Whitepaper
(v2)

Lemmatron
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Introduction

Blockchain has come a long way giving birth to products and services like cryptocurrency, DeFi, GameFi,... Crypto trading has been a focal point in the web 3.0 business industry. Be it interest in the project or its financial aspect, people are flooding in this industry every day and in the center of crypto trading sits liquidity. The rate of new projects coming in with their cryptocurrency/token is just too high and as a result, the market suffers from low liquidity. This is the problem Lemmatron is attempting to solve.

In the traditional stock exchange, there is some individual behind every trade doing all the work to execute orders. In the crypto market, however, those are all automated by what is called Automated Market Maker(AMM). The asset has to come from somewhere to swap/trade it with another asset. This is where the liquidity pool comes in. Liquidity pool contains pairs or groups of assets(like in balancer) which facilitates crypto trading of the assets in that pool. Anyone is free to contribute to the liquidity pool and as an incentive, a certain percentage of the trading fee is earned by those liquidity providers(LPs).

Current Issue

We know how important liquidity pools are in crypto trading. However, low liquidity invites many problems which are faced by an extremely huge number of crypto projects. In fact, low liquidity was voted by 36% of cryptocurrency traders as a major problem they faced in 2018 according to Encrybit.

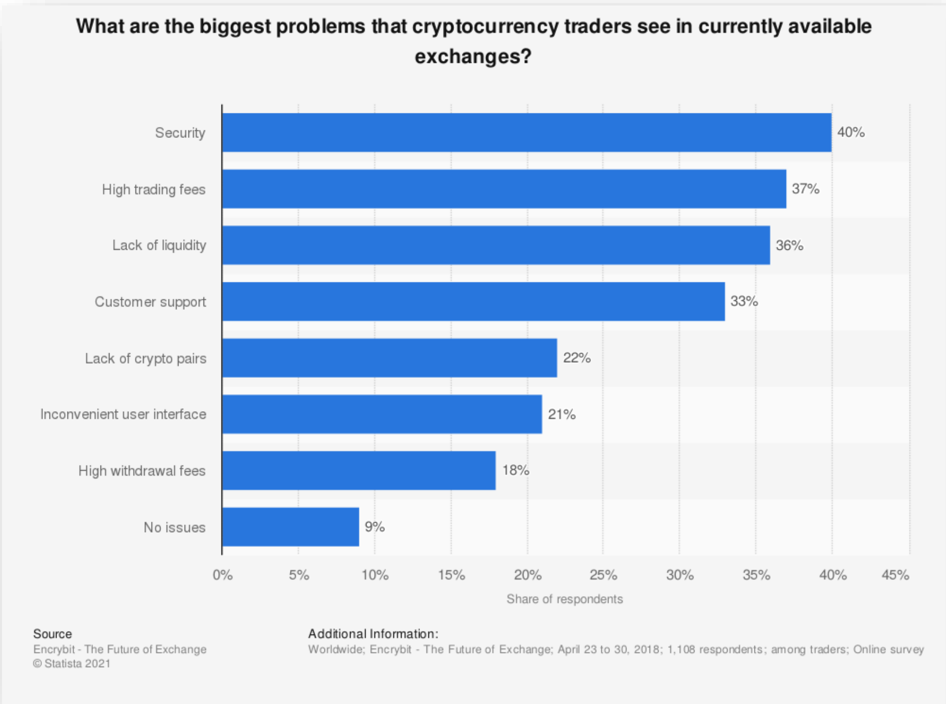

Figure 1 Problems crypto traders face

When the liquidity is low, price change is dramatic with low trading volume resulting in trade not being executed at the same price. This can scare people away as they do not get the equivalent amount of assets in exchange. All the trade analysis tools stop working which is a fundamental right of every trader. Because of these reasons, trading volume plummets, and projects struggle miserably.

Liquidity Pool Incentives

To tackle the problem of low liquidity, an incentive was introduced by exchanges to whoever provides liquidity to the pool. This helped solve the issue to a very small degree and here is why. Every project has to put an enormous percentage of their fund into liquidity which they could have used in product development. Not only that, they have to allocate a large number of their token for LP incentives. The LP incentive is fine for a large pool but the fundamental problem of low liquidity remains unsolved. A project with already low liquidity has to offer an insane APR incentive to attract new LPs. This is highly inflationary tokenomics. Once those LPs receive their incentives, they are highly tempted to sell their token because they are in the pool for financial interest. The liquidity pool suffers even more and when the project lowers the incentive, all the LPs exit the pool in search of new "shiny" pools with insane APR. As a consequence, there are countless projects stuck in the pit of low liquidity looking left and right to increase their liquidity.

Lemmatron

Enter Lemmatron. Lemmatron is a liquidity directing project aiming to solve markets with low liquidity. At the same time, the treasury of Lemmatron is designed to increase constantly which helps to maintain the floor price of its native token LEMA. The architecture of liquidity flow in Lemmatron is straightforward and hence, easy to understand.

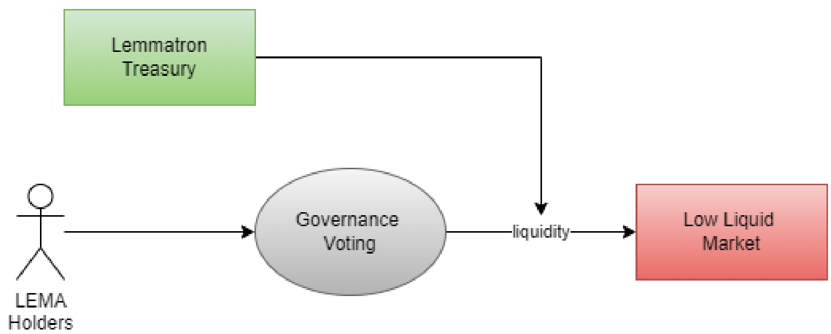

Figure 2 Top view architecture of Lemmatron

The general idea of Lemmatron is to keep the liquidity pool stable. This is the first and foremost thing that any projects have to do in order to increase their liquidity. Without this, liquidity providers(LPs) are not attracted. We can understand why this is crucial with the following example.

Let's say a project raised $100,000 and put $50,000 into liquidity and $50,000 into product development. It could have been better if all the funds were used to develop the product but to facilitate *the trading of its native token, 50% of the fund has to be put into the liquidity pool. This makes the project increasingly difficult to deliver a product of quality which they could have delivered with that additional $50,000. The LP incentive could help the project but $50,000 is low liquidity and any LP with experience will classify this pool as "highly risky". This would have been different if the pool had more liquidity because the risks for LP would dramatically reduce and attract more liquidity as a result. That nudge to attract more LPs is done by Lemmatron. So, projects can focus completely on product development.*

A part of the Lemmatron treasury is allocated for liquidity directing. LEMA holders can cast their votes on where that liquidity should be directed. The project with the most votes will then receive the liquidity until certain conditions are met after which the liquidity comes back to Lemmatron. Thus, the liquidity that is directed to other projects will all be owned by Lemmatron. Having said all of this, the projects do not have to spend a lot. The cost for *x* amount of liquidity in their pool would be no more than *x/10*.

What is Under the Hood?

To dive more into the mechanics of the process, LEMA holders and treasury are found to be in the center of everything. Not surprisingly, the liquidity directing highly depends upon the number of holders and the total value of the treasury. However, it is the LEMA pool that heavily determines the value of the treasury. Here, the reason why the LEMA pool does not completely influence the treasury is that the treasury is holding non-native tokens(NNT). The percentage of the NNT varies with time. If we look at the majority of the crypto projects' treasury, it is composed mostly of its native token. Because of this, they have to dump all the treasury tokens into its pool when they have to use it which is an extremely unhealthy practice. Keeping this in mind, Lemmatron will work to increase the NNT percentage in its treasury.

Liquidity Directing

A certain amount of the treasury is dedicated to increasing the floor price of the LEMA token on a fixed schedule. This way, the floor price of LEMA is ever-increasing boosting. Additionally, the liquidity that Lemmatron grants to other projects comes from the treasury itself. Under some conditions, this liquidity is then directed to projects that get the most votes in liquidity directing governance where different types of LEMA holders cast their vote. According to the conditions mentioned before, the liquidity comes back to Lemmatron treasury and for the service that Lemmatron provided to the project, they have to pay a service fee of no more than $1/10^{th}$ of the liquidity pool that they were granted. The service fee can be in any token/coin, even the project's native token/coin. Throughout this process, the liquidity is owned by Lemmatron the whole time.

LEMA Discounts

Users can get LEMA in discount when they sell their NNT. NNT also includes LP tokens. When they do this, they will be offered LEMA in a discounted price which will then be vested to them linearly within a short time interval of no more than 2 weeks. The discounted LEMA tokens come from the treasury and are designed in such a way as to not mess up the inflation rate.

Staking

LEMA holders can stake their tokens into the Lemmatron DeFi app and earn incentives. The working mechanism of staking is dealt with in more detail in the later section of this paper. But the withdrawal of the incentive is designed to prevent the selling pressure of LEMA tokens into the pool. Withdrawal fee tiers are introduced to withdrawals done with certain timeframes. However, the long-term stakers are charged no fees.

Voting

Every LEMA holder is granted votes according to the amount of LEMA they hold. Liquidity directing voting is conducted regularly where several crypto projects are listed asking for the liquidity to be directed their way. The LEMA holders then cast their vote on the project they want. Top standing projects then get the liquidity. The way the votes are counted is another big topic to be discussed. *(More on this later.)*

Ad Revenue

Having crypto start-ups finding it extremely difficult to market their project, Lemmatron strives to be the perfect platform for them too. The governance voting, in particular, is expected to grab a lot of attention and the ad revenues generated from there are collected into the treasury which again increases the NNT percentage sitting in the treasury.

Combining all of the above, we get the following architecture:

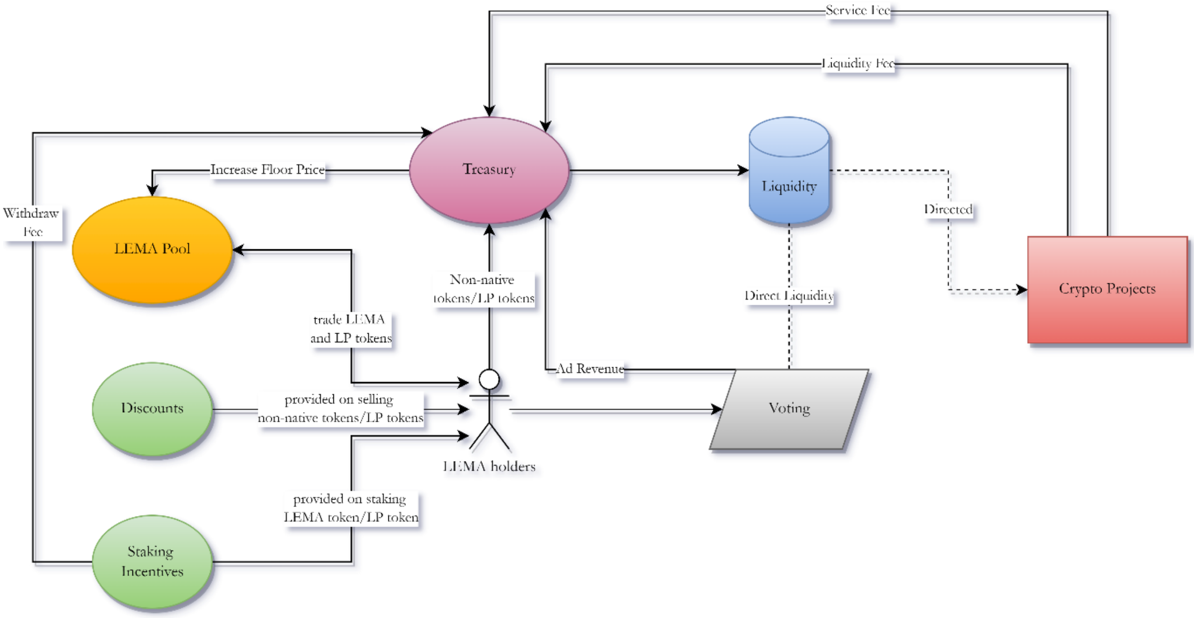

Figure 3 Detailed Architecture of Lemmatron

Staking and Voting

Staking tokens is the act of locking up your token to contribute to the ecosystem and earn some surplus tokens in return. Those tokens can be single asset tokens or Liquidity Provider(LP) tokens. Governance is of two types in Lemmatron viz. general governance and liquidity directing governance. Thus, people with interests in both the project and their financial benefit or either of them can take the advantage of staking. *[See staking for both actors]*[1].

Liquidity Directing Governance

Whenever governance is involved, fairness becomes the holy grail. However, fairness is a spectrum and one cannot simply classify something as being either fair or unfair. The same is the case for decentralisation. Because most people in the blockchain space have failed to understand this, oftentimes there are disputes regarding whether a project is decentralised or not. But moving on with Lemmatron, we attempt to make the governance lean as much towards the fair end of the fairness bar. Before advancing any further into calculating voting power in the governance, the way staking works has to be dealt with first. With that out of the way, understanding how voting power is given becomes effortless.

Staking

Generally speaking, two attributes of every wallet is tracked in staking; quasi-last staked date and total staked LEMA. There is a reason for the last staked date(LSD) to be quasi which is explained later. With these two attributes, it becomes easy to give voting power with a strong level of fairness.

Every time a wallet (un)stakes LEMA, then LSD and total staked LEMA is updated. Regarding the staked LEMA, the calculation is straightforward. In the case of staking, total LEMA is added by simple addition and vice versa. It is a little tricky for LSD. The first staking always has one date on record for any given wallet, so it becomes the LSD by default. As further stakings are done, each staking triggers the contract to find a date between the latest and previous date on record and updates it as the new value for LSD. Unstaking, however, makes no impact on LSD.

Assumption:
To have a clear interpretation, let us consider a wallet w has z LEMA token. The user stakes x LEMA at time $t1$. After t' time, the wallet deposits another y LEMA token. Finally at after t'' from $(t1 + t')$, w unstakes x LEMA token.

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[1] *While the people with an interest in the project have their voices/votes make more impact via quadratic voting, the same cannot be in the case for those with economic interest. The staking is only profitable, provided the token does not lose its value from the time of the staking. Naturally, the number of token increases after staking but the token price can greatly impact the overall investment called "impermanent loss".*

Goal:
Determine the values for LSD d, and total staked LEMA token n.

Calculation:

Case 1:
At time t,

$$d = t1$$
$$n = x$$

Case 2:
Let $t2 = t1 + t'$.
Then, at time $t2$, $\forall\, t2 > t1$:

$$d = (t2 - t1)\frac{y}{x+y} + t1$$
$$n = x + y$$

Case 3:
Let $t3 = t2 + t''$.

Then, at time $t3$, , $\forall\, t3 > t2$:

$$d = d$$
$$n = n - x$$

Conclusion:
Required variables d and n are obtained for cases for both staking and unstaking.

Notice that in the solution, the last staked date we obtain is not the actual date when the wallet staked its LEMA. Therefore, it is referred to as quasi-last staked date.

Time

Having LSD and staked LEMA out of the way, the puzzle is half solved. If we look at the traditional governance,

$$Voting\ power(P) = n$$

This only centralizes the governance to an extremely small number of token holders. Therefore, the reason why LSD was even calculated in the first place is to consider an important factor in the governance; i.e. commitment.

Imagine a scenario, where you staked xyz amount of LEMA for 3 months with an interest in the project knowing that the governance is happening tomorrow. Then someone will less degree of interest in the project also stakes xyz amount of LEMA in the very last minute. In the paper, both of you have the same amount of voting power. However, the truth is significantly different. To adjust this issue, a variable α is introduced where α is the degree of commitment.

$$P = \alpha * n$$

The equation becomes much more balanced now. But how do we choose the value for α? One way of determining it is to stop it from increasing exponentially. This was we can prevent bad actors from getting their voting power amplified in a very short amount of time. If this is not done, it becomes less fair for the long-term stakers. Another factor to keep in mind is that there should be a time at which the value of alpha must start settling down. In doing so, a sweet spot can be discovered by all stakers where the time is not too short and not too long for new people to start their staking. In between these two points, an aggressive climb of the value for alpha can be fitted in to reward the interested actors. A function that would perfectly fit our requirement is a sigmoid function.

We can use the following formula to evaluate the curve for the determining α:

$$\alpha = 1 + \frac{1}{1 + e^{\frac{-n+t_v}{m}}}$$

$$\begin{aligned}
&; where \\
&n = number\ of\ LEMA\ tokens\ staked, \\
&t_v = token\ vesting\ interval/2 \\
&m = slope\ of\ the\ curve
\end{aligned}$$

These parameters can be adjusted to meet the requirement according to the need. For Lemmaton's liquidity project, t_v is set as 45 as our token vesting interval is 90 days, and m as 12.

So why would we even introduce these parameters in the first place? This has been explained partially. But the question remains; What point in time along the 90 days should α start going exponential and for how long? As m is increased, the curve becomes more and more linear, whereas decreasing it gives a sharp sigmoid curve both of which are unfair for the ecosystem. Therefore, an optimum value must be chosen. 12 is not the outcome of some special mathematical calculation but merely a result of the hit and trial method. Lastly, about how long should α have its value change, the vesting period gives a good lead. With a time as much as token vesting interval, it is flexible enough to conduct the liquidity voting in between and still cover the next token vesting time. This helps keep the price of the token healthy and safe from most of the bad actors. As a result, we get the following:

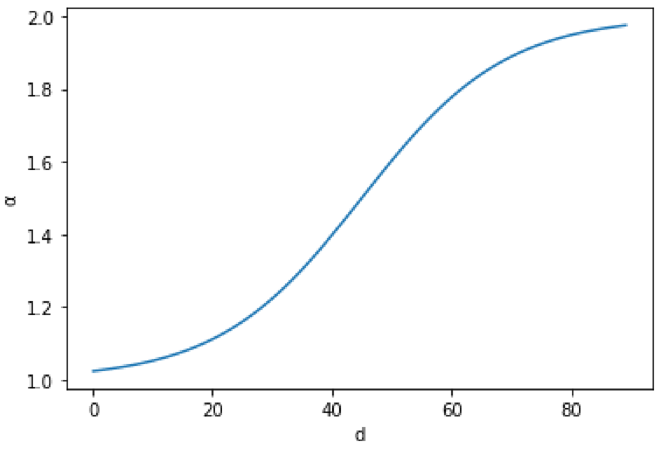

Figure 4 Days-staked(d) vs α

An important thing to also notice here is that the value of d helps α keep a significant distance between people who stake for 10, 30, 60, and 90 days as demonstrated below:

Days Staked	α
10	1.0513357931153162
30	1.222700138825309
60	1.777299861174691
90	1.9770226300899743

Table 1 Values of α at different staked days

Final Missing Piece

It seems we covered all of the aspects in such a short time. But one thing we have not considered is who can vote in the governance. Are stakers(single asset) the only ones who can vote? That becomes more centralized because people who have financial interests should also have the right to participate. For this purpose, we first have to analyse the level of risk each type of token holder is taking. After doing so, we can find out that the least risky token holders are those that do not stake or provide liquidity. Then, single-asset stakers are exposed to more risk. Lastly, with whom the most risk is involved are the LP token stakers. Therefore, the weight of the votes is adjusted accordingly with the introduction of another parameter β called risk factor. The values of β and α for different token holders are:

Token holder	β	α
LEMA Holder(no staking)	1	0
Single Asset Staker	2	α
LP Token Staker	3	α

Table 2 Values of β and α at for different actors

Putting all the pieces together, the voting power of any actor in the Lemmaton ecosystem is given by:

$$Voting\ Power(P) = \beta n \alpha$$

Thus,

$$LEMA\ Holder(no\ staking) = n$$
$$Single\ Asset\ Stakers = 2n\alpha$$
$$LP\ Token\ Staker = 3n\alpha$$

Visualization

If a wallet has 10 LEMA tokens at any given time, then the voting power that it gets in different scenarios with increasing days is displayed by the figure below.

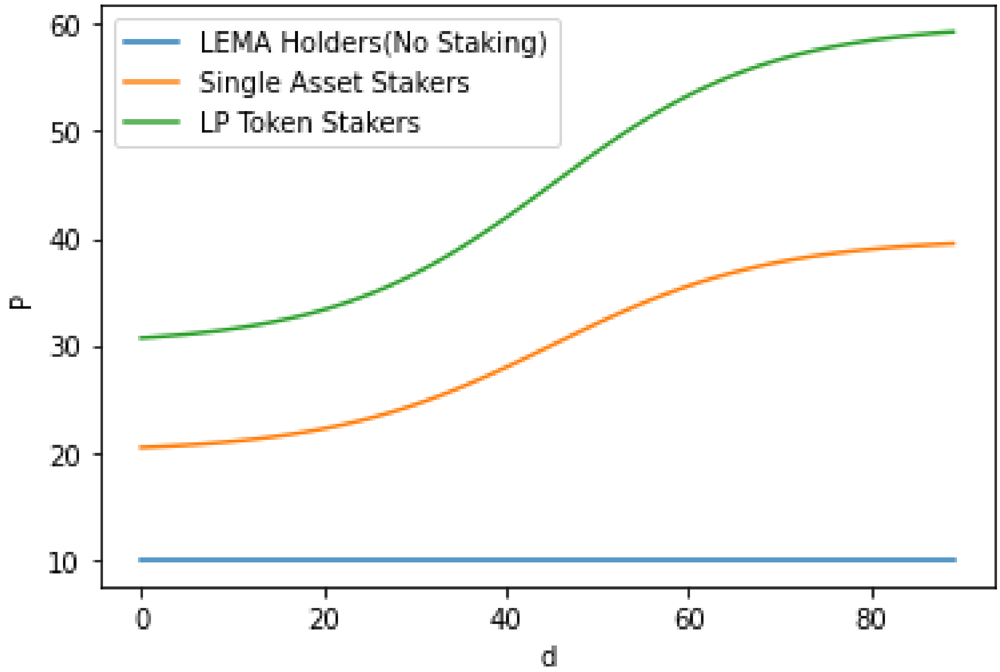

Figure 5 d vs P for different scenarios

General Governance

Having an exponential growth of blockchain space over the years, one of the many aspects being overlooked is governance. Very little light is shed on governance but a recent paper on quadratic voting has benefits over the traditional voting system. As governance is inevitable for Lemmatron, we have adopted the quadratic voting system and hope to improve even more in the coming days. It is important to know that the quadratic voting is done only for the public goods. For Lemmatron, only general governance falls under this category and not the liquidity voting.

First of all, people who have staked a certain amount of LEMA token in minimum, get to cast their vote. The goal of voting can be categorized into:

a) General

In this voting, many requests are proposed following a certain set of processes. Once the requests are finalized, eligible people cast their vote on their preferred choice. The request with a majority of votes wins and corresponding actions are taken to execute it. Generally, people have 1 vote per staked token.

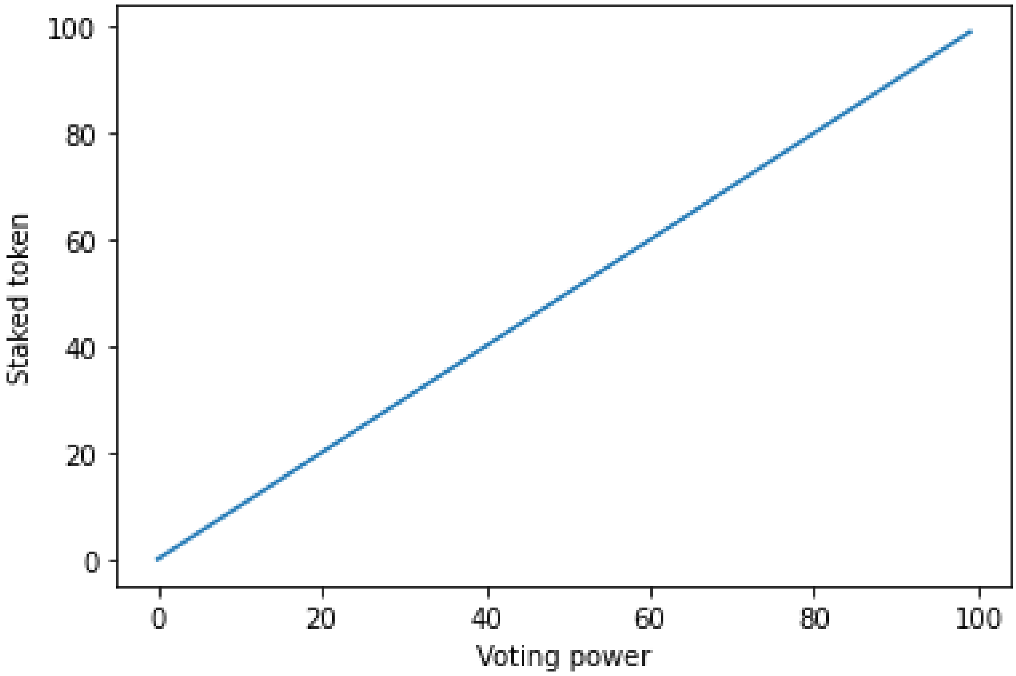

Figure 6 Traditional voting

This usually introduces more centralization as very few people hold the power of governance. Since the voting is on public goods, collective votes of the public should be taken into account. For this, a person with x amount of staked token will be granted $\sqrt{x}$ votes.

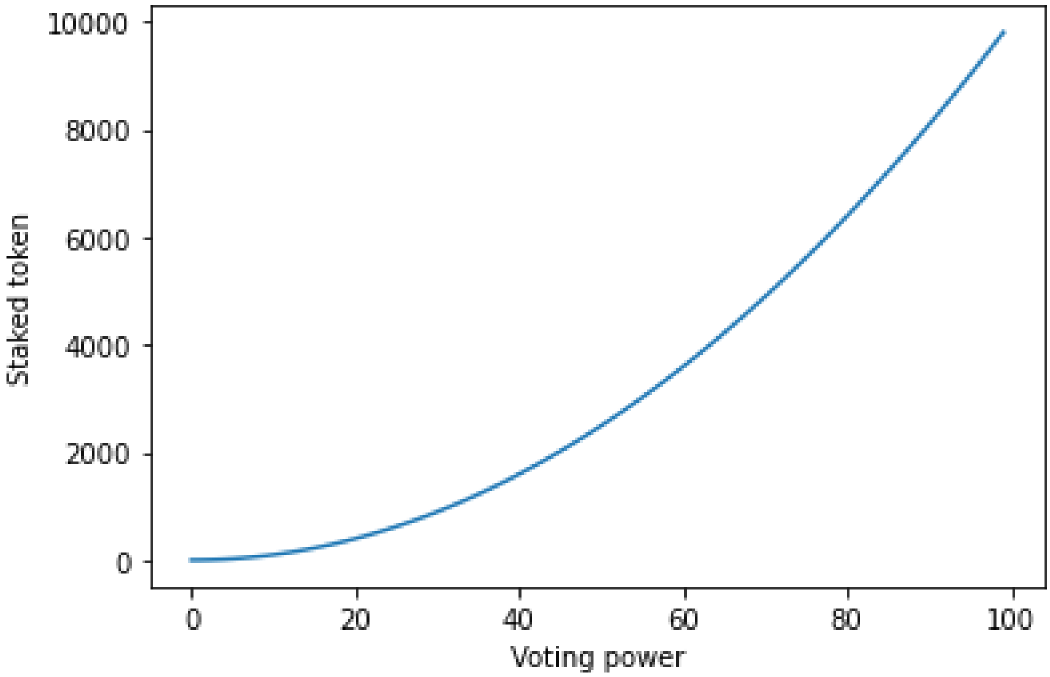

Figure 7 Quadratic Voting

To cast 100 votes, one had to stake 100 tokens before. However, to have the same number of votes now, 1000 tokens should be staked. This way, the voices of the majority are more effective.

b) Funding
Funds are constantly collected on Lemmatron treasury. This fund is then granted to the development of the Lemmatron project, be it game development or blockchain infrastructure development. Naturally, the choices for the place in which to use the funds will be countless. Thus, governance is necessary.
Let us look at how the funding works. Suppose there are three project proposals viz. A, B, and C. And the treasury has a total of $100,000 ready to fund them. To decide how much of the share each project gets, we assume the following:

Projects	Total members funding the project	Donation per person($)	Total donation ($)
A	100	30	3,000
B	15	250	3,750
C	2	2,000	4,000

Table 3 Projects and their funding

From the outside, we could guess that project C has to be given the most fund. However, the way quadratic funding concludes is by doing a simple calculation for each project. The first step would be to calculate the matched amount for:

Project A:

$$(\sqrt{30} * 100)^2 = 300{,}000$$

Project B:

$$\left(\sqrt{250} * 15\right)^2 = 56{,}250$$

Project C:

$$(\sqrt{2000} * 2)^2 = 8{,}000$$

Remember the treasury had $100,000. Now this fund is distributed to each project as:

Project A:

$$\frac{300{,}000}{300{,}000 + 56{,}250 + 8{,}000} * 100{,}000 = \$82{,}361.02$$

Project B:

$$\frac{56{,}250}{300{,}000 + 56{,}250 + 8{,}000} * 100{,}000 = \$15{,}442.69$$

Project C:

$$\frac{8{,}000}{300{,}000 + 56{,}250 + 8{,}000} * 100{,}000 = \$2196.29$$

Since project C was the most centralised, it received the least fund. More collective interest was observed on project A resulting in it getting the most fund out of three.

Tokenomics

LEMA has a limited fixed supply of 10,000,000,000. No more tokens will ever be created which is ensured by our smart contract. The following pie chart illustrates the tokenomics:

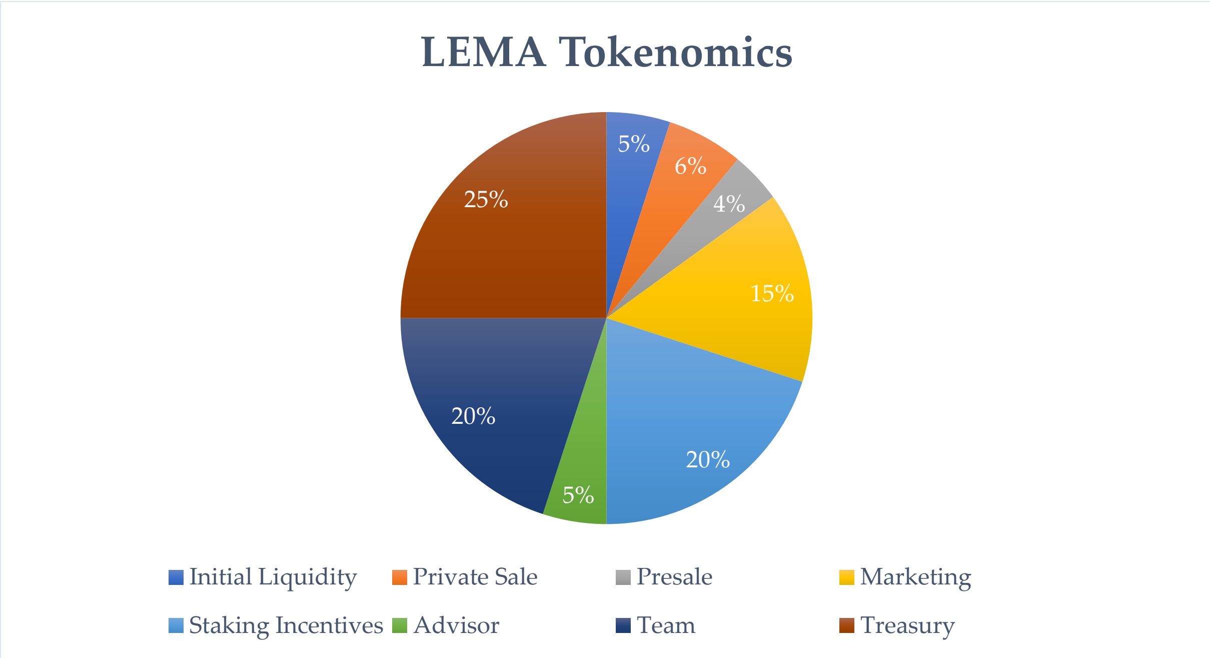

Figure 8 LEMA Token Allocation

The distribution schedule is illustrated by the following chart:

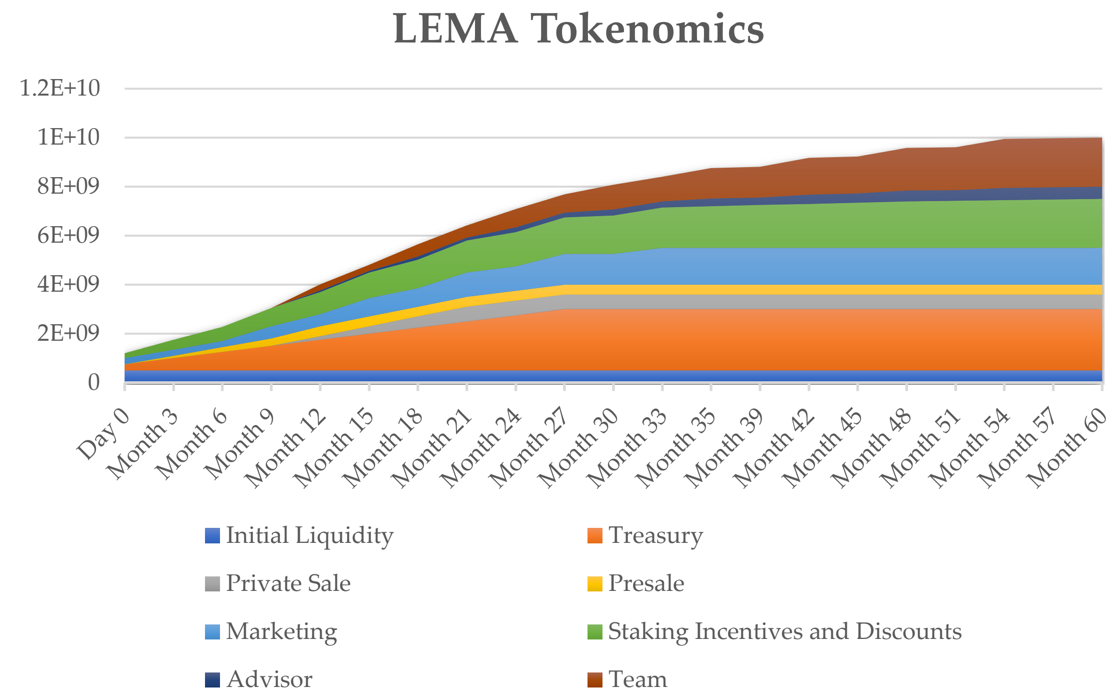

Figure 9 LEMA Distribution Schedule

A closer look at the cumulative distribution spreadsheet:

	Treasury	Initial Liquidity	Private Sale	Presale	Marketing	Staking Incentives and Discounts	Advisor	Team
Day 0	250000000	500000000	0	0	250000000	200000000	0	0
Month 3	500000000	500000000	0	100000000	250000000	400000000	0	0
Month 6	750000000	500000000	0	200000000	250000000	575000000	0	0
Month 9	1000000000	500000000	0	300000000	500000000	750000000	0	0
Month 12	1250000000	500000000	150000000	400000000	500000000	900000000	62500000	250000000
Month 15	1500000000	500000000	300000000	400000000	750000000	1050000000	62500000	250000000
Month 18	1750000000	500000000	450000000	400000000	750000000	1175000000	125000000	500000000
Month 21	2000000000	500000000	600000000	400000000	1000000000	1300000000	125000000	500000000
Month 24	2250000000	500000000	600000000	400000000	1000000000	1400000000	187500000	750000000
Month 27	2500000000	500000000	600000000	400000000	1250000000	1500000000	187500000	750000000
Month 30	2500000000	500000000	600000000	400000000	1250000000	1575000000	250000000	1000000000
Month 33	2500000000	500000000	600000000	400000000	1500000000	1650000000	250000000	1000000000
Month 35	2500000000	500000000	600000000	400000000	1500000000	1700000000	312500000	1250000000
Month 39	2500000000	500000000	600000000	400000000	1500000000	1750000000	312500000	1250000000
Month 42	2500000000	500000000	600000000	400000000	1500000000	1800000000	375000000	1500000000
Month 45	2500000000	500000000	600000000	400000000	1500000000	1850000000	375000000	1500000000
Month 48	2500000000	500000000	600000000	400000000	1500000000	1900000000	437500000	1750000000
Month 51	2500000000	500000000	600000000	400000000	1500000000	1925000000	437500000	1750000000
Month 54	2500000000	500000000	600000000	400000000	1500000000	1950000000	500000000	2000000000
Month 57	2500000000	500000000	600000000	400000000	1500000000	1975000000	500000000	2000000000
Month 60	2500000000	500000000	600000000	400000000	1500000000	2000000000	500000000	2000000000

Figure 10 Cumulative Distribution Spreadsheet

Expected topics in whitepaper v3

- Reward-slashing for bad actors
- Roadmap
- Inflation Calculation