



## STATEMENT AND BUSINESS OPPORTUNITIES

### Food Supply Chains are Broken...

Food supply chains have long been criticised as ignoring the needs of consumers. While preferences of consumers for wider choice of flavours or packaging has been widely satisfied, as competition between businesses can naturally happen along these lines without disrupting their market share and power, the concerns of people about healthiness, origins and quality of food remain largely unresolved. This is because in many cases, cheaper production at scale leads companies to choices that are undesirable for the end consumers, in order to ensure profitability of the company. As most large food conglomerates face this issue, the problem remains unaddressed. Even the recent rise in organic foods certification and labelling has not fully offset the concerns of consumers about trust in quality, origins and safety of food. The main troubles consist:

1. **No insights into individual items:** labels and certificates pertain to the whole line of product developed by manufacturer, so that individual items still run the risk of being below the standards, for example during the distribution or sourcing stages.
2. **Reliance on central party:** governments and companies become the sole party to enforce the standards, while consumers simply have to trust the enforcement of these standards. There is no independent verification tool for consumers to assure the internal parameters or external storage conditions throughout the travel of food to their table.
3. **Misleading or incomplete labels:** many labels do not always give full information about the product to the consumer (e.g. consumers who buy products with BIO - Organic - marking on them may be shocked to discover that organic does not imply GMO-free).
4. **Squeezing out of small producers:** many smaller producers and farmers actually do produce better quality products and follow the environmental and quality practices much better than large conglomerates, but they have had no way to demonstrate that to the consumers.
5. **Fragmentation and opacity of supply chains:** supply chains have become complex, opaque and fragmented, making ingredient tracing, origin authentication and identification of chemical contamination, infestation or poor transportation conditions an impossible task.
6. **Unsustainable resource use:** the socio-environmental factors are completely excluded from pricing considerations and there is often lack of insights into the sustainability of the supply chains, such as emission of CO<sub>2</sub>, use of resources in production and processing and fair working practices.

All these concerns ended up to a low trust level of the consumer in the food system and low satisfaction of food suppliers, while the powerful buyers and intermediaries capture most of the value.

### Importance of Having Food of High Quality

**Quality food is vital for health and wellbeing.** Food provides our bodies with the energy, protein, essential fats, vitamins and minerals to live, grow and function properly. We need a wide variety of different foods to provide the right amounts of nutrients for good health.

**An unhealthy diet increases the risk of many diet-related diseases.** The major causes of death, illness and disability in which diet and nutrition play an important role include coronary heart disease, stroke, hypertension, atherosclerosis, obesity, some forms of cancer, Type 2 diabetes, osteoporosis, dental caries, gall bladder disease, dementia and nutritional anaemias [1].

**Health care system costs are heavily influenced by the quality of the nutrition.** Current regulations in the food domain are only covering those aspects of health & safety that either can lead to immediate adverse effects (e.g. food poisoning) or lead to clearly linked health problems (e.g. banned ingredients). However, this is not adequate for many health-conscious consumers, as many components and ingredients are believed to be long-term contributors to cancer and other terminal diseases. Their effect does not become apparent for many years of continuous consumption and thus establishing causal links is often problematic, and yet for many people if the food products could increase their chance of cancer in 10-15 years, they would prefer to avoid the risk altogether wherever is possible. Ambrosus will be the solution for all those consumers who do not wish to wait until scientific studies establish clear links to health problems and food. Research on food safety is actively suppressed by the powerful food conglomerates with vested interests in the current market structure. Due to significant amounts of money they have, they fund a lot of research that tries to disprove any concerning findings of other researchers who establish causal links between some ingredients or processing methods and terminal diseases. Combined with strong lobbying powers, they hold a significant power over governments and agricultural regulations. Ambrosus will allow higher transparency of the farming, processing and delivery practices and will allow people to make their own, better-informed decisions that align with their health concerns.

**The healthiness of diet is directly correlated to the quality of the food products** affected by the farming, processing, storage and delivery processes within the supply chains. For instance, exposure of juices to light and oxygen generates oxidation of vitamins. The nutritional value drastically decreases resulting in poor juice quality; or debasement of products with water or of low nutritional food product lower down the daily total absorbed vital minor ingredients. An estimated 4-8% of people worldwide (i.e. 300-600 million) suffer from some form of food allergy [2]. Due to mislabelling, cross-contamination, fraudulent manipulation and to the opacity of the supply chain, even the food allergen(s) which is(are) known costs U.S. families nearly \$25 billion annually for caring [2]. Malnutrition due to low quality food and bad food choices is on the rise in the developed countries. The proportion of overweight people has doubled in less than 20 years in many OECD countries [3]. In many cases, poor nutrition is the result of lack of information about the quality of food or the effects of the ingredients, especially in those countries where the large manufacturers exercise strong lobbying power in the labelling regulations.

## Mission and Objectives

Ambrosus has the mission to align the Food Supply Chain 2.0 with the interest of the consumers, of the governments and of all the stakeholders in order to assure them the quality, origins, safety and sustainability of the food commodities in a verifiable manner.

The solution provided has the potential to assure and control the high quality standards required for delivering and producing healthy, safe, nutritious and tasty product to end-consumers. It is designed to also have an integrative overview of the supply chain in order to assure compliance, more sustainable practices and reduce fraud and counterfeiting attitudes. The implementation and deployment of this technology will support the creation of a new eco-system which will lead on a significant increase of trust in the food system by the consumers and by the stakeholders. Food Blockchain will also support sustainability of this food eco-system and help in solving some key food challenges the society is facing. The objectives of the team is to develop Ambrosus which is a package solution composed of an hardware part capable to instantly assess the food items on-site and non-invasively; and a software part based on blockchain assuring data integrity and transparency.

All quality assessment records of Ambrosus are made for individual food products so the food sector will no longer have to face this painful trade-off. It will allow consumers to make better informed food choices; incentivises farmers and manufacturers to deliver high quality raw materials and products; assures practices of processing, storage and deliveries; reduces risk of food deterioration and adulteration; and allows creation of new commercial relationships in the food sector, using peer-to-peer structures.

## Value Created

To build Food Supply Chain 2.0 that delivers tangible value to all the stakeholders of the value chains and to the consumers, the fragmented, opaque and inefficient food supply chains of today need to be transformed into modern digital supply networks. We will enable good farming and manufacturing practices to become the industry standard through advanced detection technologies, quality assessment, reassurance and traceability. Our data storage and automation processes will make supply chains intelligent, cost-efficient and self-governing. Finally, our peer-to-peer marketplace will allow new kinds of commercial exchange between different stakeholders within the supply chains. Our individual blocks will be powered by the Ethereum blockchain that will ensure security, integrity and interoperability of our food technology ecosystem with other emerging and rapidly developing sectors of the global blockchain economy. Development of Ambrosus will be community driven and we will enable developers or experts in the food industry to create dApps, software and tools that can benefit the network users and capture value through the incentives offered by our Amber token. Ambrosus is the first blockchain ecosystem, tailored entirely to the needs of the global food sector.

## Consumer Health and Well-being

### Health and Safety

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Ambrosus is an independent, publicly-verifiable assurance of food quality and healthiness that can guarantee to the consumers that the food they are buying is probably healthy. Consumers will no longer have to rely on labels or promises of manufacturers and can buy those products that are better aligned with their health concerns.

### Nutrition and Quality

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Nutrition and quality are strongly correlated to health aspects for all people. For children they play an even bigger role, as the growing organism is particularly influenced by the quality and nutrition it receives. Any parent wants their child to grow strong and smart, and the importance of proper nutrition to the growth, development and learning abilities has been firmly established. Baby food industry and children's food industry is largely controlled by powerful brands, in whom parents trust simply because of the marketing power that the big brands create by investing billions of dollars into publications, promotion, financing children nutritionists' associations and open advertisement. Due to lack of the objective platform to give them deeper insights into the quality and origins of food, parents have to rely upon brands whom they associate with quality assurance and nutrition. If any smaller challenger to the market actually offered better nutrition and quality value to children they would find it an insurmountable task to break into the market with their new products and offerings, due to the barriers created by current players. With Ambrosus they can quickly connect their farming and production facilities to our system, openly record the quality and safety parameters and put their offers on the marketplace. People would have enhanced trust to their products' quality and nutrition values and could start buying products with verifiable quality and safety aspects.

## Trust and Traceability

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The combination of our digital certification tools, blockchain data storage and sensors permits assurance of traceability of food products. Farmers can build a new level of interaction with the consumers of their food products, allowing people to find the farm on the map, have a digital tour and see insights into values and practices followed by farmers. This allows an unprecedented level of trust into the product as well as a connection to the food in ways unimaginable before. One of the key objectives of Food Blockchain is to enable tagging and tracking of individual items all the way from farm to fork, allowing detailed insights into the story of individual product through all stages of the supply chain, including origins and quality parameters, which could be verifiable by the consumers. We will provide new tracing system directly in contact with the food in order to avoid any fraudulent manipulation and new smart packaging solutions to assess food key quality attributes; both expertise are derived from technologies developed at the Swiss Federal Institute of Technology (EPFL) that has leading research laboratories in these fields.

## Fraud and Counterfeiting

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Quality data manipulation and counterfeiting are two most serious threats to integrity of food supply chains. Many scandals involving food fraud have taken place both in the developed and developing world. Mislabelling products, failing to uphold the standards, repackaging or diluting lower quality goods, refreezing products after improper storage or outright counterfeiting of known brands are some of the typical examples of fraud taking place in the supply chains. In some cases, the damage is only economic, with consumers paying unfairly high prices thinking they are getting a higher quality products, in other, more extreme, cases there is a risk of health problems after consumption of the products. In some regions of the world the problem is so bad that people are sourcing their food from foreign countries. This is especially a big problem with baby food.

Food Blockchain offers tracing solutions for the food products, allowing to determine origins and history of processing and storage for individual food products through smart tagging and packaging. Coupled with the unique ID code and timestamp, both of which are recorded on the blockchain, this completely eradicates counterfeiting, as individual products and batches would have their routes and history recorded on the blockchain.

Our sensors recording quality aspects of food would also prevent any fraudulent practices, as any suspicious activities would be immediately logged on the blockchain, where the data would be immutable. Consumers or retailers would be immediately aware of any suspicious activities.

# Value Chain Stakeholders

## Farmers and Marketplaces

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Farmers whose products are of verifiably better quality (either quality of ingredients, quality of farming practices or sustainable and social elements) can use our platform to demonstrate the additional value they are creating for their produce. When consumers discover their higher quality products, they can reward the farmers with a reputation token or send Amber as sign of appreciation. The farmers can then be discovered by premium buyers, such as organic food shops, restaurants or food-conscious consumers, who can offer to pay the farmers a higher price for their products. Our system can also allow farmers get access to financing through verification of large purchase orders received from a buyer, allowing more favourable access to finance. Finally, our P2P marketplace can also allow the farmers to build digital cooperatives that supply food with verified quality and origins to the buyers, allowing the farmers to get paid a better price when completing a transaction with the buyer. They no longer have to be at mercy of a big buyer or supply chain intermediaries.

## Food Transformers and Retailers

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Firstly, we protect brands from food scandals by assuring the quality of raw material inputs that go into their final products. Secondly, we establish good practices for origin tracing and quality assurance by creating incentives and liabilities for contract participants. Thirdly, we deliver digital certificates “Verified by Amber” that accompany the food items or batches throughout their transportation within the supply chain. The digital certificate assures good sourcing practices for raw materials, its origin and the way it was grown, extracted and processed: e.g. avoiding the use of pesticides or pharmacological products or preventing social abuse such as child labour. Finally, we create the system that allows continuous auditing to assure compliance to regulations. This decreases the cost of manual auditing and compliance. If any issues in food quality are identified, the source of the problem is immediately identified. This allows companies to make a targeted product recall, without losing big amounts of money and wasting food on unnecessary total recall or risking health threats to the consumers.

## Logistics and Distributors

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With smart contracts that monitor sensor data on the quality of food and its storage and delivery conditions, we completely remove a possibility for commercial disputes for intermediaries and distributors. It is always clear who is responsible for what product and what the readings of the sensors are. The money is immediately paid out in accordance with contract conditions. Lengthy disputes or non-follow-up with invoices as well as cash constraints are going to be the thing of the past, allowing distributors to operate in lower-risk, trustworthy environment. Later on, our solution will enable to reward distributors and intermediaries who deliver consistently good quality of food management, not only ensuring proper temperature, light exposure or humidity that affect the quality of food itself, but also wider societal implications of their operations, such as calculation of CO2 emission of the vehicles.

## Retailers and Restaurants

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Clients of shops and restaurants can now independently verify the quality, safety and origins of individual products. Those companies, shops and restaurants that adopt the label “Verified by Amber” can attract clients who are concerned about the food quality and increase their sales and consumer satisfaction rate. Restaurants can also demonstrate compliance to regulations and sanitation norms. Lastly, a lot of waste is produced in restaurants and in hotels, and improvements in waste management practices can also be demonstrated allowing businesses to showcase their efforts for more sustainable practices and be rewarded with Ambers.

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- [1] <http://www.childrensheartcenter.org/whynutritionimportantforchildren.html>
  - [2] <http://www.foodstandards.gov.au/publications/Documents/Fortification%20report%20-%20FINAL.pdf>
  - [3] <https://www.cancer.org/healthy/eat-healthy-get-active/acs-guidelines-nutrition-physical-activity-cancer-prevention/food-additives.html>
  - [4] <http://www.foodsafetymagazine.com/enewsletter/a-look-back-at-2016-food-recalls/>
  - [5] [Non-invasive sensing for food reassurance, Analyst, 141, 1587-1610, 2016; Xiaobo Z, Xiawei H, Povey M](#)
  - [6] [https://www.washingtonpost.com/business/economy/the-labels-said-organic-but-these-massive-imports-of-corn-and-soybeans-werent/2017/05/12/6d165984-2b76-11e7-a616-d7c8a68c1a66\\_story.html?utm\\_term=.a1d2dcc630f2](https://www.washingtonpost.com/business/economy/the-labels-said-organic-but-these-massive-imports-of-corn-and-soybeans-werent/2017/05/12/6d165984-2b76-11e7-a616-d7c8a68c1a66_story.html?utm_term=.a1d2dcc630f2)
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