



ESW

Ecology System World

Whitepaper



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1. Overview



In the world of globalization where the products travel around the globe passing by multiple hands, it is difficult for the consumer to know the exact provenance of the product and it's almost impossible to know the exact source of its ingredients.

ESW wants to put a label on verified products and certify their origin. ESW' vision is a world where consumers can be certain what they put on their tables to reduce the risk for their health. Our vision is a secure channel for products spanning diverse locations and categories.

ESW is an application built on the eos.io blockchain that enables secure traceability of certifications and other information in the food supply chain. We make sure to put the stamp only on verified and certified products and enable consumers to visualize a digital,

unique identity of every good. The identity proves the authenticity of the product and origin of its ingredients, creating an auditable record of the journey it undertook from the raw materials to the food on the table.

Thanks to the blockchain technology implementation, ESW will tell consumers what they eat, where it comes from, and who were the entities involved in the product handling. This will ensure not only food safety but will also increase efficiency and environmental sustainability. It eliminates the risk of product adulterating or counterfeiting while keeping track of products that re-enter the supply chain as recyclable elements.

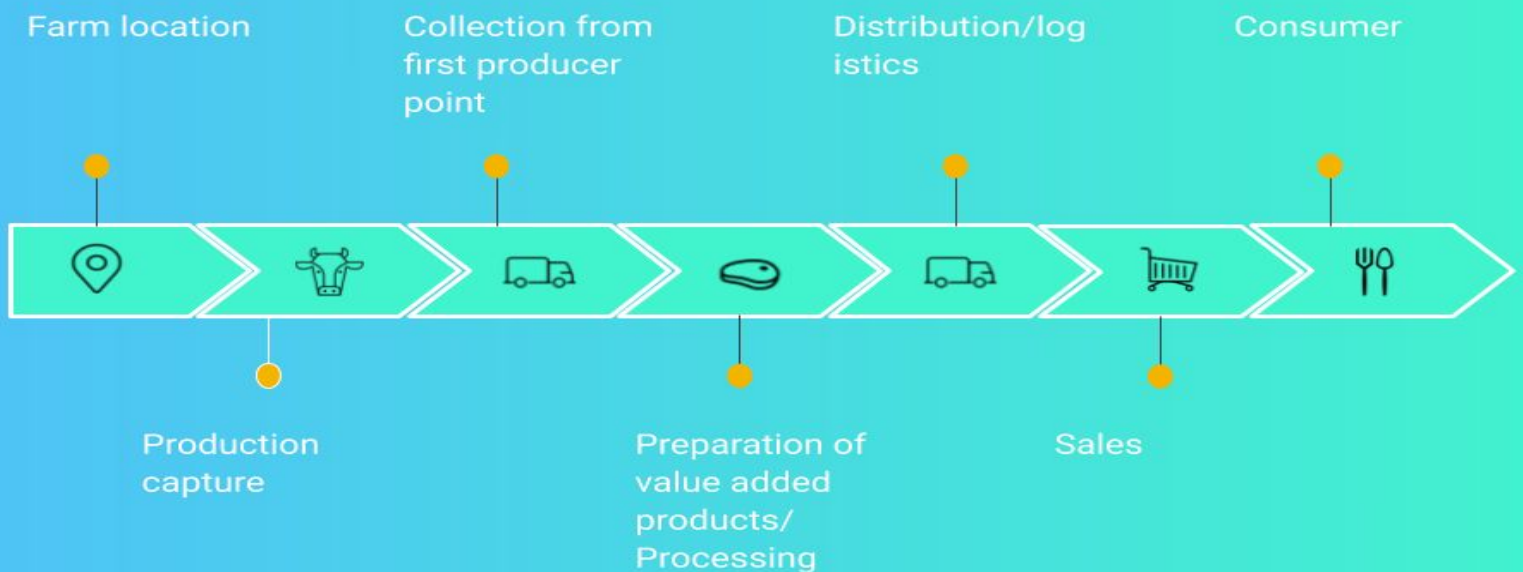
The three main properties of the blockchain: distribution, immutability, and transparency are disruptive to the supply chain bringing direct benefits not only to the consumers but also to all the participating middlemen. A supply chain is a form of an extended enterprise where actors cooperate with the ultimate goal of providing products and offering services to the customers. ESW relies on the eos.io blockchain to facilitate this process.



2. The system at a glance

A supply chain is a network of all the people, organizations, resources, activities, information and technology involved in the creation and sale of a product, from the delivery of raw materials, from the supplier to the manufacturer to the end user.

This system needs to respond to the growing consumer demand for quality and sustainability and the more complex it is the more difficult it is to trace the products, to achieve efficiency and sustainability.



Example of a supply chain

In a food supply chain, ingredients' quality and logistics are the primary factors influencing the market. Food quality is directly connected with our health that is why the information about ingredients and their origin is essential for people's dietary choices. A food supply chain is also very sensitive and vulnerable to human intervention and product treatment, storage, and logistics which have a great impact on food safety.

The last decade saw a shift towards more traceable supply chains. The need to have safer, cheaper and more environmentally sustainable food is behind simplification of supply chain and there's a growing trend towards sourcing directly from farmers or trusted aggregators rather than having the involvement of multiple intermediaries.

People need to make informed decisions and with little transparency about where the ingredients come from, they are blinded from the truth. The skepticism about food provenance is due to frequent cases of microbial and environmental, contamination or chemical toxins. This scarce information about the origin of raw materials is also the reason why it's often impossible to establish the source of the contamination because in a supply chain there may be many actors providing ingredients.

[Counterfeit food is also on the rise.](#) It's been noted that not only there is an increase in the frequency of counterfeit goods in the marketplace, but counterfeiters are becoming more sophisticated in committing fraud because of:

- Low-cost technology
- Globalization
- Consumer complicity
- Expansion of channels and markets
- Powerful worldwide brands
- Weak national and international enforcement
- High tariffs and taxes



Although initiatives like the [Combating Counterfeit Products Act](#) in Canada are being created to help manufacturers stop counterfeit products at the border, the legislation isn't always the best answer.

There is a need for secure track and trace systems that can prove the provenance, handling, warehousing and logistics involved in each product arriving on our tables. It's imperative to have solid records to trace each product to its source and the blockchain comes with the solution.

“Enhanced ability to trace contaminated food back to its source will help government agencies and companies to identify the source of a foodborne disease outbreak, coordinate more effective recalls of foods thought to be contaminated, and learn where past problems began. We think these steps will strengthen future prevention efforts and better protect the public's health from the threat of foodborne illness.”

Robert Tauxe, MD, director of CDC's Division of Foodborne, Waterborne, and Environmental Diseases

3. What problem we are solving

Counterfeit products

- Counterfeit goods are the source of a big loss for the companies;
- According to the [Grocery Manufacturers Association](#) (GMA) in the United States counterfeiting of global food and consumer products may cost the industry [\\$10-15 billion per year](#);
- Food fraud is expected in up to 10 ten percent of the grocery trade;
- Counterfeit foods jeopardize the health and safety of consumers;
- Severely damage trust and confidence in brands



Example of fake food on our tables

Food safety scandals around the world

- Food contaminated by microbiological, chemical or physical hazards;
- The link between exposure and effect of chemical hazards in foods is usually complicated by cumulative low doses and the delay between exposure and the onset of symptoms;
- [Proper food controls aren't enough to stop spreading contaminated foods](#); lack of easy and accurate identification of the source of the contamination prevents fast withdrawal of contaminated products from shops;
- Reputational cost to the company hit by a food safety scandal can be catastrophic;
- [Food safety scandal](#) can hit the whole industry or even the whole country

Some of the recent food safety scandals - source: [Wikipedia](#)

- 2011 – Poor-quality **illegal alcohol** in **West Bengal** has resulted in an estimated 126 deaths. The alcohol may have contained **ammonium nitrate** and/or **methanol**.^[59]
- 2011 – **German E. coli O104:H4 outbreak** was caused by **EHEC O104:H4** contaminated **fenugreek** seeds imported from **Egypt** in 2009 and 2010, from which **sprouts** were grown in Germany.
- 2011 – Vinegar from China contaminated with **ethylene glycol** when stored in tanks that previously contained **antifreeze**, led to 11 deaths and an estimated 120 cases of illness.^[60]
- 2011 – Meat, eggs and egg products in Germany contaminated from animal feed containing fat contaminated with **dioxins**. 4,700 German farms affected. 8,000 hens and hundreds of pigs were culled. Imports from Germany to China were banned^{[61][62]}
- 2012 – More than a quarter of a million chicken eggs were recalled in Germany after in-house testing discovered "excessive levels" of the poisonous chemical, **dioxin**.^[63]
- 2012, June – A Brazilian housewife discovered an apparently used **condom** at the bottom of a can of **Knorr** tomato paste. Unilever was fined £3,100 (\$4,800) by the **Supreme Federal Court**. She was awarded £1,110 (\$1,700) for moral damages, as she and her family had consumed a meal prepared with the paste.^{[64][65]}
- 2012, July – Around 1 million pots of herbs had to be destroyed in North Rhine-Westphalia after treatment with an **apparently organic plant growth strengthener** was found to contain **DDAC**(didecyl-dimethylammonium chloride) which resulted in contamination levels above the EU MRL of 0.01 mg/kg. This has resulted in significant additional costs to member states across the EU who put in place a **monitoring programme** until February 2013 for DDAC and other quaternary ammonium compounds across a wide range of commodity groups.
- 2012, August to September – Multiple **American Licorice Company** black **licorice** products recalled due to high lead levels in the products. Consuming a bag of product could give children lead levels as high as 13.2 micrograms/daily limit, double the amount regulators consider actionable.^[66]
- 2013, January – It was disclosed that **horse meat contaminated beef burgers** had been on sale in Britain and Ireland. Two companies, ABP Food Group and Liffey Meats, had supplied various supermarkets with contaminated **own brand** burgers from their meat factories in the UK and Ireland.

- 2013, February – In Germany 200 farms are suspected of selling eggs as "organic" but not adhering to the conditions required for the label.^[67]
- 2013, March – A batch of 1800 almond cakes with butter cream and butterscotch from the Swedish supplier, Almondy, on its way to the IKEA store in [Shanghai](#) were found by Chinese authorities to have a too high amount of [coliform bacteria](#) and were subsequently destroyed.^[68]
- 2013, March – A vegetable seller in western Germany, Rhine Main, realized that the [lettuce](#) he had been selling throughout the day contained [rat poison](#). The poison appears as small blue kernels.^[69]
- 2013, February–March – Contamination with [aflatoxins](#) results in a milk recall in Europe and a dog food recall in the United States. See [2013 aflatoxin contamination](#) for further details.
- 2013, May – A Chinese crime ring was found to have passed off [rat](#), [mink](#), and [small mammal](#) meat as [mutton](#) for more than 1 million USD in Shanghai and Jiangsu province markets.^[70]
- 2013, May – [Halal](#) Lamb Burgers contained samples of Pork DNA, affected schools 19 schools in Leicester, UK.^[71]
- 2013, July – [Bihar school meal poisoning incident](#), India.^[72]
- 2013, October – [2013 Taiwan food scandal](#)
- 2014, September – [2014 Taiwan food scandal](#)
- 2015, January - [Mozambique funeral beer poisoning](#), Beer served at a funeral in [Mozambique](#) was contaminated with [bongkrekic acid](#), resulting in 75 deaths and more than 230 people falling ill.^[73]
- 2015, April – Contaminated [milk tea](#) resulted in the deaths of two individuals and affected another^[74] in Sampaloc, [Manila](#),^{[75][76]} the cause of which was determined to have been [oxalic acid](#) being deliberately laced at more than the lethal oral dose.^[77] [Murder](#) charges were filed against Lloyd Abrigo, son of the milk tea shop owner who was among those killed in the incident; Abrigo denied the allegations,^[78] and the charges were later dropped.
- 2015, April – In the US, [Blue Bell Creameries](#) recalled eight million US gallons (thirty million L) of ice cream after an outbreak of [listeria](#) at one of their production facilities led to ten hospitalizations and three deaths.^[79]
- 2015, July – [2015 Caraga candy poisonings](#) in the Philippines
- 2015, November–December – [2015 United States E. coli outbreak](#)^[80]
- 2016, February–March – Mars Chocolates contamination incident, in which plastic found in candy bars lead to a recall affecting 55 countries.^[81]
- 2016, April–May, CRF Frozen Foods recalled over 400 frozen food products due to listeria outbreak that sickened 8 people.^[82]

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- 2016, April–May - 2016 Punjab sweet poisoning
 - 2017, 2017 Fipronil eggs contamination in Europe
 - 2017-18 South African Listeriosis outbreak
 - 2018 Australian strawberry contamination

Food safety issue caused by allergens

- Even small traces of the trigger foods can cause heavy allergic reactions or anaphylactic shock and death;
- Ingredients labeling laws aren't uniform around the world;
- No unified food standards;
- Consumers don't have enough information about the ingredients

Difficulty to establish the real provenance of the product

- Often times only country of origin is disclosed;
- When the place of production is known, there's scarce or no information about the origin of the ingredients eg. we can know where the mozzarella comes from but we don't know the origin of the milk or what kind of food the cows producing the milk eat;
- There's no certainty that the origin of the product or ingredients is the real one eg. the fisherman may say that the fish come from the Mediterranean sea while they come from the North Sea;
- The consumer cannot trace the journey of the product;
- The date of validity can be altered;

Little transparency

- Consumers are concerned about issues regarding the origin of products but struggle to get the information which frequently is not printed on the labels;
- Consumers need to trust that the producers and suppliers disclose real data and don't tamper with their data regarding the products and raw materials on their centralized system

No sustainability

- Environmental damage, exploitative extraction, unsafe work conditions, forgery, and the huge amounts of valuable material wasted at the end of product life;
- Producers and suppliers aren't required to adopt any sustainability standards

4. Solution and technology

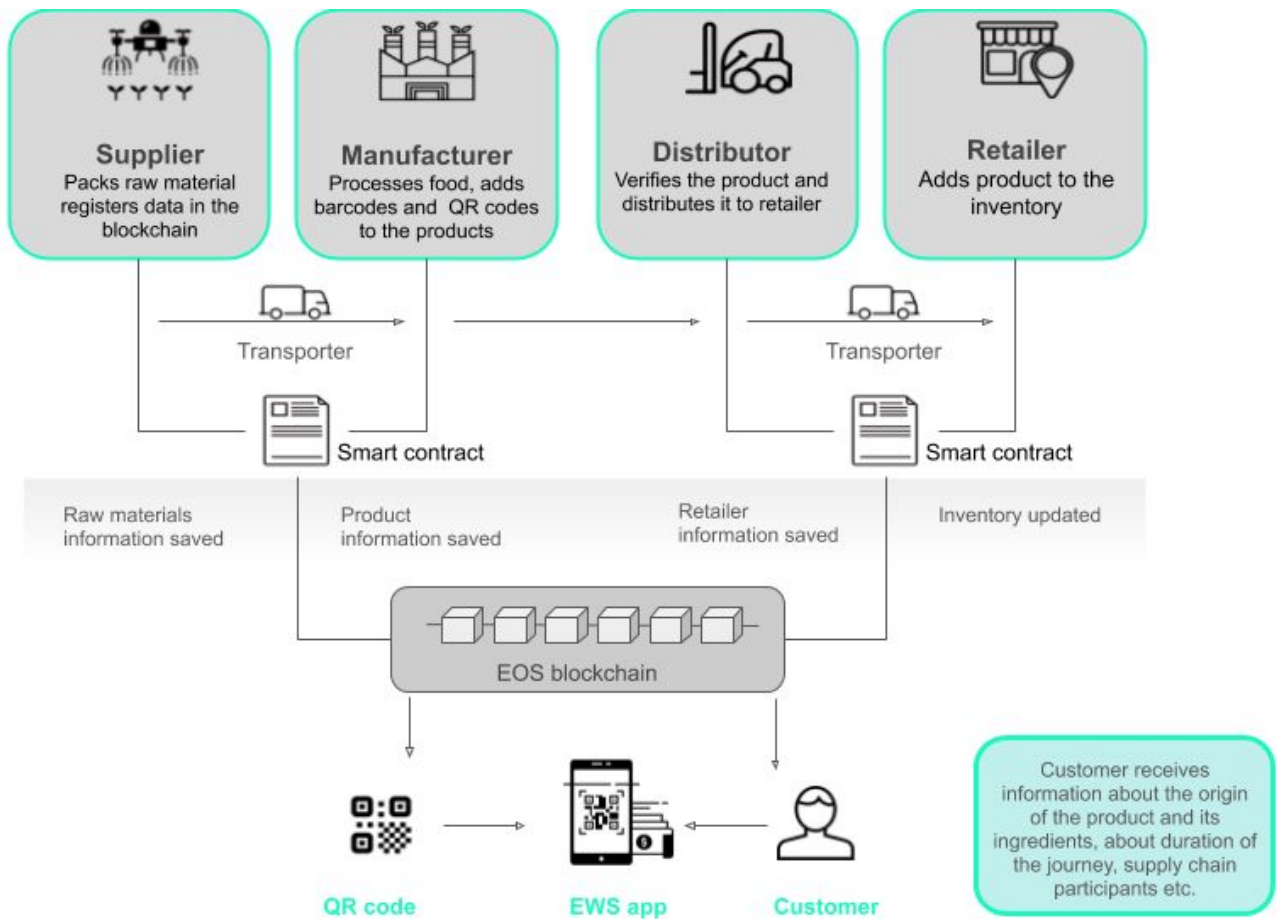
ESW adopts the blockchain technology that brings to the food supply chain all the solutions necessary to grant the consumers the level of food quality and safety they need.

The blockchain brings to the supply chain significant operational benefits that provide the companies with a significant competitive advantage while being beneficial for the end consumers.

Transparency, security, authenticity, and auditability enforced directly by the blockchain make it possible for the products and raw materials to be traced on chain which allows the customers to get the information needed to make a more informed decision.

There are several advantages that the food supply chain can derive from this technology and they are:

- Transparency
By adopting the blockchain technology in its operation, the company gains an automatic trust from consumers, business partners and regulators because everything is permanently recorded and publicly verifiable.
- Tamper proof
All the transactions are included in blocks and linked together to create a chain distributed over many computers which is tamper-proof and where the possibility of double-spending is eliminated.
- Cost-effectiveness
The blockchain technology reduces the cost and complexity of the manufacturing process. It decreases overhead costs while providing real-time feedback. Optimization and forecasting can save billions across industry



End-to-end blockchain-enabled food supply chain

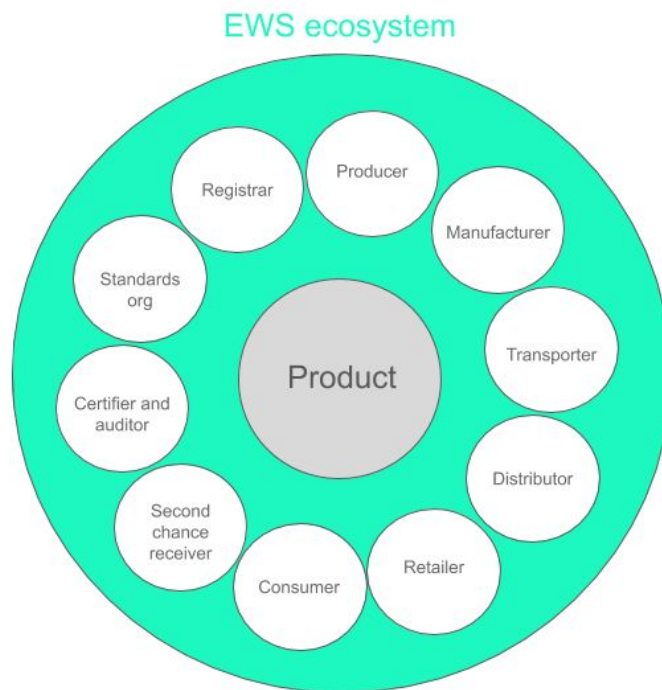
4.1. Registration

The registration process is the first step in establishing a trust relationship between the customer and the companies belonging to the ESW ecosystem.

So far, producers and suppliers were relying on their own reputation but now this process will be deployed by the registrar, who registers the accounts for the participants. These participants will include certifiers, auditors, producers, suppliers, manufacturers, and consumers. They may be asked to register their digital identity.

There are nine different types of actors involved in the ESW ecosystem:

1. Producers (e.g., strawberries grower);
2. Manufacturers (e.g., a maker of marmalade);
3. Retailers (e.g., a supermarket);
4. Transporters (e.g., ships);
5. Registrars, which are organizations that provide credentials and a unique identity to actors (e.g., uPort);
6. Standards organizations, which define the rules of a certain scheme (e.g., Fairtrade, FAO);
7. Certifiers and auditors, which are agents who inspect producers and manufacturers and verify certain standards, like annual production capacity;
8. Customers, the buyers of products all along a supply chain, including the end consumer;
9. Second-chance receivers, which are entities like food banks, charities, compost makers, animal food producers.

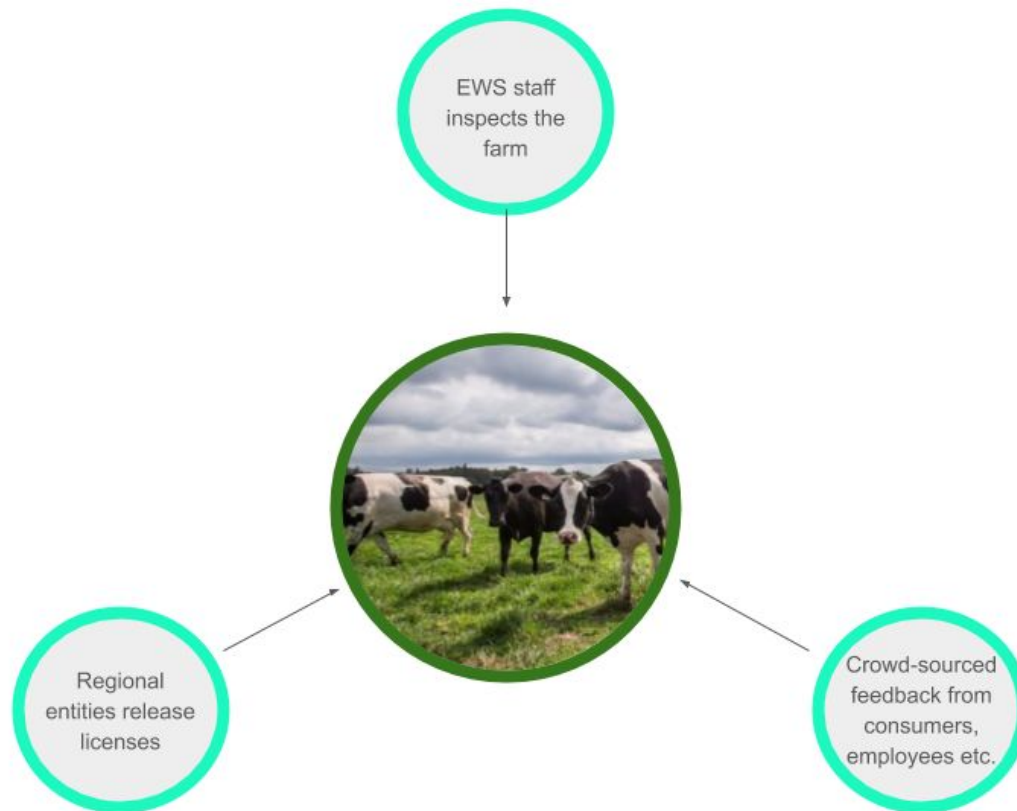


The food supply chain architecture consists of several different actors but because they work within the same blockchain ecosystem they are able to interact without friction.

Account registration and verification on the eos.io software will automatically enable each participant in the ESW token activities.

4.2. Verification in situ

Ensuring that the products and raw materials tracing is reliable requires from ESW an in situ verification of the farms and factories. ESW needs to verify that the products and raw materials that will be added to the blockchain come from the place where they are being grown, raised or produced. ESW will inspect farmers and producers before registering them to the program and giving them a certified status.



Farm and factories verification

To ensure an additional level of reliability for the ESW certification, the farmers or producers can provide certificates from regional auditors who verified their facilities and issued regional certificates. A regional level certificate has little meaning to a consumer on the other part of the world. A consumer can't know who the entity is and how trusted it can be this is why there's a need for a more international, inclusive, and transparent actor like ESW.

On the other side, a regional certification can't be underestimated because different regional organizations, associations, and governing bodies are specialized in site inspection, licenses issuance, and permissions. This is why cross-checking with these actors is essential. ESW will enable through [uPort](#) the uploading of licenses and certificates from these actors.

ESW will also provide crowd-sourced feedback as a complement to the formal certification process. People visiting farms and factories as well as workers themselves could report about the veracity of the products and raw materials

claims. With ESW the consumers themselves have the power and are incentivized to denounce untrue statements, wrongdoing, contamination cases or any other information that can have an impact on the food supply chain participants' safety and integrity of the data.

Once a farmer or a producer is registered and verified he obtains an ESW certification in the form of an NFT token which is publicly available and displayed each time a consumer accesses the product from the ESW application.

4.3. Inclusion in the Verified Producers System

To be included in the ESW Verified Producers System (VPS) and obtain certification, the farmers and other producers need to meet certain criteria. ESW will verify:

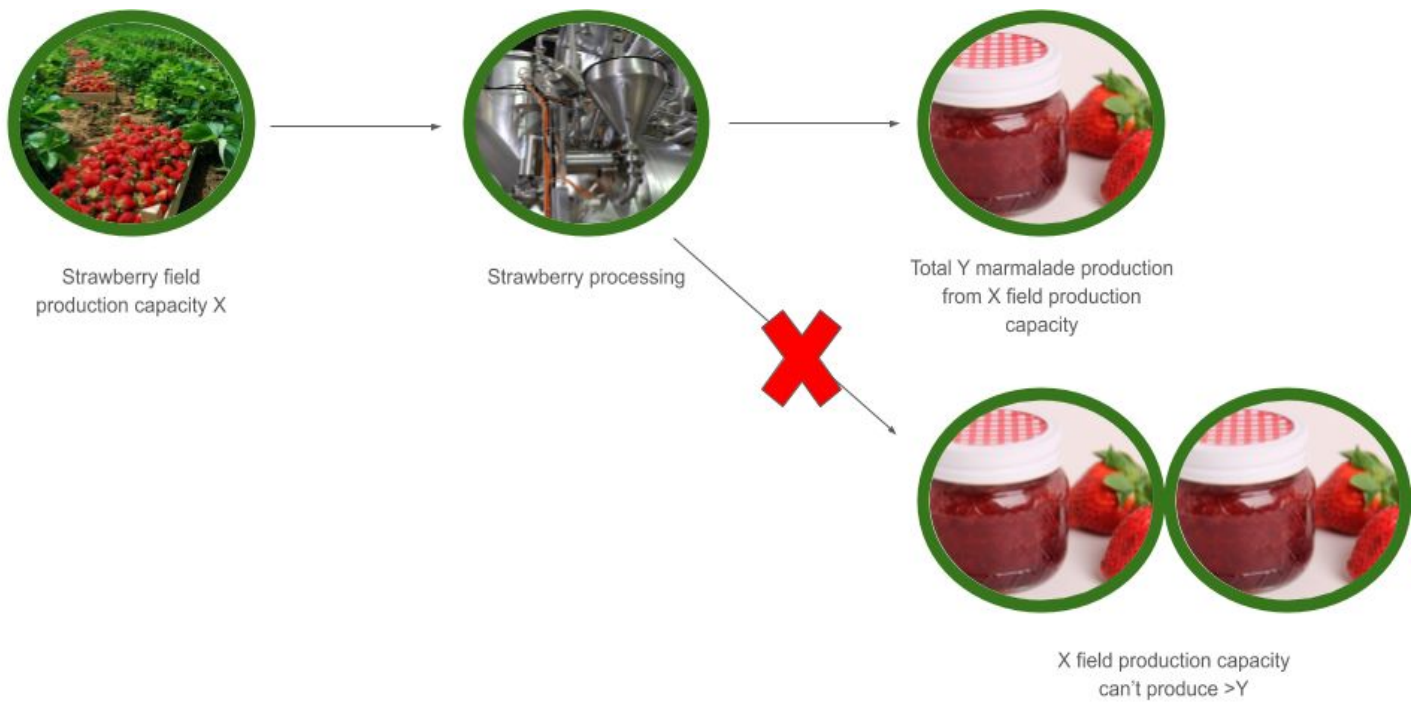
- the location of the site,
- production capacity for the production of the good,
- inputs vs. outputs: how much raw material is brought to the site vs. how much product leaves the site.

In case of an unsuccessful audit, the program will be temporarily revoked and the producer may reapply when these criteria will be met.

It is imperative that this step is thorough because it is at the base of the food supply chain. VPS is not a one-time certification event but an ongoing process in establishing continuous reliability in the traceability of finished goods. The information included in this first step will be cascaded to other parts of the chain, this is why it is critical.

To verify the real source of the raw material it is not enough to see the location of the facility but examining how much raw material can be produced from a certain area of the field is important to avoid that the farmer dilutes the original raw

material with cheaper and lower quality material from other sources with the aim of obtaining more production for minor cost. The data included in the blockchain will prove that no more output can be produced from a certain input.



Production capacity for the production of the good

4.4. Certification

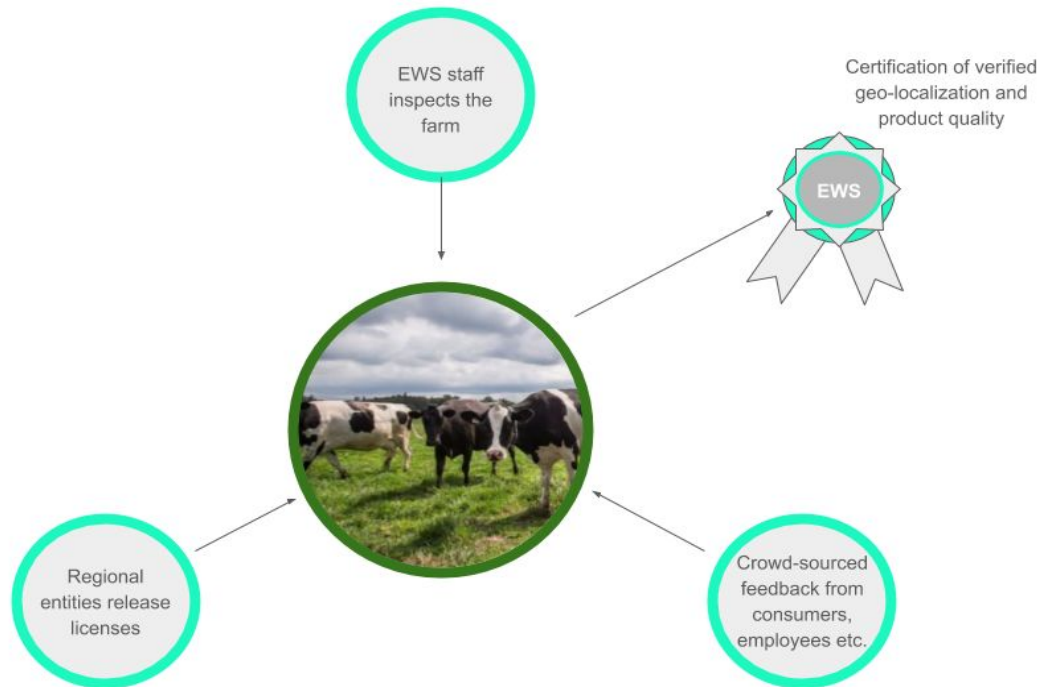
Once the registration and inclusion in the VPS are confirmed, the producer or the farmer obtains the ESW certification.

The ESW certificate is a paper certificate transformed into an electronic file. A hash value for the file is created and stored into the block in the chain system. Successively, the system creates a related QR-code and a website inquiry string code to affix to the paper certificate. It will provide the demand unit to verify the authenticity of the paper certificate through mobile phone scanning or website inquiries. The immutability of the blockchain enhances the credibility of various paper-based certificates.

The ESW certification is accessible through the ESW app. The app gives access to all the certificates and product related information. The consumer needs to scan the QR code on the label applied to the packaging to access this info. The way the label is applied is one more step in ensuring that there was no tampering with the product. The label is to be applied to the package closure in a way that each attempt to open the package will break the label and invalidate leave a sign of attempted tampering with the product.

In normal conditions, a broken label means that the product was purchased and opened to be consumed. If the blockchain receives a purchase signal but the transactions will continue to flow this means that the product was tampered with.

The blockchain will also register the validity date of the processed product and will send an alert message after the expiry date has passed. Since this date can't be changed, each time a transaction flows to the blockchain after the expiry message was sent will mean that the expiry date on the product was changed and the product is no longer safe to be consumed.



Verified farm and factories certification

4.5. ESW label

The ESW label lives both in the blockchain and in a physical world. In the blockchain, it's an NFT token (non-fungible token) containing all the data regarding the product and the producer/farmer and other supply chain participants.

The physical form is a printed, adhesive barcode and a QR code generated from it to be applied to the product. This label is physical proof of the digital identity of each product. Since the barcode and a QR code can be also copied and applied on a different product there's a need for a more secure system.

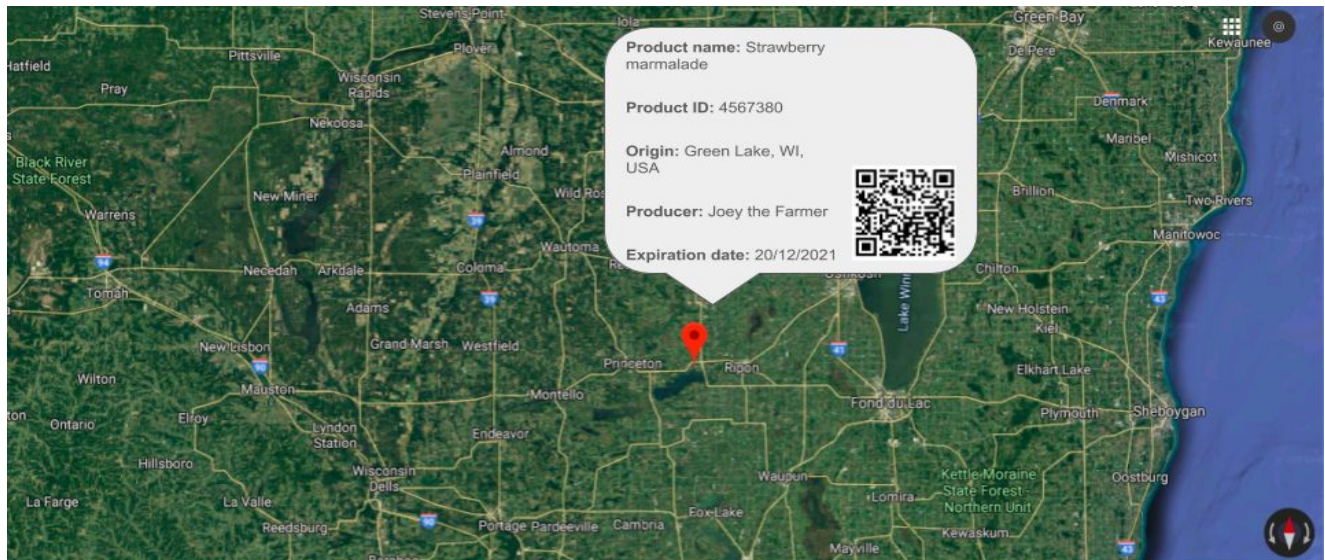
A well-designed supply chain should ensure that as each package comes off the production line, it is equipped with an identifying code registered on the blockchain. The scanners scan the barcode on the label and check the product against the blockchain database at each point in the supply chain.

The consumer accesses the product's identity by opening the ESW app and capturing the QR code with a smartphone. The information about the product, source, producer, auditors, and certificates will be displayed.



ESW label applied on products

The choice of a barcode and QR code label is dictated by its efficiency, simplicity of application and use, and cost-effectiveness. The barcodes have for ages met its role but the lack of transparency and easy tampering with the data made them vulnerable. The blockchain technology behind the ESW label solves these issues while remaining cheap.



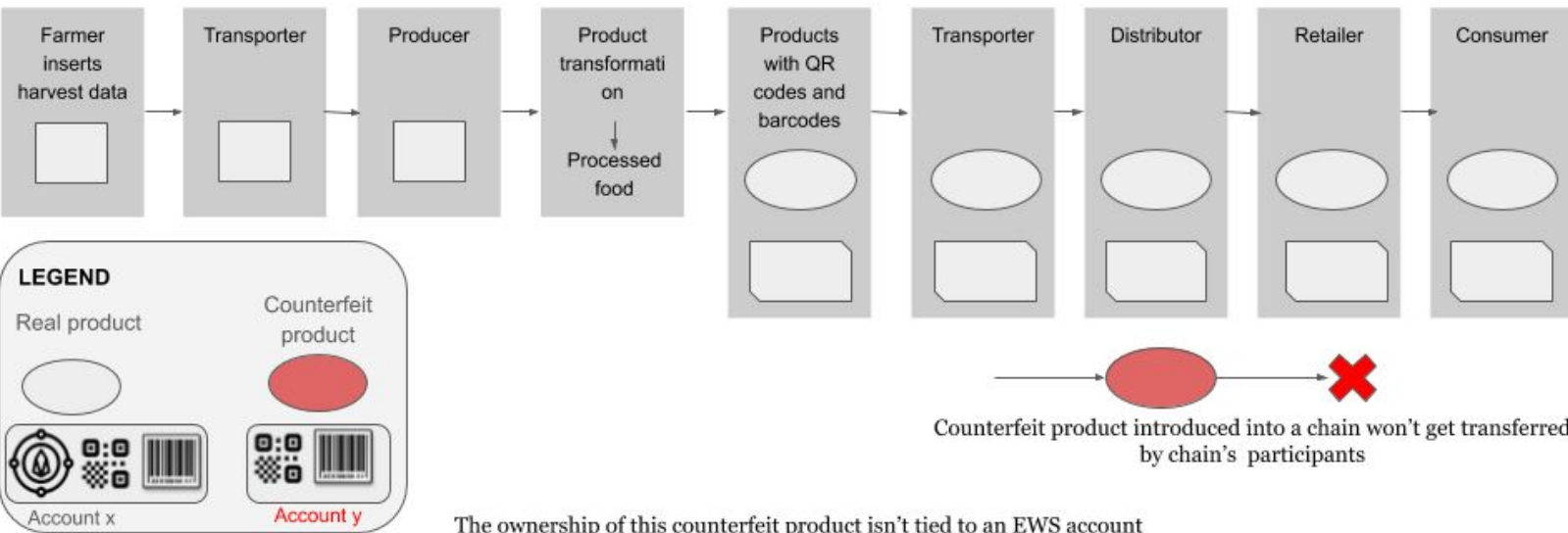
ESW app provides information about the origin of the product

4.5.1. How ESW fights with counterfeit products

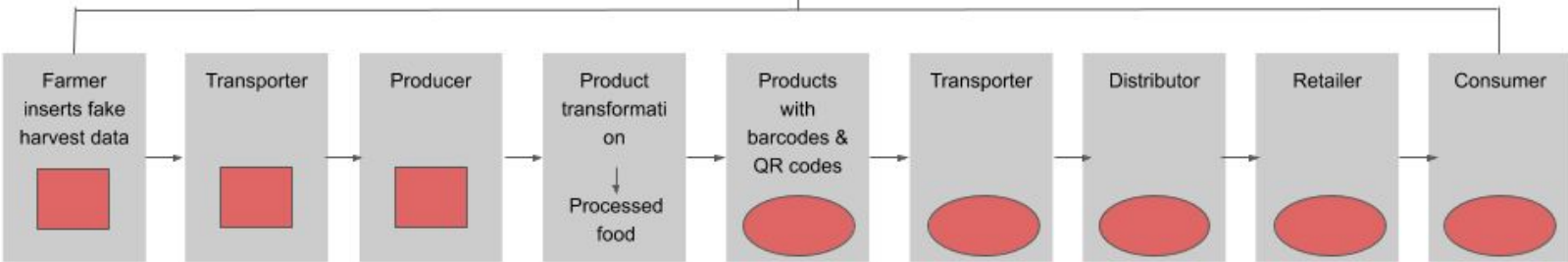
A barcode and a QR code paired with an NFT on the EOS blockchain is an effective way to fight counterfeit products. QR and barcode have the advantage of being cheap, which is very important to be efficient especially in the initial phases of the chain where raw materials/products are sold in bulk for a low price.

The barcode is needed for different chain participants to scan and make the accountability of the products with the tools they already have. A learning curve to generate and use a barcode is low and the market is used to its use.

The ownership of these products is tied to an EWS account and the certificate can be displayed



The ownership of this counterfeit product isn't tied to an EWS account



The ESW ecosystem resistance to counterfeiting and food adulteration

Since every product is assigned a unique ID, the consumer can scan the QR code and see the complete data flow and related information recorded in the blockchain. When the ID is entered or when the QR code is scanned, the system first retrieves the retailer transaction. This transaction includes batch ID, block number, and a hash of the previous block which are used to trace back all transactions made by different entities in the supply chain for the corresponding item starting from the retailer to the farmer. All the data assigned to a specific product is unique and recorded permanently in the blockchain which makes product counterfeiting impossible. Each NFT is always associated with the physical product.

All chain's participants are registered with the ESW and verified to ensure the chain's supply safety and integrity. Counterfeiting and relabelling is inefficient in the proposed system. Even if a counterfeit product is introduced into the system it will get rejected because:

- it will lack the ESW' certificate
- even if the label gets copied it won't match with the NFT data on the blockchain
- only verified ESW participants have access to the barcode and QR code generator panel
- the ESW ecosystem is a closed circuit for those who are verified

This system ensures transparency and security in the overall process of the food supply chain.

ID: EG001

Block# 23487498

Batch# 1

Origin: ABCD

Type of product: XYZ

Treatments: PQRST

Pruning Date: D/M/YY

Delivery Date: D/M/YY

Prev. Hash:
057A2719E5030BD5F29E5ACB4810C31E90BF4
46AF6D18D25435A873A0ED5536B

Block Hash:
057A271892E2C82DFD62A6545688DA29888A8F
91AB45113393C7D0EB8ECE7571

The transaction generated by the farmer

An ID number is used to uniquely identify each participant in the supply chain, and the batch number indicates the production batch supplied by the farmer.

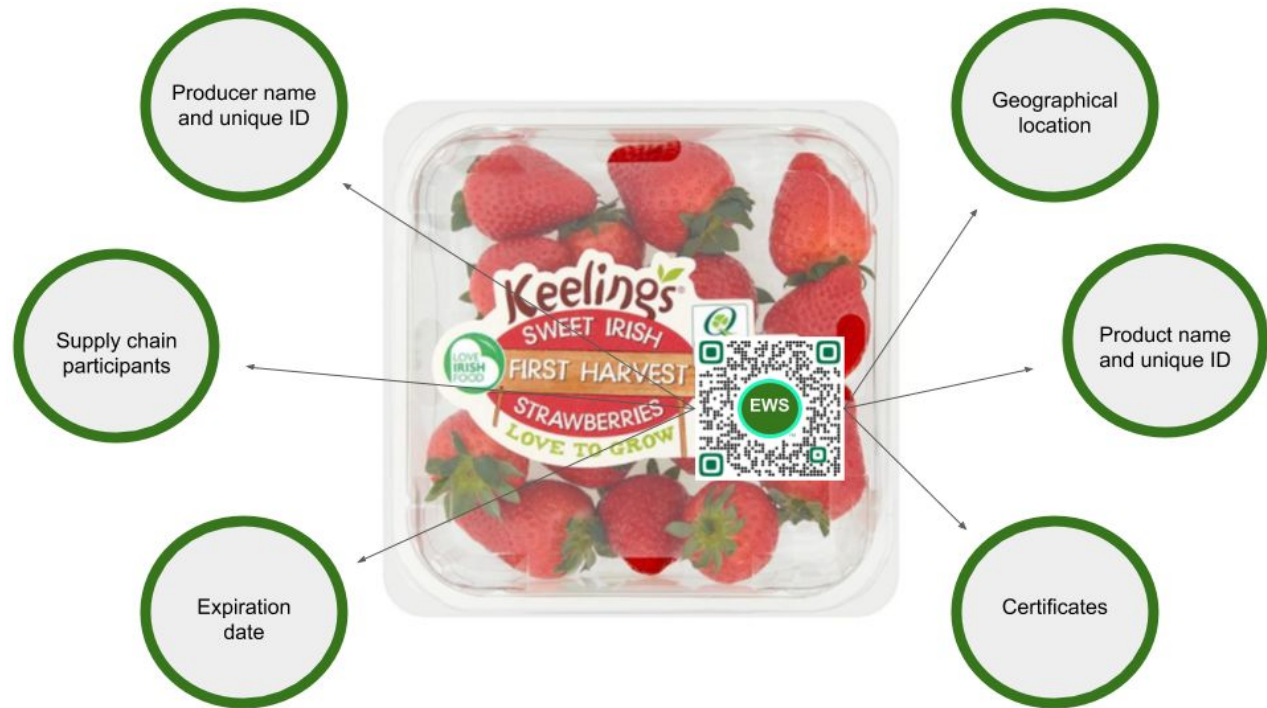
Other data like origin, type of product, pruning and delivery date, and the treatments are also included in the transaction.

The producer puts all information in a block and share it with all other participants.

This procedure is followed by the distributor, wholesaler, and retailer in order to include their transactions in the chain.

4.5.2. How the ESW label works for the consumer

QR code (quick response code) is a square-shaped symbol that can be scanned using a smartphone to learn more about a product. This encrypted square can hold links, coupons, product details, geographic location, and other information. QR code has large storage capacity and ability to translate additional information to consumers beyond what creative and/or packaging could convey this is why they are ideal for what ESW wants to offer.



In ESW, the QR code is linked to a blockchain identifier, the NFT token, using a secure hash. While the QR code can be copied, there can't exist two instances of the same NFT token. The token is unique and proves ownership. Each time the QR code is scanned the system is updated with certain data like:

- Geographical location
- Unique ID of the product
- Unique ID of the farmer/producer
- Dynamic code
- Scan time

The customers who scan the code placed on a product validate its location. If the product appears in two distant places at the same time this means that the label was cloned and applied to another product. A security system comes into play.

The system will detect the danger of counterfeiting and will alert the user. The user will not buy the product which eliminates the economic incentive to

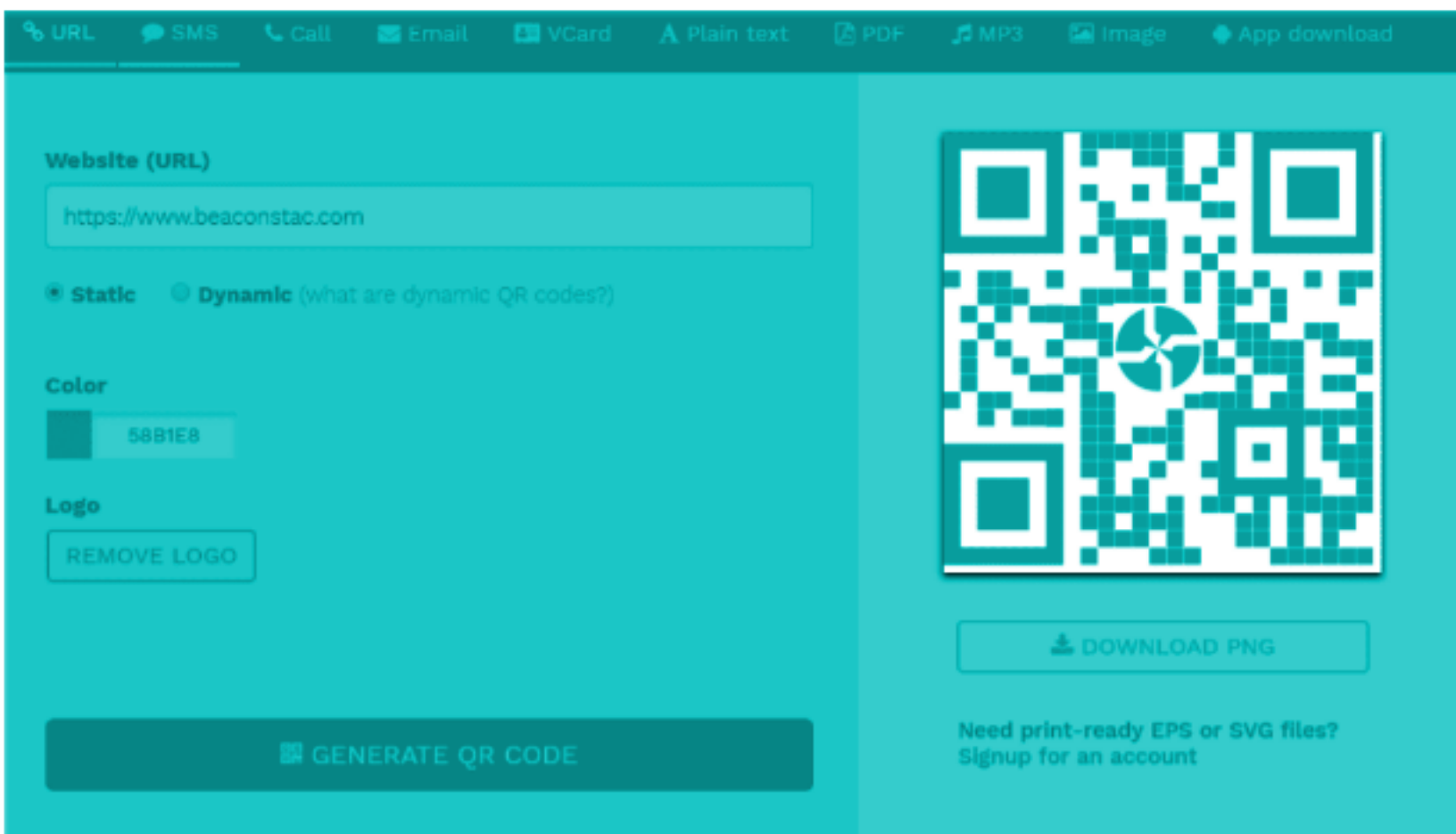
the fake good's producer and will revoke the certificate to the original producer prompting it to take action.

4.5.3. How the ESW label works for the producer/farmer

When the producer/farmer registers and passes the verification process for inclusion in the VPS and issuance of the certificate together with the blockchain unique ID he also gets access to the barcode and QR generation panel.

The producer inserts the data corresponding with the product, the geographical location and unique ID of the farmer/producer are pre-inserted by ESW while the unique ID of the product is generated randomly for each product.

It is up to the farmer/producer how detailed the data should be. The information provided could include for example the age of the animals or the kind of food. In cases where the farmer/producer specifies the food, ESW will work to include the food supplier in the supply chain in a way that it can start from the source.



QR generator panel

The barcode and QR code label is printed, applied to the product and scanned. The company can then track the product during each phase of its life-cycle, from the source all the way to the consumer and further.

The producer/farmer obtains an EOS account at the registration. It is possible to manage different levels of permissions on this account so the farmer/producer can set different responsibilities for its employees.

5. ESW certified supply chain

A supply chain can be of different complexity. The simplest one is from the farmer to the consumer while the more complicated supply chains can involve several different actors and many miles of the distance. The shorter is the chain the fewer verification passages it needs. A raw product can be tagged at the source and sold directly to the consumer. If the product is sold through a retailer things start to complicate and the consumer has no direct contact with the farmer. Normally he needs to trust that the retailer is telling the truth about the origin of the product. With the ESW app based on the blockchain, the consumer doesn't have to trust the retailer anymore. The consumer scans the ESW label and sees the origin of the product, the certificates, and all the additional data related to the product.

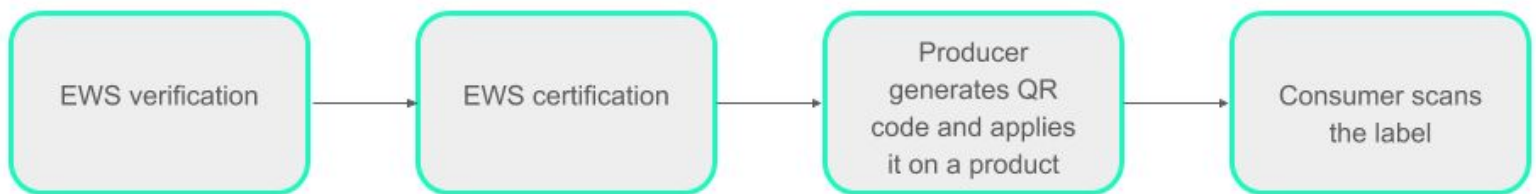
An EOS.IO blockchain explorer like bloks.io allows everyone to check the raw content of the product under the form of a digital asset (NFT token) on the blockchain. ESW app, however, visualizes the product in a user-friendly way under the form of the text and images.

5.1. How the food supply chain works in practice

5.1.1. Simple supply chain

The ESW certified farmer/producer collects the harvest, creates ESW labels and applies them to the products. The product is sold directly to the consumer. The consumer scans the QR label and visualizes the certificate

and the origin of the food. In the majority of cases, this simple, direct interaction between the farmer and the consumer doesn't even need any certification as the relationship is based mainly on trust and both participants probably know each other. When there's no knowledge, it's better to use the ESW app.



Simplest form of a food supply chain

5.1.2. Complex supply chain

The ESW certified farmer/producer collects the harvest and creates a transaction with the batch number indicating the production batch supplied by the farmer, the origin, type of product, pruning and delivery date as well as the treatments. Each batch or piece of product is an NFT whose

ownership is transferred from one participant to the other. The food is transferred to the producer. The supplier is also registered as one of the ESW participants and he confirms the transfer by issuing a blockchain transaction. The producer receives the food and confirms the reception with a new transaction. When food is processed and ready to be distributed the producer creates new NFT tokens for each kind of processed food. The new tokens contain the metadata of the original NFT to create continuity of the information and the possibility of tracing the product back to its origin. The producer applies an ESW label containing the barcode and a QR code on each product.

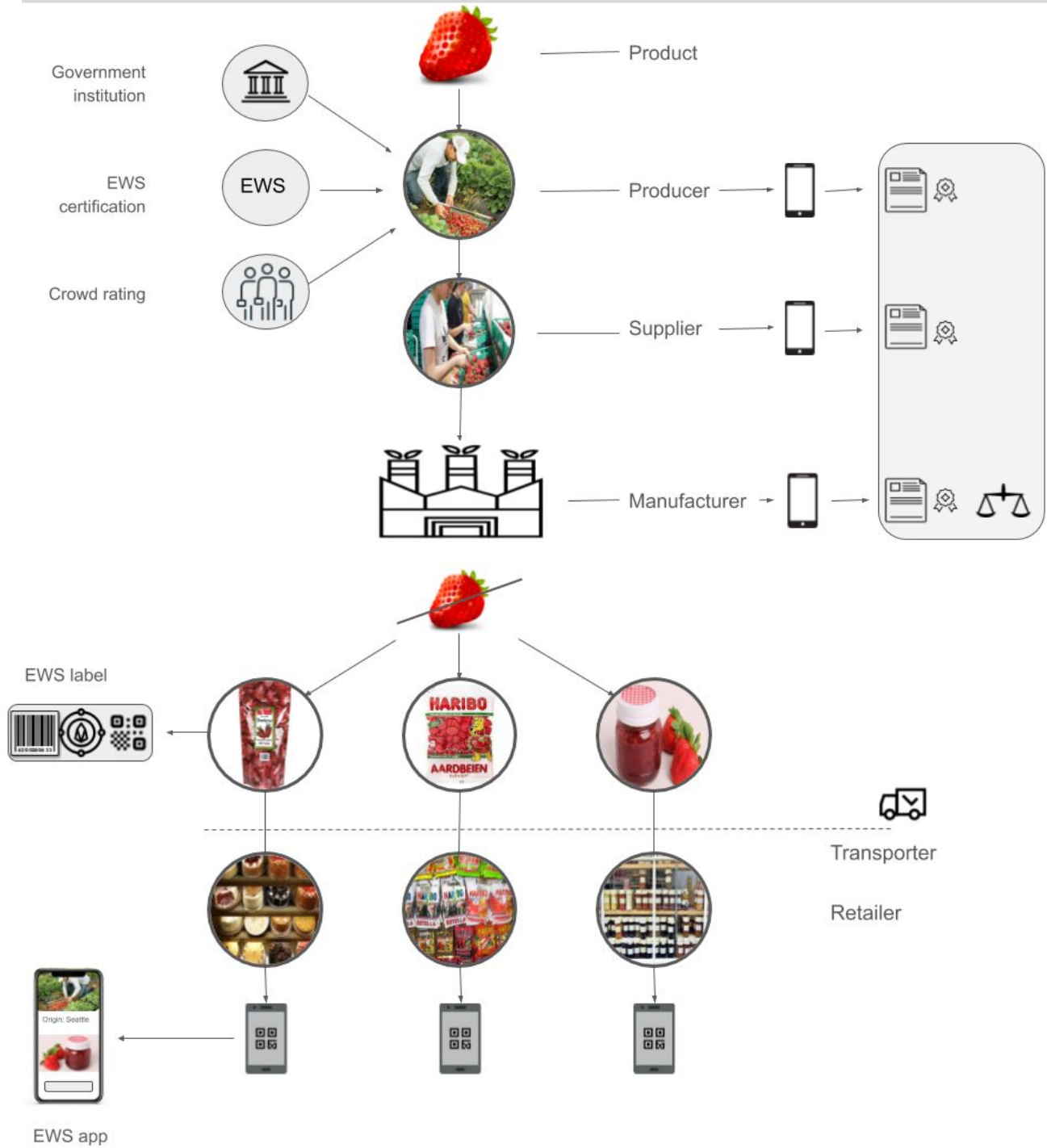
Each time the product undergoes some kind of processing, a new label should be created by the entity processing the food and new NFT token with previous metadata should be created. This way only the ESW approved supply chain participants can take part in the process to ensure the highest business integrity and quality of the products.

From the producer, the product reaches the consumer through different distributors and retailers. Each step needs to be recorded in the blockchain. The consumer scans the QR label and visualizes the certificate and the origin of the food.

After the purchase, he may want to give the excess to some food bank. He earns tokens each time he changes the status of the food to “second-chance” which is confirmed also by the approved food bank or another waste food receiver. This action commences the recycling part of the ecosystem.

Producer verification and certification

EOS Blockchain



A complex food supply chain with the ESW label application

6. Sustainability

Creating a sustainable food supply chain is ESW's mission. The introduction of blockchain technology to the food supply chain is an important step towards the reduction of food waste. Providing information and token incentives to the consumers ESW will prompt environmental and social responsibility powering the circular economy.

The majority of waste in the fresh food supply chain comes from overproduction, defects, and transportation.

[A study conducted by Gustavsson et al., 2011](#) concluded that almost one-third of food produced for human consumption is lost or wasted globally and the level is significantly increasing. [The annual value of food wasted](#) globally is \$1 trillion, and it weighs 1.3 billion tonnes. In most developed countries, the biggest food waste takes place in the home while in the UK supermarket practices are directly responsible for much [food waste elsewhere in the supply chain](#). An average [USA family wastes food](#) worth \$2,275 per year.

Products that undergo a big waste are these with very short shelf life which means that they need to be processed quickly like fruits or vegetables for example. By using ESW relying on the blockchain technology, the farmers/producers and all other participants of the food supply chain can trace the journey of products and their quantities. By retrieving this information recorded on the blockchain, it will be easy for the food supply chain participants to optimize their activities like production, manufacture, transportation, distribution or acquisition.

Apart from the related economic and environmental impacts, food waste also has an important social angle – a donation of surplus food should be facilitated so that safe, edible food can reach those who need it most.

ESW introduces also a recycling program for food and food packaging to tackle not only the economic impact but also the environmental and social angle. ESW' recycling program creates incentives around the donation of surplus food so that safe, edible food can reach those who need it most.

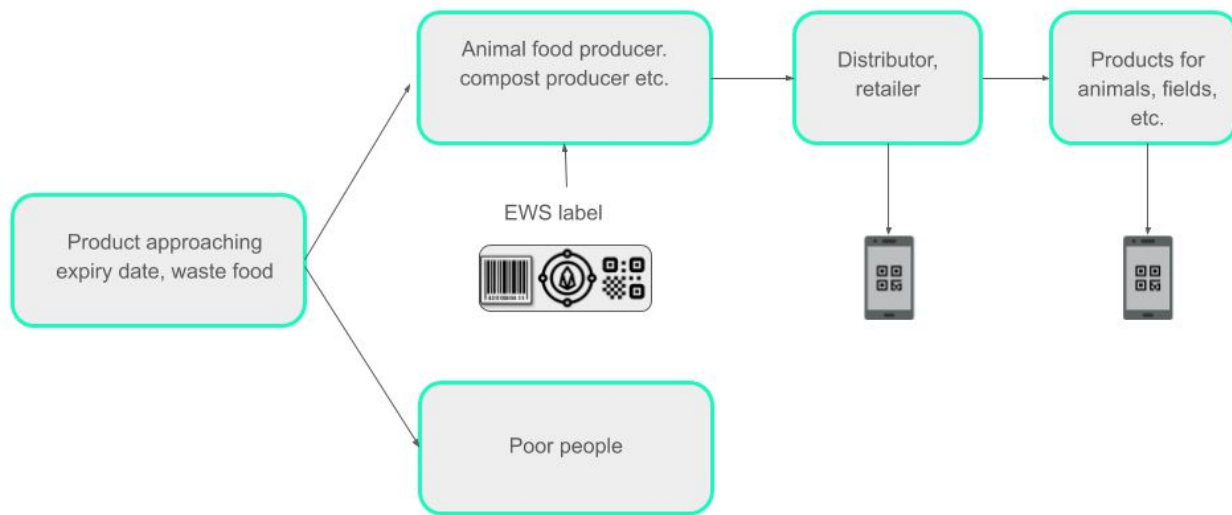
Food considered as "waste" can be also utilized as a resource to produce animal food or as compost to produce energy. The problem with food waste is the lack of the link between those who have an excess of food with those who need it. ESW' role is to link them and help with circular economy evolution.

Blockchain tracking permits to get the information about when products like packaging are returned to be assessed and remanufactured into a new item.

6.1. How ESW' food recycling works

When a product with an ESW label approaches the expiry date, when it was produced or purchased in excess and is going to go to waste, the owner can decide to donate it to a charity, use it for compost or resell/donate it as a resource to produce animal food.

The owner needs to access the application and connect with a 'second-chance' receiver. When the product changes hands and arrives at a new owner its status needs to be updated to "recycled". This operation will be registered on the blockchain and rewarded with a token. Despite the blockchain will receive the transactions after the purchase, the product won't be labeled as counterfeit but rather as "recycled". This will permit for tracking the product even after the purchase and registering a longer life-cycle.



ESW 'second chance' possibilities and the

7. Decentralized supply chain market

Investment in supply chain innovation is at a critical inflection point. From 2015 to 2018 the trend of investment was declining but the newest [report](#) says that this trend reversal started this year with a 95% increase in projected spending for 2019.

[The global food traceability market](#) accounted for \$11.64 billion and it will reach \$21.84 billion by 2025.

Food traceability monitors and tracks products' journey from producers to customers. The technology used in the food traceability method traces the precise product to prevent the exchanging of discarded or contagious food with consumable food. It is no surprise that

companies are looking for support in the blockchain technology to support their activities because it is best suited to fulfill this task. Food contamination is a major concern and transparent product tracking is key to prevent and circumvent the spreading of contamination.

Major companies like Walmart, Nestle, John West, and many others have already started using the blockchain in their operations for product tracking, forecasting, cost reduction, and efficiency.

7.1. Walmart

[Walmart China](#) created the Walmart China Blockchain Traceability Platform and introduced 23 product lines at launch. It is expected to scale by another 100 product lines this year including fresh meat products, rice, mushrooms, cooking oil, etc. Walmart China's traceability system wants to trace by the end of 2020 50% of its fresh meat total sales of packaged fresh meat, 40% of total sales of packaged vegetables, 12.5% of seafood of the total sales of seafood. It uses VeChain's blockchain technology to implement a traceability strategy for products. Customers scan the labels and acquire information like the source of the scanned products and geographic location received by Walmart, and the logistics process.

Walmart run previously two [proof of concept projects](#) on the Hyperledger Fabric permissioned blockchain. One project was about tracing mangos sold in Walmart's US stores and the other aimed to trace pork sold in its China stores. For pork in China, it allowed uploading certificates of authenticity to the blockchain. Meat origin was a serious issue and Walmart looked to solve it with the blockchain. In the case of mangoes proof of concept, the company achieved fruits' traceability to their provenance in just 2.2 seconds from 7 days that were needed before implementing the blockchain technology.

[Walmart started asking its leafy greens suppliers](#) to use the blockchain so the food supply chain can start at the origin.

8. The ESW token system

8.1. The ESW utility token

ESW is a fungible, utility token working as an incentive within the ESW ecosystem. ESW is fungible, meaning it can be exchanged for other currencies, which is a powerful incentive to shape platform participants' behavior.

ESW approved actors (farmers, producers, food banks etc.) can earn ESW tokens each time they scan an ESW label. This gives an incentive to everyone to join the platform and get an ESW certificate.

Chain participants like farmers/producers, 'second chance' receivers who are involved in the NFT creation are rewarded for this action. Each token transfer from one owner to another owner also results in new ESW tokens being mined.

The end consumers receive the ESW tokens for purchasing the product, recycling, and scanning the labels.

Multiple label scan with the same QR code and account name are counted as one scan. While producer, retailer, supplier are limited by the number of articles they have and it's fair for them to earn on each product, a customer can scan as many labels as there are products in one or more shops. This is why after the product is delivered to the retailer, the scan will be counted only if the product will be also purchased.

The consumer can accumulate the ESW tokens and spend them on products with the ESW label. This way the consumer doesn't have a big incentive to sell them on an exchange but rather to buy other products with the same token.

Food banks, charities, and other entities participating as recyclers earn tokens from receiving donated food which means that these participants not only receive

food waste or near-waste food but they earn also the ESW tokens for this second-chance activity.

ESW token rewards undergo the process of halving when a certain number of transactions is reached. This is essential to reduce the inflation.

Each supply chain participant needs to purchase a stake for security reasons. The DAC (*see point 9*) may decide to apply special conditions regarding stake management.

8.2. Incentivized onboarding

The token incentive could become more rewarding for a business than him gaming the system with adulterated food or altered expiry date products. In this hypothetical scenario, a business has more to gain from being compliant with the ESW ecosystem rather than from going in the opposite direction.

The farmer/producer cares that his product arrives at the destination (the consumer) with the initial information i.e. the origin of the product and all the data regarding the product.

If the product goes from the farmer to the factory where it undergoes processing and the factory doesn't belong to the ESW ecosystem that means the farmer can't obtain his goal. While he cares about promoting his food's quality, the factory being outside of the ESW ecosystem is a barrier between him and the consumer. The factory won't apply the label with his farm's location and details. That is why he must try to make the factory join the ESW ecosystem so the supply chain can include all its participants.

The onboarding process is perhaps easier from a retailer's perspective. It is usually the retailer who has more persuading arguments for making his producers and suppliers join the ESW covered supply chain.

8.3. Non-fungible token

A non-fungible token (NFT) represents something unique and it's used to store the data about the product like the ownership, product description, geographical location of the farm, etc. It's not interchangeable with another NFT token like for example BTC with another BTC because the metadata contained in that token wouldn't correspond.

The QR label is a link between the physical product and its respective data contained in the NFT token. When the user scans the label, the data recorded in the EOS blockchain can be accessed through the ESW app.

Each time a new NFT is created, a correspondent number of ESW utility tokens are generated and transferred from the smart contract to the owners' account.

8.4. Tokenomics and rewards

ESW is an inflationary token with a 1% initial inflation rate and a supply of 1.000.000.000. The inflation decreases proportionally to the increase in production.

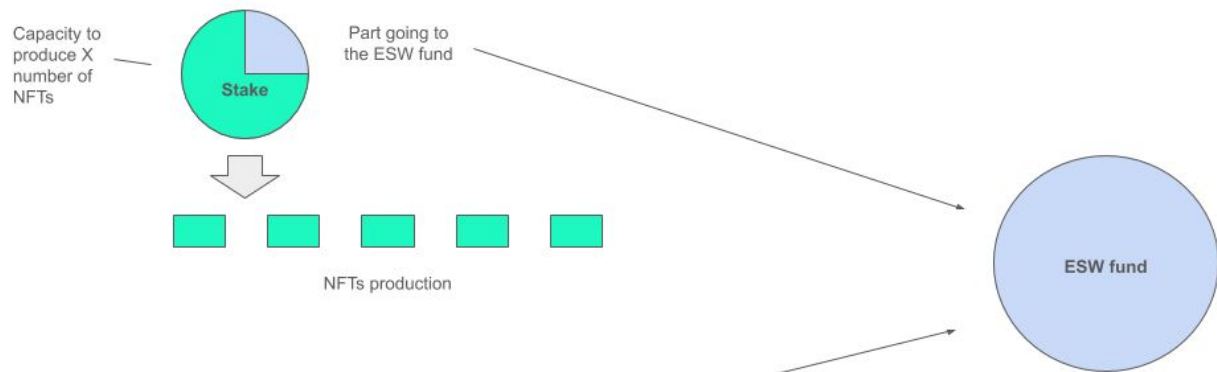
Stake

Chain participants with the ability to create NFT tokens (the producers) are required to stake the ESW tokens. The stake is proportional to the number of transactions performed. 25% of the stake is collected in the account eosio.eswfund and grows together with the growing number of chain participants and their transactions.

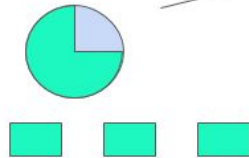
Other than being a prerequisite for NFTs creation, the stake is also a security measure and an incentive for the participants to remain honest. In case there's the suspicion of fraud or any other misconduct the dispute will be resolved by the arbitration and the stake will be used to slash the bad behavior.

75% of the participant's stake is used to create NFTs and 25% is used for the ESW fund. The ESW fund will be managed by the ESW DAC (see point 9) and used mainly for the ESW ecosystem development and other activities.

Participant 1

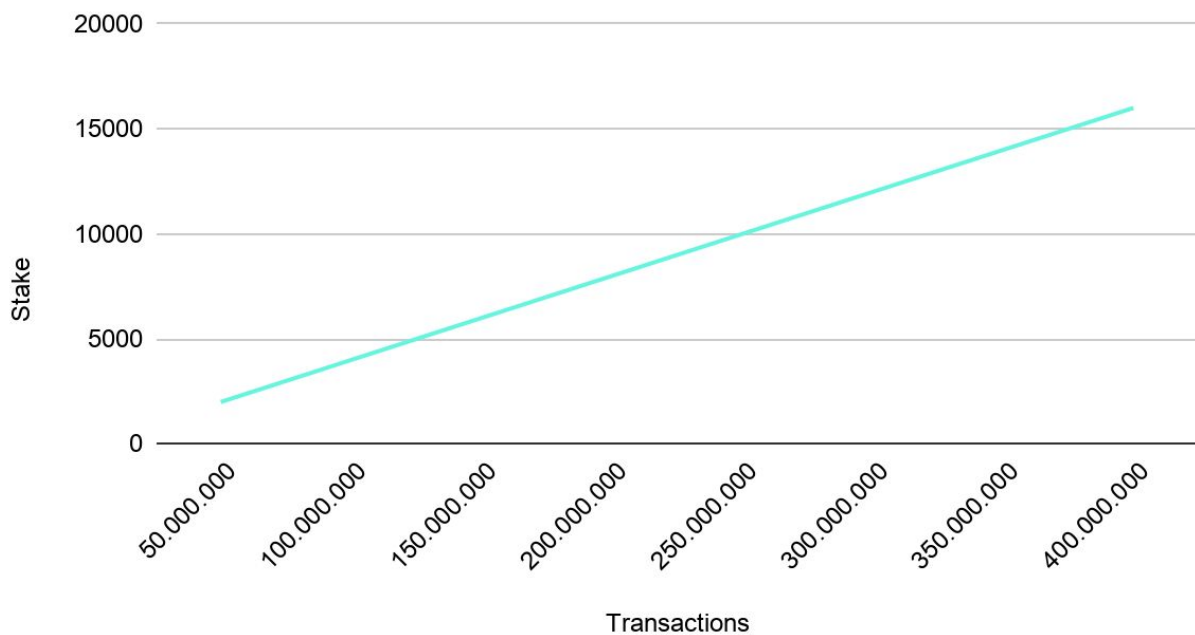


Participant 2



The use of the participant's stake

Transactions vs Stake



Delegated Proof of Stake

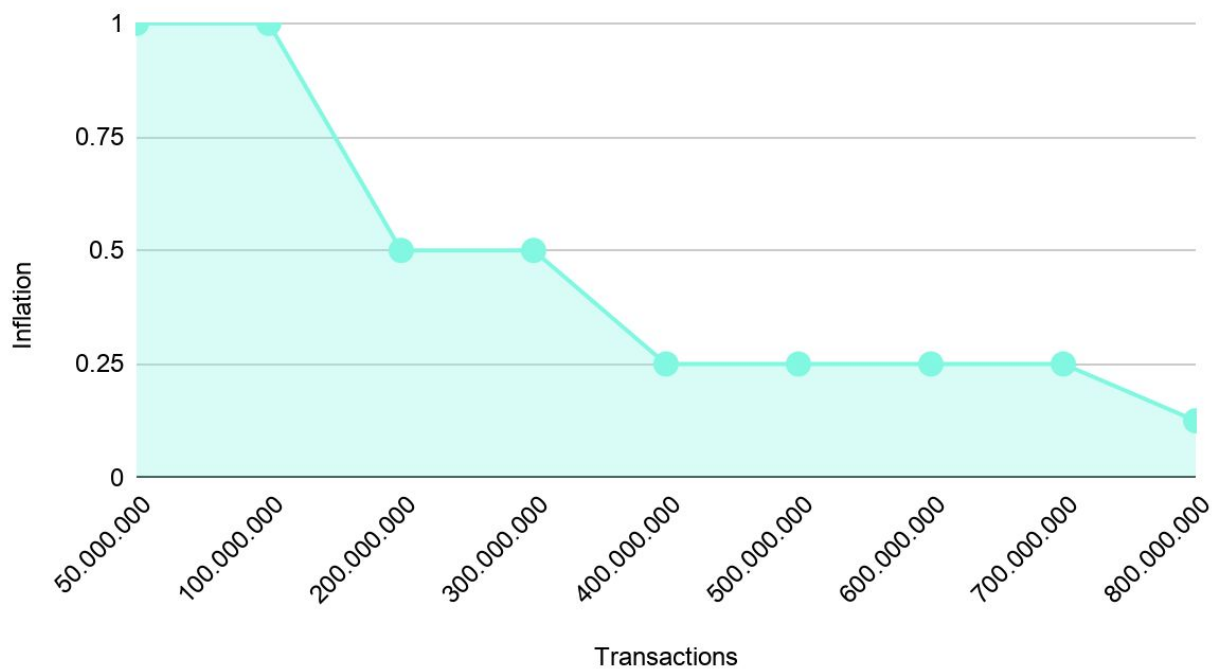
Delegated Proof of Stake (DPoS) algorithm invented by Daniel Larimer and implemented in blockchains like BitShares, Steem, EOS, Tron, Telos, and many others. DPoS is designed as an implementation of technology-based democracy. It uses voting and election process to choose block producers validating transactions and producing blocks.

ESW chose EOS as the blockchain to build on. EOS is currently the fastest blockchain capable of supporting thousands of transactions per second. It has upgradeable smart contracts and accounts with key management.

Inflation

ESW adopts initial inflation of 1%. This inflation is subject to halving when ESW reaches 200,000,000 of transactions. Each doubling in the number of transactions will cause inflation halving.

Transactions vs Inflation



The inflation is used to reward chain participants for:

- NFTs creation
- NFTs transfer
- product recycling

ESW utility tokens are created every time an NFT is created or it is transferred from one account to another.

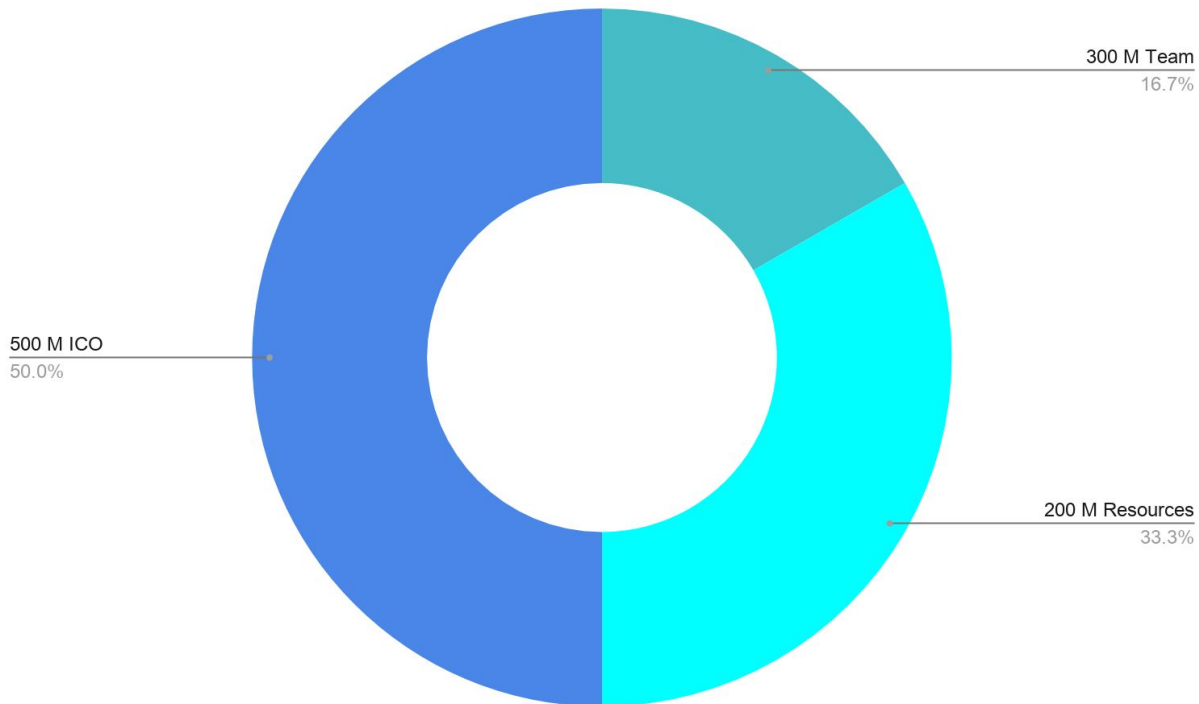
Each time a consumer purchases the product and scans the QR code or gives a product a 'second chance' enabling circular economy, he is rewarded with ESW tokens.

The rewards can be used to purchase ESW products.

Token distribution

ESW will run ICO where 500.000.000 of the total 1.000.000.000 will be put up for sale. The price for 1 ESW token will be fixed. ICO soft cap will be set to 1.000.000 USD. 300.000.000 ESW are distributed to the team and locked for 1 year. 200.000.000 ESW reserved for the EOS resources.

Total ESW token supply 1 Billion



RAM

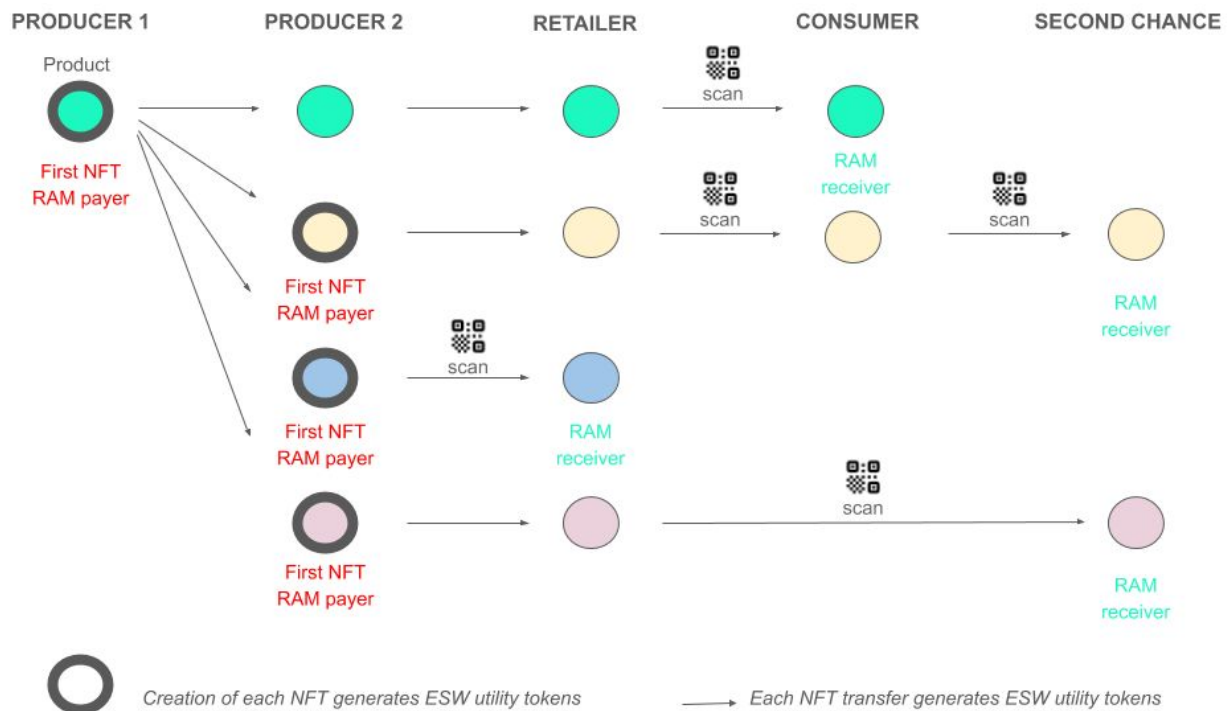
The RAM on EOS is used to permanently store and easily access the data on the blockchain. This resource is provided to the chain participants via the hardware block producers and needs to be acquired at the market price. RAM pricing is based on the Bancor algorithm.

NFT tokens need RAM to store the data like text or images. One empty NFT requires 267 bytes of RAM. An NFT containing one link to the website and a short string of text requires around 390 bytes. This RAM needs to be paid by the token creator (producer) to be able to put products on chain. At the current rate of 0.0710 EOS per 1KiB of RAM one NFT with a link and some text would cost 0.0277 EOS

≈ \$0.064. Each time a token is passed to the new owner and the new data are stored in the RAM, the NFT requires more RAM. This additional RAM is provided by the new owner.

The RAM can be released at the end of the cycle when the product is consumed or destroyed for whatever reason, however, it's the last NFT owner receiving it. The consumer who buys the ESW product without scanning the label can't be recorded as the new owner of the product and its NFT. To receive the ESW token rewards and the RAM he needs to scan the label on the product after/before its purchase. In case the product has been purchased and no scan occurred, the rewards and the RAM will belong to the retailer after the product's expiry date takes effect.

Each generation and transfer of the NFT creates new ESW utility tokens as a reward. These tokens may offset the cost of the NFT creation. The last owner has the possibility to get both: the RAM and the ESW reward what constitutes an incentive to buy the ESW certified products.



RAM economics

9. Governance - DAC

ESW is an app governed by a decentralized autonomous community (DAC). DAC custodians are voted in by users. Custodians vote on all issues concerning the project. The development is proposed through community worker proposals. At the initial stage of the project, the app is run by a core team. This is to ensure that the development is fast and easy to manage in the most delicate phase which is the launch and the initial few months of life. As time passes by, new custodians will be voted in one by one. ESW plans to adopt the same DAC framework as [eosDAC](#) which is also used by [vig.ai](#).

10. Roadmap

- Q2 2020 - Society creation and FINMA regulation
- Q2 2020 - ICO starts

1.000.000.000 ESW total supply

The price for 1 ESW token is fixed to 1:1 ratio??

ICO soft cap 1M

500.000.000 are put on sale

300.000.000 are distributed to the team and locked for 1 year

200.000.000 reserved for the EOS resources

- Q2 2020 - Listing on the exchanges
- Q3 2020 - ICO ends
- Q3 2020 - App deployment on a testnet

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- Q3 2020 - Security audits and bug bounty
 - Q3 2020 - Partnerships announcement
 - Q3 2020 - ESW app launch