lexicon through social mechanisms based on a pay for work model which is executed over the blockchain by invitations to vote or answer questionnaires.

5. Security & Sybil Attacks

The main problem in any system where reputation is involved is the threat of Sybil attacks. In a Sybil attack, the attacker subverts the reputation system of a peer-to-peer network by creating a large number of identities and using these identities to gain a disproportionately large influence [15]. The vulnerability of a reputation system to a Sybil attack depends on how inexpensively identities can be generated, and whether the reputation system treats all entities identically [16].

Therefore, the following mechanisms are implemented to prevent a Sybil attack:

- Trusted Members - Only Trusted Members can vouch for others or cast votes. As stated in 3.2.2, to become a Trusted Member requires effort and SDX, making it expensive and time consuming for the attacker.
- Security Deposits - To provide data for the MarketSpace, a data provider stakes SDX for a probation period. The security deposit can be lost if the user provides empty or forged datasets.

The high costs and long period of time to create trusted IDs as well as the loss of the security deposits in escrow discourage this type of abuse.

6. Data Pricing

The pricing of data is left at the sole discretion of the data provider. However, a data price estimation tool based on popularity, quality, and quantity of the data is implemented for data providers and data buyers. The SciDex MarketSpace analyzes the provided dataset and suggests a price according to historical prices of similar datasets on the market. Each dataset can be split up into various items for sale with different price tags.

For example, a provider could have the a dataset once sold with a 'for non-commercial use only' restriction, and have a different price tag on the identical dataset sold without any restriction.

7. The SciDex MarketSpace Governance Actors

The SciDex MarketSpace promotes a three-tier governance system that allows market actors from diverse fields of expertise to contribute to the ecosystem via a unique and innovative self-governing mechanism.

7.1. The SciDex Foundation

7.1.1. Attributes

SciDex Foundation Ltd (the **Foundation**) is a non-profit organization incorporated in Singapore.

The Foundation will oversee the strategic development of the SciDex MarketSpace based on the principles of best practice governance rules, including operation management, market promotion, development of underlying technology and construction of service system, planning and technology development.

7.1.2 Directors of the Foundation

The Board of Directors shall be the ultimate decision making body of the Foundation and shall comprise up to 9 Directors.

The Directors are appointed for a maximum of a 4 year period, which maybe renewed without limitation. The renewal or appointment of new Directors will be subject to a vote of the members of the Foundation as well as the Committee of Experts (see below).

At least one third of the Directors will be independent, meaning they are not affiliated with the Directors or top management of the Foundation, and do not maintain business relationships with these people. Further, it shall be an additional condition that they do not hold a significant number of SDX.

Each Director of the Board of Directors should arrange his personal and business affairs to avoid, as much as possible, any conflicts of interest. In case of such a conflict, the Director should inform the Board so as to make a decision on the resolution of the conflict.

The Board will promote the diversity and equality of genders among its Directors.

Depending on the matters, the Board may invite members of the Committee of Scientific Experts (see below) or Trusted Members to attend Board meetings with observers seats.

The Foundation will issue an annual report on its activity with financial statements reviewed by an independent auditor.

7.2. Scientific Governance

A Committee of Scientific Experts (CSE) shall be appointed by industry and domain specialists, as well as data scientists/AI experts.

The CSE will consists of a maximum of 9 people.

The members of the CSE will be appointed by the Foundation for a 4 year period, which can be renewed without any limitation. The renewal or appointment of new experts will be subject to a vote of the members of both the Foundation and the CSE.

7.3. Trusted Member

To ensure a proper representation of scientific knowledge, Trusted Members have their voices taken into account with respect to subsidies and making of grants, and on no other matters.

As described in section 3.2.3, Trusted Members are the most active, engaged, and recognized community members who also hold a defined amount of SDX. Upon call for a vote by the SciDex Foundation, Trusted Members shall vote on whether to support companies that have applied for grants.

7.4. Voting Mechanism

The SciDex MarketSpace implements a simple and efficient voting mechanism, which weights voting rights based on the actual amount of SDX held and loyalty of the SDX holders. The voting rights shall be assigned equally to the SciDex Foundation, the CSE, and the Trusted Members. The vote will be cast on the blockchain for transparency and trustworthiness.

- The SciDex Foundation will receive 1/3 (one third) of the voting rights
- The Committee of Science Experts will receive 1/3 (one third) of the voting rights, if and only if 10% of the total number of Science Experts take part in the vote
- The Trusted Members will receive the remaining 1/3 (one third) of the voting rights, if and only if 10% of the total number of Trusted Members take part in the vote

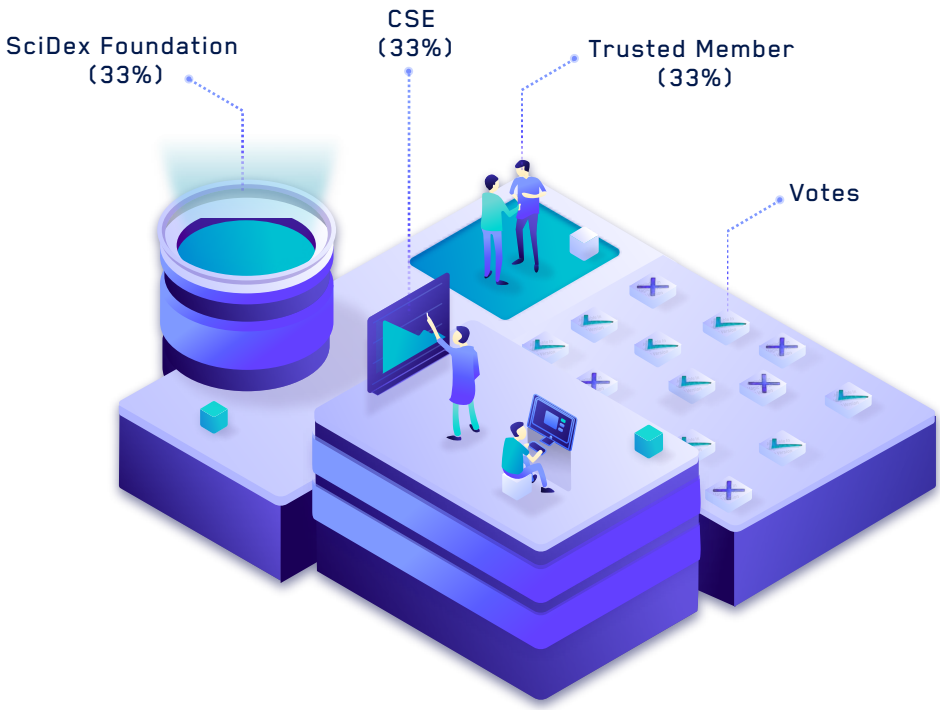
This 10% percentage ('quorum') requirement ensures a fair discussion of views from each body. In the event that the requested 'quorum' is not satisfied for one governance body, its voting rights percentage will be reassigned to the other governance bodies.

(For example, if the Committee of Experts does not meet the quorum, the Trusted Members and the Foundation will be granted 50% of the voting rights each. If the vote results in a tie, a new vote will be called for. If the event where the same situation repeats, the Foundation will have a casting vote).

The community voting tokens will be non-fungible ERC721 Tokens and will be distributed among the Trusted Members in the community prior to any vote. Each vote will have its own non-fungible token and will be non-transferable.

Each token represents a simple Yes/No regarding a specific vote. Votes can be amended as long as the voting period is ongoing. When this period ends, votes will be locked and visible to everyone on the blockchain. The voting mechanism is designed to avoid a situation where members could abuse the system through market manipulation on the SciDex MarketSpace.

The Voting Mechanism & Actors



8. The SciDex Subsidy & Grant Models

Upon the birth of the SciDex MarketSpace, the SciDex Foundation (as detailed in section 7.1) is established to subsidize companies with the potential to contribute a lot of data and to make grants to breakthrough scientific start-ups. A unique subsidy and grant system driven by SDX holders is built to fuel and empower these promising projects. Together with SciDex Foundation, the SciDex MarketSpace provides these companies with the necessary intellectual resources as well as compliance frameworks and tools to accelerate their R&D process, facilitate their go-to-market and lower their expenses.

8.1. The Subsidy Model

The SciDex MarketSpace allows companies that generate a significant amount of data to monetize it further. Often, part of the data collected by these companies is not used, as it does not directly impact the main business stream of the companies. This unused data might have key benefits for other companies and organizations and should be leveraged.

A subsidy model is implemented to motivate companies by covering the cost of adding their data to the MarketSpace. These companies are either identified by the SciDex Foundation or selected through a nomination process.

The nomination process enables Trusted Members to submit companies they believe should be subsidized. The CSE then selects the best potential candidates in accordance with the compliance rules. They then present the companies to the Board of Directors to cast the deciding votes.

Finally, the Trusted Members have the right to vote on the proposed subsidy recipient for approval.

The subsidy model is mainly targeted towards institutions such as governments and universities that aim to offer free data on the SciDex MarketSpace. This data is often of “low quality” and it requires prior curation before the data is valuable to the platform.

8.2. The Grant Model

Unique and state-of-the-art propositions for data streams which could benefit science should have the chance to thrive. Therefore, as a non-profit organization which promotes advancements in science as one of its goals, the Foundation has established a grant model to provide the most promising start-ups with the support needed. Interested startups or organizations can submit an application to the SciDex Foundation detailing the company’s main business, mission, and vision of the company as well as the expected impact on the current and next generation of scientific research.

After submission, the company is vetted by a thorough screening process performed by the Foundation. If accepted, it will then enter the self-governed voting system which will cast votes on the grant to be made. For the avoidance of doubt, while the views of the users and token holders of SDX would be acknowledged, ultimately they are not connected with the Foundation (or its affiliates) in any manner, and the assets and funds of the Foundation (or its affiliates) remain under the control of the relevant Board of Directors who shall exercise independent judgment in order to determine whether a start-up will receive the grant.

The Foundation does not take stakes in the start-ups which have received the grants.

Qualified start-ups will receive funding from the Foundation. In return, the Foundation will charge a fee in SDX based on the revenue generated from sales on the SciDex MarketSpace by the startup in question, which will be applied towards the objectives of the Foundation.

The following case study illustrates a grant made by the Foundation:

Silencio is a startup in the early stages of development. They are developing a software application for smartphones that constantly measures the level of noise in the periphery of the smartphone, while discarding any personal noise or conversations.

Silencio developed technology and intellectual property that is unique and groundbreaking, however, the forecasted cost of further development and commercialization is significant. They decide to apply for a grant by the Foundation. The SciDex Foundation recognizes Silencio as a potential candidate for grants due to the uniqueness of the outdoor and indoor background noises data collected and decides to allow Silencio to move through the steps prior to making grants as described in the paragraphs above. After proper vetting and voting, the Board of Directors of the Foundation agree to make a grant of SDX to Silencio.
Following the grant made to Silencio, the company will periodically index and maintain representative datasets of their findings on the SciDex MarketSpace in order to provide community members with valuable data.

Such data could serve:

- Geo-marketing analysts running different studies for companies, such as Real estate Agencies or Double-glazing companies.
- Governmental researchers focused on noise cancelling solutions in cities.
- Health care companies, organizations or corporations in charge of analyzing the impact of background noise on the health of the population.

8.3. The Grant & Subsidy System Compliance & Rules

The main goals of the grant and subsidy system are:

- To incentivize and subsidize data holders and data creators to adopt the SciDex MarketSpace who would otherwise not be able to join the platform.
- To provide the community with high quality scientific data streams by making grants to promising start-ups.

The Board of Directors of the Foundation have broad discretion to decide whether funds received by applied companies may be in the form of donations, loans or other alternatives.

The grants and subsidies model is governed by the following best practices:

- A defined maximum number of SDX for overall grants and subsidies per year
- A defined maximum number of SDX per grant and per subsidy
- Initial review of applications and nominations by the grant & subsidy protocol of SDX
- Standardized technical, financial, tax and social audit to assess the legal risk
- Evaluation of the potential scientific value and contribution by CSE of applicants
- Community vote

As previously stated in 7.4, the total voting rights will be assigned and distributed evenly to following parties:

- The Foundation will receive 1/3 (one third) of the voting rights
- The CSE will receive 1/3 (one third) of the voting rights, if and only if 10% of the total number of CSE take part in the vote
- The Trusted Members will receive the remaining 1/3 (one third) of the voting rights, if and only if 10% of the total number of Trusted Members take part in the vote

For the avoidance of doubt, while the views of the CSE and Trusted Members would be acknowledged, ultimately neither the CSE nor Trust Members are not connected with the Foundation (or its affiliates) in any manner, and the assets and funds of the Foundation (or its affiliates) remain under the control of the relevant Board of Directors who shall exercise independent judgment and apply them to achieve the Foundation's objectives. The right to vote does not entitle members of the CSE nor Trust Members to vote on the operation and management of the Foundation (or its affiliates) and does not constitute any equity interest in the Foundation (or its affiliates).

8.4. The General Commitments & Responsibilities of Companies

Upon receiving the grant, start-ups will commit to issue periodic reports to the Foundation and comply with best practices.

From a financial standpoint, start-ups commit to provide:

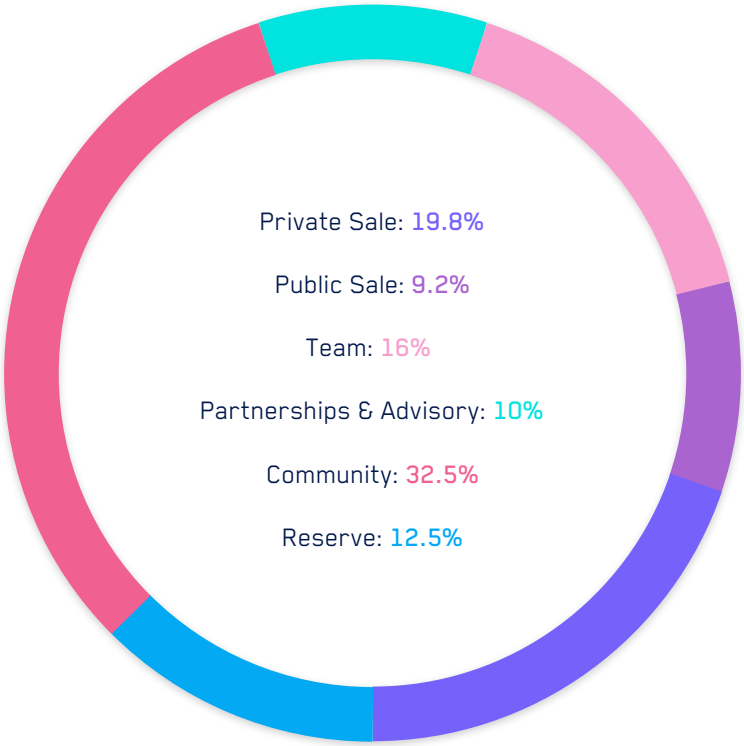
- An annual budget at the beginning of each year
- A quarterly report on cash and revenue
- Financial year statements within 4 months of the closing of the year

If required by the Foundation, the start-up will appoint to their Board of Directors (or equivalent) and one Director of the Foundation. They will convene at least 4 board meetings per year to allow proper supervision of the management. If it is deemed necessary for the Foundation, a complementary audit may be carried at the expenses of the company.

9. Initial Token Allocation & SDX Release Schedule

The initial token allocation is designed to incentivize the community, the token purchasers and the team to build a sustainable and healthy ecosystem. The Distributor of SDX shall be an affiliate of the Foundation.

In the quest to create the first decentralized MarketSpace for scientific data, a significant amount of work will be required to build a full stack of software, frameworks and tools to serve every market actor and participant in the ecosystem on the SciDex MarketSpace.



The total amount of SDX distributed will be 1,200 Million.
The initial SDX price will be set at $0.10.

The initial price of SDX was set after running internal models of the ecosystem economy of the SciDex MarketSpace. The structure of the economy had been closely modelled following the suggestions of token economy experts. A full explanation of the economic model of the SciDex MarketSpace will be released after legal review.

In particular, you understand and accept that SDX:

(a) does not represent or confer on the token holder any right of any form with respect to the Foundation (or any of its affiliates) or its revenues or assets, including without limitation any right to receive future dividends, revenue, shares, ownership right or stake, share or security, any voting, distribution, redemption, liquidation, proprietary (including all forms of intellectual property), or other financial or legal rights or equivalent rights, or intellectual property rights or any other form of participation in or relating to the SciDex MarketSpace, the Foundation, the Distributor and/or their service providers;

(b) is non-refundable and cannot be exchanged for cash (or its equivalent value in any other virtual currency) or any payment obligation by the Foundation or any affiliate;

(c) is not intended to represent any rights under a contract for differences or under any other contract the purpose or pretended purpose of which is to secure a profit or avoid a loss;

(d) is not intended to be a representation of money (including electronic money), security, commodity, bond, debt instrument or any other kind of financial instrument or investment;

(e) is not a loan to the Foundation or any of its affiliates, is not intended to represent a debt owed by the Foundation or any of its affiliates, and there is no expectation of profit; and

(f) does not provide the token holder with any ownership or other interest in the Foundation or any of its affiliates.

The sale proceeds of SDX will be used in the following manner:

- 40% will be set aside for research & development
- 40% will be set aside for marketing
- 20% will be set aside for business development

The contributions in the token sale will be held by the Distributor (or its affiliate) after the token sale, and contributors will have no economic or legal right over or beneficial interest in these contributions or the assets of that entity after the token sale. To the extent that a secondary market or exchange for trading SDX does develop, it would be run and operated wholly independently of the Foundation, the Distributor, the sale of SDX and the SciDex MarketSpace. Neither the Foundation nor the Distributor will create such secondary markets nor will either entity act as an exchange for SDX.

10. The Founding Team & Advisors

The SciDex team is composed of a group of scientists, engineers and entrepreneurs from diverse backgrounds. Based in Beijing and Tel Aviv, the team has been working on cutting-edge technologies that promote the progress of society, including big data, artificial intelligence, deep learning, and blockchain. With a full range of successful business and technical experience, the team has built a space that enables the unlocking of unexplored knowledge using advanced scientific data.

10.1 The Founding Team

Shuo Wang - Co-Founder - Shuo started off her career by focusing on designing exoskeletons and using cognitive science and AI to control them. She then successfully co-founded a start-up developing and selling smart health devices as CTO. Shuo holds a B.Sc. and a Masters of Science from MIT. At SciDex, she is in charge of product development as well as strategic decisions for the Asian markets.

Alex Bouaziz - Co-Founder - Alex led product marketing and development at various startups. He first co-founded Lifeslice, which was selected by Google as one of the best new apps in the video space, as well as Sarona Ventures, a successful up and coming fund in Tel Aviv. In his spare time, he built a popular DApp, CryptoFighters.
Alex holds a B.Sc. from the Technion Institute of Technology, a Masters of Engineering from MIT, and did scientific research at Imperial College London.
At SciDex, he focuses on business development as well as strategic decision-making for the western markets.

Constantin Overlack - Co-Founder - Constantin co-founded Aeris Cleantec AG, a successful IoT and data driven hardware startup. He managed to considerably grow the company in both China and Central America. Prior to this, Constantin worked at BMW and various startups focusing on product marketing and design. He holds a B.Sc. and Masters in Engineering from ETH Zurich. At SciDex, Constantin focuses on marketing and community growth.

Ofer Simon - Co-Founder - Ofer is an award winning App developer with years of experience in blockchain and DApps. He was a Communication System Officer in the Israeli army (IDF) and with his expertise successfully co-founded several cyber, consumer and blockchain companies. Ofer holds a B.Sc. in Communication System Engineering from BGU. At SciDex, he is in charge of the technical development and leads the development team.

10.2 Advisors

Philippe Bouaziz - Philippe is a highly successful European serial entrepreneur. Philippe is the founder of the Prodware Group which is listed in Paris Stock Exchange and serves 20,000 customers in over 15 countries. He is known as one of the leading personas in the high-tech industry in Europe and Israel. Philippe sits in numerous advisory boards of large companies as well as Engineering and Business Schools. Philippe is an early investor in blockchain and crypto focused companies. At SciDex, Philippe actively supports Shuo and Alex in the strategic decision making and will focus on cementing significant business partnerships.

Elie Galam - Elie Galam co-founded Peerform. He is also Chief Investment Officer for Panorama Partners, a New York based hedge fund that invests in deep value derivative instruments throughout the world. Prior to Panorama Partners, he worked at leading hedge funds where he invested billions of dollars across multiple asset classes.

Jia Tian - Jia Tian is an early investor in Bitfinex & Limited Partner of Bitfund, Advisor to FBG Capital and Consultant to Zcash. He holds M.S./B.S., from Tsinghua University, focused on distributed system.

Franck Cohen - Franck Cohen is the President of Digital Core and Industry Solutions at SAP. Franck is responsible for SAP's go-to-market, operations, and all underlying processes across all lines of business globally. He also oversees the SME business and SAP's top strategic customers.

Michael Shmilov - Michael Shmilov has been a key member of the Viber Management team working alongside with the founding team since the launch of the company in December 2010. As Chief Operating Officer, Michael is responsible for several cross company projects,overseeing innovation initiatives and working closely with product and R&D teams.

Ben Maurer - Ben is the co-founder of reCAPTCHA, a system which determines if a user is human while simultaneously digitizing books. reCAPTCHA was acquired by Google in 2009. In 2010, Ben left Google to join Facebook, creating headlines in the tech world. Ben also worked at the White House as part of the US Digital Service where he improved the communication tools used by the President and his staff.

11. Data Confidentiality

Privacy and personal data protection are priorities for the SciDex MarketSpace. The MarketSpace adopts the new European Union General Data Protection Regulation as a template for global privacy compliance.

Following the principles of privacy by design and privacy by default, the SciDex MarketSpace will follow these compliance guidelines:

- **Legal basis for treatment:** the legal basis for the treatment of personal data inside the SciDex MarketSpace will be Consent. Anyone becoming part of the SciDex community will provide explicit consent to the treatment of their personal data for the purposes of their membership (including providing or purchasing data, curating indexed content, managing the community etc). This consent will comply with the requisites of GDPR and will be stored centrally and presented when necessary.

- **Data minimization:** no personal data will be stored in the blockchain. All personal data involved in the system (contributors, purchasers, administrators etc) will be kept outside the blockchain.

  Advanced pattern recognition tools will detect and prevent potential personal data from entering the blockchain.

  Only personal data strictly necessary for the operation of the system - with regards to the membership and roles of the data subjects - will be collected.

- **Geographical restrictions:** repositories containing personal data will be managed centrally and kept in the European Union, with the exception of datasets containing data derived in China.

- **Individual rights:** data subjects whose data is managed by the system will be able to exercise their personal rights (access, rectification, cancellation, objection etc) through a request system. There will be tools and processes in place to apply these individual rights requests on the personal data repositories.

- **Security and access control:** the personal data processed by the system will be adequately protected against unauthorized external access using advanced security measures and technologies. Personal data will be encrypted in transit and at rest. Perimetral network security will protect the data from breach attempts. Security will be constantly monitored and logged.

There will be rules and processes in place to prevent authorized system operators to access parts of the information they don't need for the fulfillment of their roles.

- **Documentation and notification:** personal data processing activities will be documented and available on request. The Privacy Policy for the system will be publicly available.

  In the event of the data breach, processes will be in place to notify the supervisory authority within 72 hours.

12. Risks

You acknowledge and agree that there are numerous risks associated with purchasing SDX, holding SDX, and using SDX for participation in the SciDex MarketSpace. In the worst scenario, this could lead to the loss of all or part of the SDX which had been purchased.

- **Uncertain Regulations and Enforcement Actions:** The regulatory status of SDX and distributed ledger technology is unclear or unsettled in many jurisdictions. The regulation of virtual currencies has become a primary target of regulation in all major countries in the world. It is impossible to predict how, when or whether regulatory agencies may apply existing regulations or create new regulations with respect to such technology and its applications, including SDX and/or the SciDex MarketSpace. Regulatory actions could negatively impact SDX and/or the SciDex MarketSpace in various ways. The Foundation (or its affiliates) may cease operations in a jurisdiction in the event that regulatory actions, or changes to law or regulation, make it illegal to operate in such jurisdiction, or commercially undesirable to obtain the necessary regulatory approval(s) to operate in such jurisdiction.

  After consulting with a wide range of legal advisors and continuous analysis of the development and legal structure of virtual currencies, the Foundation will apply a cautious approach towards the sale of SDX. Therefore, for the token sale, the Foundation may constantly adjust the sale strategy in order to avoid relevant legal risks as much as possible.

- **Other risks:** In addition to the aforementioned risks, the potential risks set out above are not exhaustive and there are other risks (as more particularly set out in the Terms and Conditions) associated with your purchase, holding and use of SDX, including those that the Foundation cannot anticipate. Such risks may further materialize as unanticipated variations or combinations of the aforementioned risks. You should conduct full due diligence on the Foundation, its affiliates and the ABC team, as well as understand the overall framework, mission and vision for the SciDex MarketSpace prior to purchasing SDX.

- **Inadequate disclosure of information:** As at the date hereof, the SciDex MarketSpace is still under development and its design concepts, consensus mechanisms, algorithms, codes, and other technical details and parameters may be constantly and frequently updated and changed. Although this white paper contains the most current information relating to the SciDex MarketSpace, it is not absolutely complete and may still be adjusted and updated by the ABC team from time to time. The ABC team has no ability and obligation to keep holders of SDX informed of every detail (including development progress and expected milestones) regarding the project to develop the SciDex MarketSpace, hence insufficient information disclosure is inevitable and reasonable.

- **Competitors:** Various types of decentralized applications are emerging at a rapid rate, and the industry is increasingly competitive. It is possible that alternative networks could be established that utilize the same or similar code and MarketSpace underlying SDX and/or the SciDex MarketSpace and attempt to re-create similar facilities. The SciDex MarketSpace may be required to compete with these alternative networks, which could negatively impact SDX and/or the SciDex MarketSpace.

- **Failure to develop:** There is the risk that the development of the SciDex MarketSpace will not be executed or implemented as planned, for a variety of reasons, including without limitation the event of a decline in the prices of any digital asset, virtual currency or SDX, unforeseen technical difficulties, and shortage of development funds for activities.

- **Security weaknesses:** Hackers or other malicious groups or organizations may attempt to interfere with SDX and/or the SciDex MarketSpace in a variety of ways, including, but not limited to, malware attacks, denial of service attacks, consensus-based attacks, Sybil attacks, smurfing and spoofing. Furthermore, there is a risk that a third party or a member of the Foundation or its affiliates may intentionally or unintentionally introduce weaknesses into the core infrastructure of SDX and/or the SciDex MarketSpace, which could negatively affect SDX and/or the SciDex MarketSpace.

  Further, the future of cryptography and security innovations are highly unpredictable and advances in cryptography, or technical advances (including without limitation development of quantum computing), could present unknown risks to SDX and/or the SciDex MarketSpace by rendering ineffective the cryptographic consensus mechanism that underpins that blockchain protocol.

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