OSA

decentralized

The world's first decentralized marketplace providing AI-driven solutions to retailers, manufacturers, and consumers

company@osadc.io
www.osadc.io

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Executive Summary

OSA Decentralized (OSA DC) is the world's first decentralized AI-driven marketplace providing real-time solutions to retailers, manufacturers and consumers.

OSA is a successful existing business established in 2015. We provide services for world leading consumer product retail and manufacturers, including Coca-Cola, PepsiCo, JTI, Mars, L'Oreal, Metro Cash & Carry, and many others.

After two years of development in close partnership with ECR organization that unites more than 70 leading manufacturers and retailers, we developed proof of concept in 2016, and as of 2017 deployed **OSA Hybrid Platform (OSA HP)** - Big Data platform powered by AI that manages products optimal shelf availability in retail stores in real time.

Optimal shelf availability is the biggest problem in global consumer retail, costing manufacturers and retailers 400 billion dollars in lost sales per year. It is caused by business processes' inefficiencies along the supply chain and in the retail stores. OSA HP integrates with the big data systems of the participating retail chains and then combines optical recognition and machine learning technologies to issue alerts to the in-store staff each time our algorithms discover there might be a problem with optimal shelf availability of the products being distributed by our clients.

As we started scaling our solution, we confronted a number of bottlenecks.

First of all, our solution implementation was resisted and at times even sabotaged by some of the in-store staff, who appeared to benefit from proliferation of existing product tracking and accounting solutions, by tampering with the data, with the objective of fraud and pilferage. We also revealed instances of selling expired products, to keep the waste levels to within target levels. Other instances included sales of counterfeit products and other “creative” attempts to maximize profit at the cost of the shoppers' health.

Secondly, more than 30% of out-of-stocks happen outside of the retail stores and are caused by the imbalances in the supply chain, from the manufacturer all the way to the retailer warehouse, and cannot be solved in the retail shop.

In the supply chain we confronted two major issues - 1) complete inconsistency of product tracking - names, measuring units and IT solutions, and 2) unwillingness to share data due to lack of trust between supply chain members, particularly between the manufacturers of consumer products and the retailers.

Having assessed these issues, we eventually come to the understanding that these can only be overcome with the help of blockchain, in combination with a set of other breakthrough technologies.

OSA DC Solution takes this a stage further - it develops a range of technologies that aim to overcome the obstacles identified in implementation of OSA Hybrid Platform Solution - lack of transparency across entire supply chain and “human factor”.

Firstly, synergy of AI and blockchain with smart contract functionality will secure supply chain members' data from manipulation and unauthorized access and will make it transparent.

Secondly, creation of Product Master Data Catalogue that will contain product name, visual appearance, 3D model and comprehensive product information across 150 product attributes. It will allow AI to analyze clean data and provide all members of the supply chain with smart prescriptions.

Each product will include Image Recognition (IR) model, generated by teaching AI on synthetic

data sets (unique technology developed by our partner Neuromation). IR functionality allows controlling AI generated tasks' execution by shop staff, collecting necessary data in real time and providing unique services to the consumers and supplying chain members.

These technologies, mounted on top of the existing Big Data Platform, Real Time processing and Machine Learning will allow to completely solve product availability issue, drastically reduce huge product write-offs and deliver tangible benefits to the supply chain members and the end consumers.

OSA DC will make all of its reliable product data available to consumers, in an easy-to-use format. Enriched with product and store performance ratings, this data will allow consumers to make intelligent and conscious product and store choices and

1. save consumers money
2. save consumers time
3. stay healthy and lead a healthy lifestyle.

OSA DC will encourage consumers to generate and share valuable consumer data that will guide manufacturers and retailers to produce better products and improve business processes to deliver better services.

Consumers will be rewarded by OSA Coins for generated data and will have wide range of possibilities to use OSA Coins, including purchase of consumer products.

OSA Decentralized Solution creates unique ecosystem that unites various parties which are disconnected today - supply chain members, data providers, data scientists, IT specialists, apps developers, computation power providers, laboratories, regulators and end consumers - in order to develop myriads of B2B and B2C services on decentralized blockchain and smart contracts based platform, aiming to help create better products and services to the end consumer. OSA Coin is fuel to enable ecosystem operation, reward to the ecosystem members for adding value and payment unit to enable billions of transactions between OSA ecosystem members.

The core element of OSA ecosystem will be OSA coin, which simultaneously is a tool for global OSA solution scaling.

The initial token for sale is OSA Interim Token, which is an ERC20 standard token. After building own blockchain infrastructure for OSA coin, that will ultimately meet platform's requirements of transactions speed, cost and quantity (currently planned for the second half of 2019). All token holders of OSA tokens will be able to freely exchange their OSA tokens into OSA coins at the rate of 1 to 1.

OSA blockchain will serve as the basis for OSA smart contract infrastructure, which will enable key stakeholders of our ecosystem — namely: product vendors and retail store owners — to enter into a smart contract establishing KPIs for optimal shelf availability of a vendor's products. Each product metric, like quantity, alignment and presentation of the product on the shelf, will be tokenized using OSE KPI tokens sitting on top of OSA blockchain.

Introduction

This white paper describes the Optimal Shelf Availability Decentralized Platform, also known as OSA DC. As a standard term in the retail industry, optimal shelf availability refers to the immediate availability of all the relevant goods on a retailer's shelves at any moment in time [McKinnon][1], [Corsten & Gruen][4]. An airtight OSA is crucial to increasing sales volume and profitability, customer satisfaction, and the overall efficiency of a retail business. The OSA DC platform itself is a business project, developed by a team distributed between Russia, Ukraine, the United States, and Israel. It uses data science, artificial intelligence, machine learning, and optical recognition technologies to improve optimal shelf availability for retailers and like businesses.

In this section of the white paper, we introduce OSA DC's business concept and the problems it's looking to solve within the retail industry and supply chain markets. In addition, we outline our customer base, existing competition, and our sources of inspiration. We'll conclude by describing our product's developmental progress and our current achievements, finally summarizing these details with our product roadmap for 2018/2019.

The High Cost of Empty Shelves and Damaged Packaging

The retail industry loses $400 billion in sales annually from product shortages and understocked inventory [Lee][3]. Data collected from more than 71,000 consumers in 29 countries shows that, when shoppers can't find at least one product they're looking for in store, they typically do one of six things:

1. Find a substitute from the same brand.
2. Buy a similar item from a different brand.
3. Delay their purchase.
4. Don't buy the item at all.
5. Buy the item at another store.
6. Exit the store without buying anything.

Most of these alternatives are detrimental to several aspects of the supply chain's ecosystem [Nickels][5]. Depending on the product category:

- 7% to 25% of consumers faced with out-of-stock products won't buy a similar item as a substitute at the same store, while 21% to 43% will go to another store to buy the same item
- Only half of consumers make their intended purchases when their desired products are out-of-stock, knocking off about 4% of profit for individual retailers annually

The negative consequences of stock-outs, however, are not always immediately noticeable. Retailers and product brands either suffer them slowly or indirectly; for instance, they may feel the effects in the 55% of shoppers who report having given a negative social media review to suppliers or retailers [PwC][6]. The most likely outcome for consumer goods producers, though, is losing hard-earned customer loyalty, as, for example, when a customer buys a Pepsi instead of a Coke.

Large-scale retailers often operate on extremely narrow profit margins and suffer greatly when they lose shoppers to their competitors. The situation is somewhat different for premium retailers (e.g., Whole Foods, Wegmans, Publix) where out-of-stocks aren't so common because

they can maintain full shelves by charging higher prices. Higher prices also allow these retailers to accept high product waste levels as they are fully covered by the extra margin.

As Harvard Business Review notes, “the root of the problem lies in the lack of transparency in product flow between retailers and consumer goods manufacturers. Once the manufacturing company ships its products to the main warehouse of, say, a major retail chain of 1,000+ stores, it has no control or understanding over what happens to its products further. The only way that the manufacturer can try and ensure higher levels of the on-shelf stocks is to push more stock on the retailer. This does not help much in solving the out-of-stock problem, as only 70% of cases the problem occur in store. Remaining 30% of out-stocks stem from the stocks imbalances across the supply chain. The 'push' practice creates overstocks and contributes to high levels of product waste — over 2% of total sales, or 100 billion dollars a year” [Corsten & Gruen][4].

In addition to stock-outs, as much as 11% of product unit shipments have some degree of case damage, which also affects a retailer and consumer brand's short-term financial gain and long-term reputation [Bodenheimer][7]. According to *Packaging Digest* (http://www.packagingdigest.com/packaging-design/damaged-packaging-potential-source-serious-revenue-loss), “only 8 percent of respondents said they would pay a normal price for a food product with damaged packaging, with a further 55 percent saying they would still purchase it but expect to get a discount” [Lingle][8].

A recent McKinsey study examines how up-and-coming technologies could help the industry mop up these issues, thus transforming how retailers operate and compete. For example, retailers and supply chain operations that have adopted data analytics programs have seen up to a 19% increase in operating margins over the last five years. Using data and analytics to improve merchandising (pricing, assortment, and placement optimization) also helps retailers to improve their operating margins by 16% [McKinsey][9].

OSA builds on these improvements with our own existing solutions. With these, the platform aims to solve the major challenges retailers face across the globe due to the distrust and lack of transparency that plagues the supply chain industry.

Consumer product manufactures and retailers drive their own agendas, and as such, they are reluctant to share data with each other. For fear of weakening their negotiation leverage and leaking data to competitors, they hoard relevant data for their own use only.

Along with personalized, closed-source data, each member of the supply chain uses its own product tracking processes. To make matters worse, the same products often bear different names within each of these tracking systems, fragementing and dirtying the data for the purposes of analysis. Even within the same retail chain, we found almost 200 names for the same product depending on the store, management team, and/or accounting system.

This hodge podge of system dissimilarities creates headaches for product tracking, forecasting, and planning. It makes widespread overstocking and understocking all too common occurrences, both of which result in significant losses in sales, dissatisfied shoppers, and substantial product waste. Further, improper storage, transportation and handling inefficiencies, and in-store theft (often times perpetrated by a shop's own staff), exacerbate these problems.

China gives us the most infamous example of supply chain trust gone awry. In 2008, China suffered a widespread food safety incident wherein milk and infant formulas were contaminated with melamine (when added to milk, melamine gives the appearance of higher protein content). The mishap afflicted roughly 300,000 victims and hospitalized over 55,000 babies. The company responsible for the crisis, Sanlu Group, added melamine to cut corners, but it turns out that they were not alone. According to a government inspection, 21 other companies engaged

in the same practice.

This debacle raised major concerns about retail food safety and led 11 countries to cease importing Chinese dairy products. The ensuing case led to two executions and resignations from several officials. Following this episode and several similar cases, Chinese shoppers now regularly spend more than $40 for tins of baby formula imported from Australia and other neighboring countries.

From this single example, it's easy to see why consumers have low trust in product quality and nutrition facts. Studies show that 75% of consumers don't trust product information or labels that promote the following standards: “healthy,” “organic,” “non-GMO,” “no preservatives,” “ethically produced,” “kosher,” “gluten-free,” etc. Since there's no reliable method to monitor or confirm these promises, brands abuse consumer trust in pursuit of higher profits. Still, consumers are willing to pay premium prices for products that provide additional nutritional value, so long as they can justify that these added benefits are legitimate.

Lack of product transparency is even more egregious in online shopping, causing consumers a not insignificant source of discontent. More and more, shoppers want detailed information about the products they are buying, such as where materials are sourced and whether they were ethically produced.

Who Are Our Customers and Stakeholders?

Before making the move to blockchain, OSA's existing business has proven itself by optimizing the on shelf availability in real time of its multinational clientele. Our OSA Hybrid Platform Solution have helped manufacturers and retailers alike to improve their bottom lines, as was proven in the platform's pilot test program. Launched in 2016, this pilot was run in 41 large retail stores, and resulted in 5,4% sales increase across tested product categories vs. control panel and 150-450% ROII (Return on Inventory Investment) increase for the participating retailers. The pilot test was designed and implemented under close supervision from 5 participating multinational manufacturers of consumer goods: Mars, L'Oreal, DANONE, EFES and JTI.

Figure 1. **OSA Stakeholders Map**

Stakeholder	Role in Our Ecosystem	Our Points of Added Value for this Stakeholder
Vendors, Manufacturers or Independent Suppliers	The first parties of interest. OSA helps Vendors to increase their sales, minimize in-store issues, and manage marketing expenses.	• Enhanced product display and verification • Improved retailer adherence to agreed product display and pricing standards • Reduced stock-outs to increase sales and profits • Access to data in real-time • Improved consumer loyalty to reduce brand swapping • Improved consumer loyalty, reduced switch-out

Stakeholder	Role in Our Ecosystem	Our Points of Added Value for this Stakeholder
		• Competitive advantages for building an effective retail presence • Demand planning implementation to enhance ingredients sourcing and improve cash flow
Logistics Companies	This layer simplifies the process during which products leave the supplier's warehouse en route to retail stores. By its nature, this process is vulnerable and, as such, requires increased attention from all involved parties and will be optimized using OSA DC's flawless data flows.	• Improved delivery times • Higher transparency for product transportation and handling conditions • Better inventory and warehouse planning • Closer integration with a vendor's delivery and retail monitoring systems • Point of differentiation among other providers.
Retailers	As the backbone of our ecosystem, retailers are the meeting point for products and their customers. Their shelves provide goods for the end consumers, and they own the in-store customer experience on which our entire ecosystem depends.	• Less out-of-stock inventory, more sales • Increased shopper loyalty, less shopper switch-out, and increased customer volume • Cost optimization • ROI Return o Investment) improvement • A trustful shopping environment built on reliable data sharing and transparent product information • Competitive advantages over other retail chains by providing vendors with state-of-the-art monitoring solutions.
End Customers	The consumer is our end-goal, our most valued customer, beneficiary, and stakeholder. While our business is built on selling more to end customers, it	• Consumers won't have to pay for all the inefficiencies and out-of-the-stock losses of vendors and retailers, making shopping much less costly

Stakeholder	Role in Our Ecosystem	Our Points of Added Value for this Stakeholder
	also improves their quality of life by providing reliable product information and making responsible choices easier.	• Less time spent in-store looking for the right products to buy • More quality inventory and greater product variety improves customer health and makes the in-store experience much more pleasant.
Technology Partners	OSA's platform is a complicated, multilayer technological protocol. The platform is built to integrate a multitude of 3rd party solutions that benefit our stakeholders.	• At $28,3 trillion in 2018 FC, the retail market could be a highly lucrative venture for 3rd party tech companies [Statista][10]. • Partnering with OSA leagues you with outstanding product development and business teams that have gained visible market traction • Access to a big data infrastructure and clean data • OSA DC serves as the ultimate link between businesses and data science.
Data Providers	All members of the supply chain are key data providers. Apart from them, OSA relies on a variety of 3rd party data to generate accurate forecasts and alerts. When using B2C services on the decentralized platform, consumers generate a wealth of unique data related to shopping patterns, product predilections, pricing influence on purchasing decisions, etc. With consumer consent, this data is used to enrich machine learning algorithms and improve B2B services. OSA DC enables a fair share approach and rewards consumers for sharing data. Such data is invaluable for enhancing business solutions to develop better products and services for end customers.	• Practical machine learning solutions analyze consumer provided data • Dedicated team of data scientists • We reward consumers with OSA coins if their data is used by OSA DC Platform or our clients for their business solutions • We incentivize consumers to provide data for certain activities (product purchase, feedback provision, etc) • Consumers can use OSA coins to receive additional B2C services through the OSA DC platform, become eligible for special offers, or purchase products.

Stakeholder	Role in Our Ecosystem	Our Points of Added Value for this Stakeholder
Industry Associations	As an innovative technological solution, OSA cooperates with various industry clusters and offers help in creating added business value to their members	• OSA is a reliable and disciplined leader in the emerging AI industry with a proven track record • Unique value propositions and discount programs for members of Industry Associations
Infrastructure Providers	As a decentralized, AI-driven big data platform, OSA requires mass amounts of computing power to enable neural networks, machine learning, blockchain records, and data storage. Thus, we will engage with infrastructure providers including mining organizations to pool spare computation power at a higher margin than mining currencies themselves.	• Fair share approach for using mining power for the decentralized platform's needs (e.g., data mining) • Access to the trillion dollar AI and data mining market

Vendors, Manufacturers and Suppliers

Failure of goods to be constantly available on retail shelves and in perfect packaging creates a risk of the consumer forgoing the purchase or switching to a competitor which hands suppliers' competitors a free ride, compared to the average $22 cost of acquiring a customer [Kummerer][11].

Product brand suppliers, such as Danone, SunInBev and L'Oreal are already using OSA Hybrid Platform Solution to ensure quality presentation of their goods when reaching consumers, when and where the consumers need it.

OSA DC cooperates with the following world leading FMCG vendors:

Logistics Companies

Logistics companies are the link between suppliers and retailers, and consumer goods of all kinds must be stored, transported and handled in product-specific ways. More and more, transportation trucks and similar vehicles are outfitted with GPS and other communication technologies which allow businesses to track the progress of their shipments in the supply chain and take action if any disruptions should occur. To give an idea of this technology in practice, store owners are increasingly installing temperature and bio-sensors that register heating/cooling signatures so that they can keep tabs on handling conditions in real-time.

Retailers

Retailers traditionally operate on extremely narrow margins, and they face stiff competition with other retail chains and online retail. In recent years, retailers have reported declining customer traffic and increasing business costs. To combat these problems, they often cut costs and/or downsize staff, but this may only aggravate these problems [The Future of Grocery][12].

The situation is somewhat different for premium retailers, as stock-outs are rare and full shelves are maintained by charging higher prices. This, in turn, allows retailers to accept high product waste levels as they are fully covered by the extra profit they generate.

Offline retailers (which represent 91% of the total retail volume in 2018) and online retailers (9% of the total retail volume) [Saleh][13] will greatly benefit from OSA products. **OSA has delivered 5.4% volume growth for its retail customers. It has achieved this profit increase with AI-driven staff management and real-time analysis of understocked and overstocked products. In total, this incremental sales growth ensures, at minimum, 150% ROI on money invested in OSA's services.**

And this is just the beginning. Upcoming OSA solutions will continue to galvanize retailer strategies, driving sales and optimizing costs while making the shopping experience more enjoyable for customers, as well. For your business, OSA can help you to: effectively manage floor staff, streamline inventory and delivery processes, reduce product waste, efficiently manage shelf space to maximize sales, properly plan promotional campaigns, utilize optimum pricing models, and gauge consumer product preferences. We provide services to 7 retail chains, 5 of which belong to biggest 250 retail chains. Many more are in various negotiation stages.

Consumers

The biggest beneficiaries of OSA DC Solution are the end customers. Under current models, as detailed in the “High Cost of Empty Shelves and Damaged Packaging” section above, consumers suffer from supply chain failures and can punish suppliers and retailers accordingly by taking their business elsewhere. What's more, consumers end up paying more for their desired products when retailers have to mark-up prices to account for supply chain inefficiencies and product mismanagement. Thus, OSA's solutions can lower prices for customers as retailers and suppliers revolutionize product management and business strategies in highly competitive environment.

Additionally, consumers will have the ability to search for available products listed on the platform based on their individual requirements, whether these come from diet, budget, or otherwise. Every product category has a wide range of product attributes, features, and specifications (e.g., organic, biodynamic, gluten-free, kosher, salt or sugar free, safe for children, safe for pregnant mothers, no artificial flavorings or specific allergic components, manufactured without child labour, fair-trade, eco-friendly) you name it, and OSA DC can help you find it across the myriad providers and retailers on its platform.

You can even filter and identify these products with your smartphone. By simply taking a photo of shelved goods, OSA's augmented reality function, for example, can superimpose color schemes over products to highlight in green which products are suitable for pregnancy. This customer data creates the basis for alerts and forecasts for other customers, a practice which is

compliant with international data privacy laws.

Comprehensive consumer benefits and functionality is described in chapter “Power of The Smart Consumer. B2C” below in this document.

Technology Partners

OSA utilizes cutting edge technologies from companies such as Neuromation, which provides neural networks for various applications including Image Recognition (IR). This helps OSA in two ways:

1. We reduce our dependence on internet connection, as IR modeling is device-specific
2. We create a unique pipeline to develop IR models using synthetic data, and thus, we eliminate the need to take individual photographs in stores and label them manually

Our other technology partners include:

- **Hacken:** our cyber security partner. Hacken helps us to secure all OSA's sensitive data, as well as provide the platform with HackenProof service for smart contracts.
- **Ambrosus:** has one of the strongest blockchain teams and a similar application focus. We have reached alignment to join our forces to develop blockchain solution, as well as test and implement temperature, bio, and other product sensors.
- **Paytomat:** our partner that allows consumers to spend OSA coins in stores, hotels, and restaurants. In addition, Paytomat is our CRM partner together with LoyMax.

Data Providers

Some key determinants of supply chain and product demand disruptors include weather, deviant prices, promotions, popular events nearby, etc. For instance, summer months come with a spike in water and beer consumption, and product promotions can influence consumers to buy product X over product Y. OSA Hybrid Platform (OSA HP) already pools consumer data from around 100 open data sources to forecast these purchasing factors. OSA DC will similarly get the data from multiple open sources or from partners, depending on the individual objective (be they a retailer, a manufacturer, or a research firm). In this vein, we invite data providers to become an OSA DC partner and monetize their data in a decentralized, fair manner.

Similarly, consumers will become one of OSA DC's most valuable data providers, and they'll have access to the same rights as any other data providers on the platform. If they consent to provide the data, consumers will be rewarded for their contributions in OSA coins, which can be used to purchase extra B2C services, subscribe to special offers, and receive incentives from manufacturers or retailers. As the platform grows, it will be possible to use these coins to purchase products from participating retailers, online and offline alike.

Industry Associations

OSA works with associations representing suppliers and retailers to create shared standards for data sharing to boost supply chain efficiency. With one of our partners, ECR, a joint industry initiative that unites the world's major manufacturers and retailers across 40 countries, we're

working to make Fast-Moving Consumer Goods (FMCG) retail more responsive to consumer needs and create a more cost-effective supply chain.

ECR has been working on the issue of on-shelf availability since 2005. In 2015, they elected OSA HP as their primary solution developer because of our team's unique set of expertise, our big data platform, and our transparent IT code and machine learning models.

In close cooperation with ECR, it took us 2.5 years to develop the OSA Hybrid Platform. We received enormous support and expertise from the ECR organization's members, who represent more than 70 leading consumer goods manufacturers and retail chains. Overall, OSA Hybrid Platform Solution was developed by over 110 experts from six countries, including those from the ECR community who contributed at different stages of its development.

Figure 2. **OSA Hybrid Platform Experts Panel from the ECR Community**

Alexander Tsygichka
Danone

Sergey Perchenok
Efes

Viktor Zhilyaev
L'Oreal

Alexey Nikiforov
SunInBev

Alexey Okhlopkov
Mars

Existing Retail Technology Projects That Serve as a Sources of Inspiration and How We Differ

Figure 3. **Categorization of bn/Existing Retail Data Analysis Technology Ecosystems**

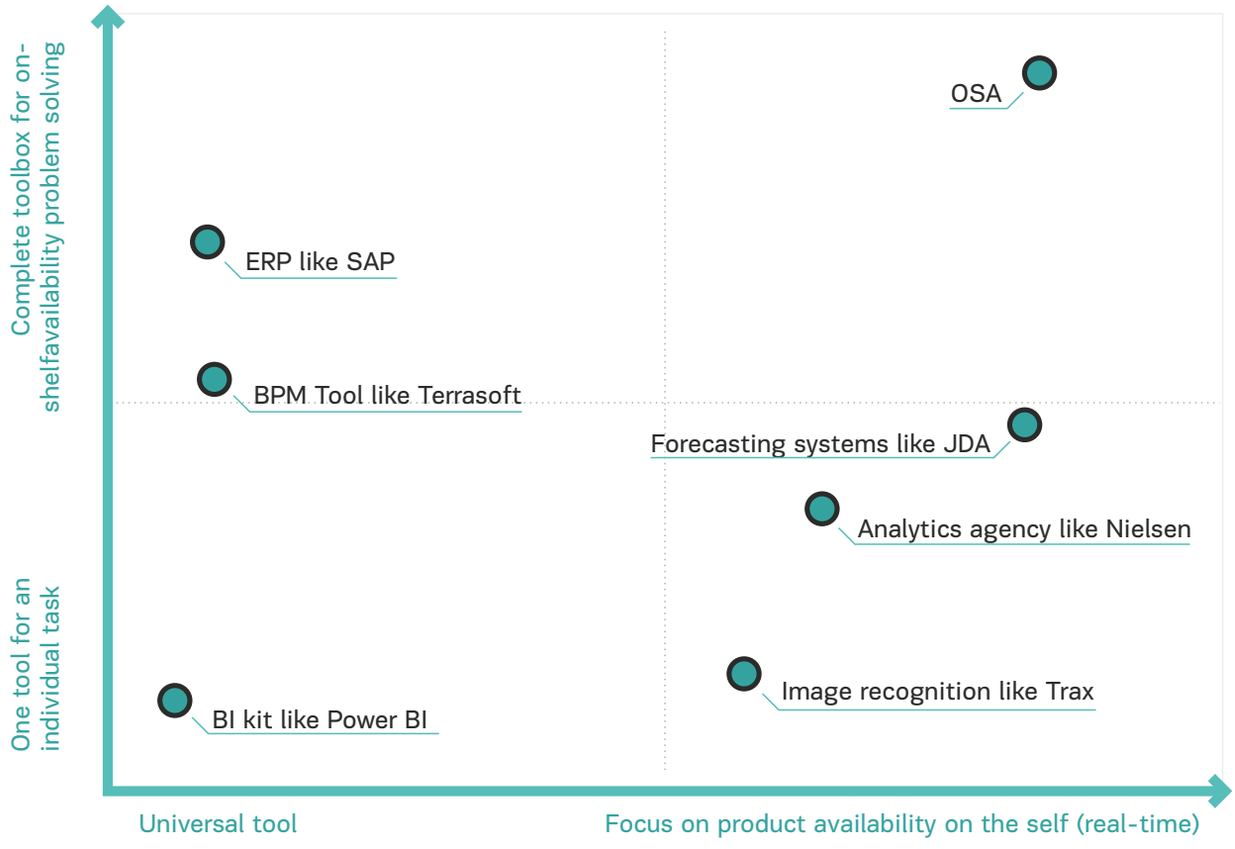


Figure 4. Inspiring Projects in Retail Data Analysis Technology

Solution type and Example	Why Does This Solution Stand Out?	How is OSA Solution Different?
Custom, in-house solutions for large brick-and- mortar retailers	Retailers who can develop their own optimum shelf availability monitoring solutions with their existing IT infrastructure can certainly benefit from OSA's solution for their data systems. Obviously, by "optimum shelf availability" we do not mean merely installing a sensor to prompt a notification when the shelf becomes physically empty.	We use a shared costs business model to lower the financial threshold for implementing an empty shelf control solution for all retailers, not just the big players. The more clients we onboard, the more affordable the service becomes. We absorb all the costs and risks of implementing and running the service. Meanwhile, our clients benefit from partnering with a team with cross-market expertise. This enables us to collect more insights and provide sharper, more finely-tuned algorithms. In our current business model, the OSA solution is free for retail chains to install, with installation costs being covered by vendors interested in getting better in-store sales volumes. On top of that, OSA's solution contains a much wider range of valuable data vs. typical retailer data set.
Stand alone image recognition services for retailers like Trax (traxretail.com)	Trax provides in-store product execution monitoring that helps retailers "win at the shelf" with a comprehensive, real-time view of their store's performance across other retail channels. Trax collects real life shelf pictures via sales reps, and these pictures are sent to the Trax cloud to be analysed. The sales rep then receives mobile reports and management teams get detailed assessments online.	In-store execution precludes other important facets of the supply chain. More than mere in-store services, OSA enables customers to understand and analyze issues before that product hits the shelves. Besides image recognition, our supply chain monitoring tool set includes machine learning, statistical algorithms, and neural networks. Speaking of image recognition, our synthetic data learning algorithms substantially lower capital and operating expenditures to develop specific IR model, as well as allow us to cover almost all of store assortment and inventory (this is crucial to improve in-store processes). Also, OSA-Neuromation IR model is implemented into individual devices, so users can access and execute these

Solution type and Example	Why Does This Solution Stand Out?	How is OSA Solution Different?
		services WITHOUT dependence on internet connection. This is very important feature to scale IR services globally. By seamlessly integrating IR with our own product master data catalog we improved the ways in which recognized data can be used. For example, end customers can set their dietary limitations and get real time purchase recommendations based on the shelf photo. Services like Trax can be integrated into OSA DC as the technology provider for image recognition.
Forecasting systems like JDA (www.jda.com)	Typically, enterprise forecasting systems are focused on distribution centers to warehouses to retail store chain. The purpose of the forecast is to avoid overstocking and ensure appropriate restocking, the forecasting period can vary from one day to several weeks.	OSA is not limited to providing stock replenishment forecasts. Our in-store alerts help customers to better understand their current situation, whether in real-time or within the fastest data collection interval a client's IT infrastructure can provide. OSA's in-store analysis helps to proactively solve any issues and detect their root causes (e.g., price tag missing, product packaging damaged, expiration date issue). We also provide product execution control instruments to make sure that alerts not only arrive to clients, but that the problems receive due and timely attention from the store's employees.
Market research agencies like Nielsen (www.nielsen.com)	Currently, product/shelf availability data via market research agencies arrives within 24 hours of a surfaced issue. In addition to this data, market research agencies can provide explanations for how the problem occured based on prior research. Their recommendations are usually standardized.	Our service can provide product/shelf availability data within maximum an hour of a problem occurring, and we administer proactive alerts for these issues at the latter stages of service development. This feature allows us to be more involved in the business execution process to better serve both customers and store owners. The speed of our problem tracking also enables more nuanced and insightful forecasting. Our data science algorithms

Solution type and Example	Why Does This Solution Stand Out?	How is OSA Solution Different?
		process client information that is relevant to an incident, and they provide action recommendations based on the real-time data landscape and a client's business record. Further, image recognition and other instruments allow us to cover all products range sold in large retail stores, including slow-moving products.
Business intelligence kits like Tableau (www.tableau.com)	Tableau helps organizations unleash the power of their most valuable assets: data and people. The system can be integrated with multiple data sources, either with internal hardware or the cloud. Customers can choose from thousands of templates with beautiful visualizations.	OSA DC enables integration with various enterprise level BI solutions via its External ETL API. If customers are not ready to pay more for an additional BI solution, we offer our built-in BI tool sufficient enough for most daily tasks in modern retail. OSA does not only offer a data visualization solution but also a multi-layer AI system. With this, we aim to assist the client in improving product availability and placement while minimizing downtime.

Figure 5. **Startups in Retail Technology that Inspire Us**

Project	Why Does This Solution Stand Out?	How is OSA Solution Different?
Blue Yonder (www.blue-yonder.com)	Blue Yonder develops an engine that calculates probability forecasts for end-to-end business processes with data from numerous item, store, or channel combinations. This solution comes complete with stock replenishment and stock inventory optimization algorithms based on a retailer's inventory management policies. Blue Yonder also advocates for a shift from a weekly planning cycle to a daily planning cycle for retail businesses.	OSA is not limited to one vendor — retailer pair. Our technology integrates the retailer with all vendors it operates and vice versa. We integrate our solutions within our client's enterprise structure. Thus, when we discover a shelf availability issue, we address the issue with the proper employees within the business.

Project	Why Does This Solution Stand Out?	How is OSA Solution Different?
RI Team (www.ri-team.com)	The RI Team provides a cloud platform to predict and mitigate stock-outs for retailers and brands. The RI Retailer product suite makes sure that customers have access to the products they want, maximising sales potential and minimising retail cost. The project's website claims that “making immediate interventions to recoup sales, [the] RI Item Availability and Saleability product consistently delivers more than 0.5% increase in sales”.	In addition to out-of-stock alerts, we also monitor numerous other, more nuanced parameters, such as shelf placement, damaged packaging, and product shelving mix-ups. We also monitor the supply chain in its entirety, so if a problem occurs at the delivery stage from the factory or distribution center to the store, OSA will notify the clients of the issue. Moreover, in addition to issuing an alert, we also provide exact steps needed to correct issue and executional control.
AIPoly (www.aipoly.com)	This product is developed by the AirPolyVision team and is based on its previous product: an object and color recogniser helping the blind, visually impaired, and color blind to understand their surroundings. AIPoly enables retail owners and suppliers to analyze the movement of both products and customers in the real-time, while also providing instant notifications for stock-outs and sales. Founders claim that AirPolyVision's AI “can track items on shelves at intervals of a few milliseconds, making suggestions for ideal layouts, allowing fast A/B testing, producing heat maps, and a lot more.”	OSA does not stop with consumer behavior prediction algorithms within the store; we also unite various data sources to provide a complete picture of product availability, from factory unit to store shelf. More than offering more holistic prediction and analysis, OSA also provides alert execution controls, so that analysis transforms itself into action and clients can solve problems as they arise.
Nextorbit (www.nextorbit.com)	Nextorbit is a cloud platform that predicts and addresses out-of-stocks for retailers and brands. Nextorbit's website does not provide any updatred information on its current product status and business traction. Based on previous claims published on Nexorbit's website, this appears to be another single vendor - retailer pair solution.	OSA has a proven track record in five retail chains in Eastern Europe, and we've gone to work with major international FMCG brands. Also, OSA provides better prediction and analysis, augmented by execution control instruments.

Project	Why Does This Solution Stand Out?	How is OSA Solution Different?
Ambrosus (www.ambrosus.com)	Ambrosus provides sensors for tracking supply chain products in various industries and develops blockchain solution to streamline the supply chain. Combining high-tech sensors, blockchain technology, and smart contracts, the Ambrosus team is building a universally verifiable, community-driven ecosystem to assure the quality and safety of consumer goods. A combination of robust sensors, biosensors, and food tracers assess and monitor the product's physical attributes and its surroundings down to the individual unit. All of this is accomplished in real-time with unique product IDs, smart tagging, and anti-tampering mechanisms.	Supply chain traceability and product handling are important factors that contribute to product on-shelf availability. So far, most of the sensor-based projects in retail struggled because of the high inventory costs of this technology and ability to hack the sensors. We work closely with Ambrosus to integrate sensors into our platform and to develop blockchain solution for the supply chain.
INS	The big idea of this project is to remove retailers out of the end-customer supply chain by providing vendors with direct marketing, communication, and delivery tools for reaching consumers. Currently, the project is centered around grocery vendors.	The vendor to consumer business model is an interesting and novel concept. However, the multi-billion dollar retail industry still exists and it is ready to pay for real life solutions to its problems. OSA already solves a number of the problems Instamart is attempting to neutralize, including product availability and supply chain monitoring.
Lokad (www.lokad.com)	Lokad looks to optimize all fine-grained supply chain decisions: when to buy, how much to buy, what to stock, and when to recount and provide an end-to-end report on your entire supply chain. Lokad typically crunches numbers with three different datasets: (1) list of products (2) sales history and (3) purchase order history. Lokad offers data connectors for	Most of the reasons for unavailability of stock on the shelf are located within the last element of the supply chain. These problems are related to the correct placement of the goods on the store's shelf. Traditional supply chain management tools do not offer solutions to analyze and manage this stage.

Project	Why Does This Solution Stand Out?	How is OSA Solution Different?
	many popular apps, and if your app is supported by Lokad, you can import all the relevant data into your Lokad account in just a few clicks.	OSA combines supply chain analysis with data engineering and data science, optical recognition, and AI to provide multistage analysis of stock availability.

Comparison with Direct Competitors That Use Blockchain Technology

Not all startups in retail are the same. If you have questions such as: "Are these startups not similar?" or "with whom are you competing?", we offer you 5 criteria to help you find the answers.

Positioning

It makes sense to compare only the startups that have (partially or completely) the same problem. In our case the problem is unavailability of the product on the shelf. The retail industry loses $400 billion in sales annually from product shortages and understocked Inventory.

All startups related to solving the inaccessibility problem can be positioned in three steps:

Step 1: Startup offers a separate feature or a complex solution.

Example of features can include controlling the ingredients in the product. Alone, this service does not solve the problem entirely. However, it can be used not only for solving the problem of unavailability of goods, but also for other projects.

Step 2: Projects that offer a complete solution are divided into two groups: those who propose to build a new retail infrastructure (e.g., robotic personal complexes) and those who offer to optimize processes in existing retail infrastructure.

It is necessary to note that the existing retail infrastructure has only about 800,000 stores in organized networks, and examples of new infrastructure are so far rare.

Step 3: Projects that offer a comprehensive solution for the existing retail infrastructure can be divided into two groups: those who offer integrated software as a substitute for the existing one, and those who offer an addition to existing software.

At this step, you need to remember that there are not many ready-to-automate networks that have not yet implemented the core software. This means that projects offering automation from scratch would probably have to stop using the old software. Such processes require significant time and organizational resources within each transaction.

Functionality

We compare only the functions needed to solve the problem of inaccessibility. It is possible that some projects have additional functions not used in the process of solving the problem of unavailability of stock. These functions are simply not included in the comparison table.

Blockchain

Blockchain's technological capabilities are quite diverse these days. That is why it is not sufficient to say that the solution will be to use Blockchain. If you want to compare the solutions yourself, you need to clarify why and how Blockchain is used in the project.

Integration

Is the product a platform that can implement a single data space for all integrated solutions, or is the product conditionally autonomous.

History

Are there public cases of implementation in real retail, or are there no such cases.

Comparison criteria / Products			Provenance.org	Radiostud.io	Ambrosus	IBM Blockchain for food safety	Origintrail.io	Mojix	INS	Retail robotics & Blockchain	Splice Machine	Lokad	Aipoly.com	OSA DC
Positioning	Step 1:	Offering a separate feature	✓	✓	✓	✓	✓	✓	–	–	✓	–	–	–
		Offering a comprehensive solution to the problem	–	–	–	–	–	–	✓	✓	–	✓	✓	✓
	Step 2:	Offering a solution for new retail infrastructure	✓	✓	✓	✓	✓	✓	✓	✓	–	–	–	–
		Offering a solution for existing retail infrastructure	✓	✓	✓	✓	✓	✓	–	–	✓	✓	✓	✓
	Step 3:	Offering complete automation from scratch	–	–	–	–	–	–	–	–	–	✓	–	–
		Offering an addition to the existing IT infrastructure	–	–	–	–	–	–	–	–	✓	–	✓	✓
Function		Master data	–	–	–	–	–	–	–	–	–	–	–	✓
		Planning/supply chain management	–	–	–	–	–	–	✓	✓	–	–	–	✓
		Controlling ingredients	✓	✓	✓	✓	✓	–	–	–	–	–	–	✓
		Controlling conditions of transportation and storage	✓	✓	✓	✓	✓	–	–	–	–	–	–	✓
		Monitoring the performance of supply chain	–	–	✓	–	–	–	–	–	–	✓	✓	✓
		Data-driven search problems in the supply chain (on shelf)	–	–	–	–	–	–	–	–	–	–	–	✓
		IoT-driven search of problems in the supply chain (on shelf)	–	–	✓	–	–	✓	–	–	–	✓	✓	✓
		Informing the Executive of the issue	–	–	–	–	–	–	–	–	–	–	–	✓
		Controlling the Executive's method of response to the problem	–	–	–	–	–	–	–	–	–	–	–	✓
		Supply chain optimization	–	–	–	–	–	✓	–	–	✓	–	✓	✓
		Marketplace of external developers' services	–	–	–	–	–	–	–	–	–	–	–	✓
Blockchain		Raw data hashing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Hashing of sensory data	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		KPI hashing	–	–	–	–	–	–	–	–	–	–	–	✓
		Smart Contract	–	–	✓	✓	✓	–	–	–	–	–	–	✓
Integration		Can be integrated into the OSA DC platform	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Can be integrated into the Aipoly.com platform	–	–	–	–	–	–	–	–	–	–	–	–
History		History of implementations (public cases)	–	–	–	✓	–	–	–	–	–	✓	–	✓

Our Current Traction and Achievements

Within only two months of launching the OSA Hybrid Platform, we signed $2.5 million worth of service agreements. The OSA Hybrid Platform is currently integrated with almost 2,500 shops and is on track to expand to 28,000 retail stores in Russia alone by the end of 2019, and we have also started collaborating with 7 of the 15 largest retailers in Russia.

Eleven consumer goods manufacturers already use the OSA Hybrid Platform, and their combined market share of the retail industry is roughly 30%. These clients aside, there are 26 more in the contract finalization stage. Leading consumer goods manufacturers and retailers such as Coca-Cola, PesiCo, Mars, DANONE, SunInBev, L'Oreal, JTI, METRO, Efes, Magnit and many others have started using OSA HP. We are finalizing negotiations with Nestle, PepsiCo, Unilever, Diageo, Mondelez, P&G, and others.

As well as manufacturers, retailers, and retail think tanks, OSA also cooperates with the following groups: distributors, logistics providers, data providers, weather forecasters, research agencies, computing power providers, data centers and/or mining farms (e.g. Giga Watt), data scientists, and IoT and AI developers.

Product Roadmap

Figure 6. **Product Development Roadmap (IT, R&D)**

2015

- April • Team formation
- June • Product concept developed
- July • Product concept test (MVP)
- October • Beta version introduced
- November • Data integration and test started

2016

- February • New machine learning protocol tested
- March • Product updated, OSA technical architecture introduced
- June • Internal proof of concept (POC) approved
- July • Machine learning models updated
- August • External POC tested
- November • POC finished: 5.4% sales growth for our partner companies
- December • Image recognition POC introduced

2017

- March • Image recognition POC tested
- April • Machine learning models upgraded
- July • New UI/UX solution introduced
- September • New big data architecture development begins
- October • Integration with transaction data operators
- November • Master data catalogue tested
- December • Image recognition model developed for 300 products (in partnership with Neuromation)

2018

- January • New big data architecture introduced
- Master data catalogue tests
- February • Machine learning model enhancement
- May • Blockchain & smart contracts development (stage 1)
- Blockchain testing
- June • Image Recognition model development for the next 1000 products
- Master data catalogue development
- August • OSA DC choose EOS blockchain for further development after its successful launch
- Image recognition engine training on Asian products models (showcase assortment)
- Image recognition engine: train 400 products models (mini-market assortment)
- September • OSA B2B solution enhancement
- October • Start of B2C solution development
- Digital assistant ver.01
- November • Finalize Advanced Blockchain technologies tests
- December • Decentralized platform development (Stage 1)
- B2B Blockchain solution enhancement (Stage 2)
- Enhancement ML solutions development for supply chain (Stage 2 start)
- Image recognition model development and functionality enhancement (Stage 3 start)
- Machine learning model enhancement
- Product rating system development (Start)
- AR functionality development (Stage 1 start)
- Blockchain development (Stage 3: decentralization)

2019

- March • B2B solution enhancement
- April • B2C solution (POC start)
- Decentralized platform prototype test
- B2B functionality enlargement
- June • B2B solution upgrade following USA and Asian POC
- Image recognition engine upgrade and deployment in focus markets
- July • Product catalogue pipeline deployment
- August • Decentralized platform POC tests
- October • Decentralized platform deployment
- B2C solution deployment (ver.02)
- AI Recommendation engine deployment
- December • B2B solution enhancement and functionality enlargement (ML, AR, IR, IoT)

TECHNICAL ASPECTS - B2B

New Client Onboarding

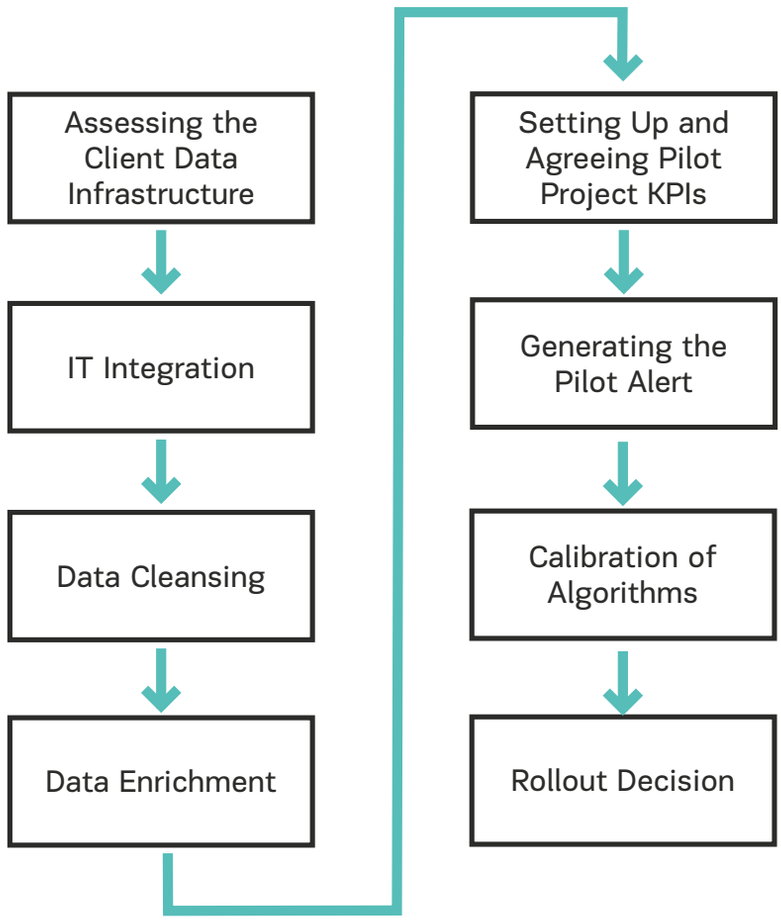
Since 2017, the OSA Hybrid Platform has on boarded 12 clients and 26,000 retail stores into our system. By any measurement, these are impressive statistics even for an established retail technology business. To enable this growth, we invested our efforts and technology into creating a streamlined client on boarding process.

When working with a new client, we start by brokering a business agreement between the decision makers on the client's side and the OSA business development team. This business agreement is usually formalized as a conventional paper contract or via EDI through either party's legal teams.

Our communications team then joins the process to promote the new deal to the general public, if the client permits this publicity, that is.

We organized the next steps of the on boarding process into the flowchart below, and we explain each major milestone in this process in the following subsections.

Figure 7. **The New Client Onboarding Process**



Assessing the Client's Data Infrastructure

After brokering the business agreement, our technology on boarding team joins the process to conduct an assessment of the client's data infrastructure and sources.

We agree on the data list for the upcoming integration and the methods and terms of the data transfer. However, the integration setup requirements cannot be less than our recommended minimum. This is to ensure that the client gets the most out of the platform, as the larger the data set they provide, the more features the platform will be able to offer. A typical data set for new client on boarding includes:

1. Catalog of selling positions
2. Catalog of categories
3. Catalog of stores
4. Historical sales data for the last two years
5. Periodically updated current sales data (refreshed every 10 minutes to on hourly basis)

The client should also provide data on their products' supply chain, however much they can produce. As with before, if the client can offer more detailed data for each element of the supply chain process, then the platform can provide more detailed analysis to pinpoint inefficiencies, inventory issues, etc.

We prefer to receive all data through our Protected Partner Data API. However, sometimes we make temporary exceptions for the sake of speeding up the implementation process. In this case, our client's employees usually upload the data manually into our Big Data layer.

Setting Up and Agreeing to the Pilot Project KPIs

After the client's technical team and we agree on data sources, routes and access credentials, it is time for the pilot test. The ultimate purpose of the pilot is demonstration of our system and its key features to the decision makers on the client's side and enabling organizational knowledge formation by the client's execution team. Before they fully launch our platform, we want to make sure that they familiarize themselves with the platform's management and business execution tools.

The client can get a system for monitoring on-shelf availability or he may also want to evaluate the pilot's ROI. In this case we add to the KPIs the instruments for assessing business effectiveness. Our usual method for assessing ROI is comparing the pilot and the reference group of retail stores.

Generating the Pilot Alert

After our technological team and the client's own agree on data sources, routes, and access credentials, the pilot can finally come underway.

At this stage, we establish the data exchange infrastructure with the client's team, as well as build the AI's necessary analytic framework. Our machine learning algorithms will begin by processing their first learning cycle, and they'll also start to generate pilot alerts to establish the environment and parameters that trigger these alerts.

Algorithm Calibration

After we established all the necessary infrastructure and the first pilot alerts have been generated, we start calibrating our algorithms. For calibration to be successful, an in-field

research team will constantly verify the quality of the alerts generated by our system. This team could consists of our personnel alongside our client's employees and, at times, even independent contractors. Only members who have undergone calibration training may be a part of this in-field research team.

Each member of the research team is tasked to receive an alert in real time in one of the pilot stores, evaluate its relevance and accuracy, give feedback to the system if there is a mistake and, if there is one, discover the factors which might have caused the mistake.

When necessary, the calibration process can include several cycles. With each new cycle, we improve the next iteration of the alerts system using feedback from the pilot's in-field team. The calibration process ends when alert accuracy meets or exceeds the KPIs agreed to by the pilot team.

OSA provides our clients with instant learning opportunities through our artificial intelligence framework and the enormous analytic capacity of the platform's neural networks. Our pilot program along with the calibration stage, typically lasts for one to three months.

Rollout Decision

After the pilot is complete, we assess its output using the KPIs and criteria agreed upon with the client before implementation. If the assessment is positive, we integrate the service into the client's entire retail chain. Depending on budget, time constraints, and other factors, the integration might be absolute or split into various stages. During the integration, OSA's team:

- adds additional data sources and IT resources to the existing data and IT infrastructure
- forms machine learning models for the rest of the chain’s stores
- performs additional calibration on demand
- trains permanent administrative personnel and in-field teams
- generates an Execution Specialists' Map, which is then used by the Task Management Kit and BPM Kit to push aler

The calibration is a continuous process and lasts throughout OSA's entire deployment. Yet, after the initial rollout, the calibration is predominantly managed by AI. Normally, the rollout stage takes 2 to 3 months depending on the numerous factors described above.

In-Store Alerts and Forecasts

OSA's alerts and forecasts are basic units of added business value in the OSA ecosystem. An alert covers a situation that already occurred in near real time, such as juice boxes being shelved in the soup aisle instead of the juice aisle. While in-store sales management systems indicate that the juice box is on the shelf, the customer does not see it on the usual shelf. The vendor loses sales, the store loses customer loyalty - no one is happy about the juice situation.

Alerts generation can be enhanced by optical recognition streams and sensors, the retailer's own in-store data infrastructure, or a customer's Smartphone. All of these can work together to spot in-store irregularities and provide immediate and relevant notifications to the store's employees.

While an alert helps customers to make purchasing decisions based on the past and present, a forecast helps them to plan for purchases in the future. Our Data Science Module constantly monitors the client data that passes through our ecosystem. When its algorithms identify a possible irregularity, the Post Processing Service on our backend starts calculating the chances for this irregularity to arise again in the future. This process is like a chess game, but instead of moving the pieces, we advise retailers on the best move to win the game of efficiency.

Alert Lifecycle

We can generate alerts for any element of the supply chain at any given moment in time. An alert is generated by an algorithm within our Data Science Service and sent to the KPI Service, which, in turn pushes it as a notification to the end user via our platform's backend.

Our backend supports all customer accounts on end user devices. The alerts regularity and frequency depend on the user's settings preferences, which we store in the system's notification service. The regularity of alerts also depends on the speed pf data arrival from retail store's databases. The Task Management Kit within our backend organizes alerts like tasks lists, which we then transfer into the BPM Kit as business processes.

Currently, we only deliver alerts to the web interface. However, after OSA's token sale, we plan to launch a mobile application for iOS and Android. This business-focused app should not be confused with the mass market OSA mobile application, which enables consumers to choose products based on reliable information about product features and attributes, including dietary information as well as relating to safety and authenticity of various products. The mass market mobile application will be covered in a separate section of this document.

We do not create a universal algorithm for generating alerts. Instead, we create a set of algorithms to individually analyze each element of the supply chain and generate alerts if issues arise at any step of the process. Each algorithm corresponds with its own scenario and is used to solve specific problems. These algorithms will:

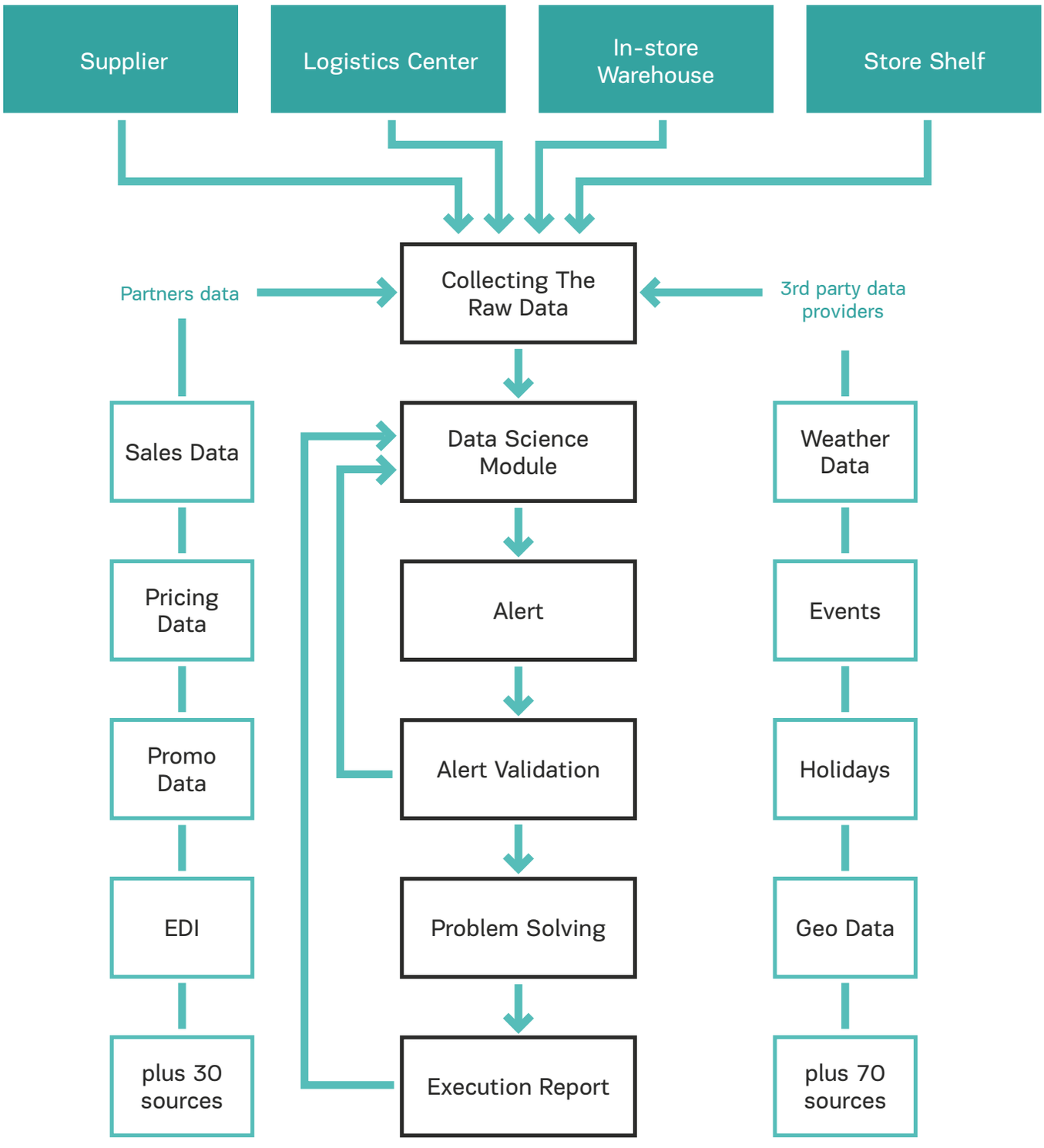
1. Analyze data for each element of the supply chain
2. Use our machine learning framework (MLF) to discover data anomalies
3. Formulate hypotheses on the problem’s possible causes
4. Pinpoint the most plausible hypothesis
5. Generate an alert based on the most plausible hypothesis
6. Verify the alert within the store itself
7. Perform MLF followup based on feedback from the real store to:

a. Correct the machine learning algorithm in case the hypothesis failed

b. Record a successful hypothesis, when applicable, and examine the possible explanations for this success

8. Perform business execution control functions for an alert with the BPM Module

Figure 8. **In-Store Alert Lifecycle**



Alerts Categorization

Figure 9. **Example of In-Store Alerts**

Alerts for In-Store Personnel	Alerts for Logistics Department
• There are no goods on the shelf • The shelf stock for this product is critically low • This product is out of stock in this store • The warehouse stock for this product is negative/critically low/below the purchase level • This product inventory in store is erroneous • An insufficient product shipment arrived to store • The supply for this product arrived late or prematurely • The in-store stock order for this product is insufficient	• The product is absent from the distribution center warehouse • The product stock is negative/critically low/ below the vendor order level in the distribution center • The distribution center has an erroneous record of the product's inventory • An insufficient amount of the product arrived at the distribution center. • The supply for this product arrived to the distribution center late or prematurely • The distribution center's stock order for this product is insufficient

Business Execution Controls for Alerts

Each alert is targeted and addressed to the relevant employee according to the Execution Specialist Map. For each alert type, we create a status tree, which records the the relevant supply chain paty's or store's response to this alert. The status tree may include the following options:

- Default (predefined) preferences
- Text inputs
- Numbers inputs
- Photo capture/upload

Status Trees

A status tree may have a hierarchical structure that includes up to five levels. A few example of a status tree's functionality and process at work:

- The product is on the shelf → take a photo. The employee responsible for acting on this alert will then have to select one the following responses:
  - all product placement requirements are met (OSA generated an alert by mistake)
  - there is no price tag

- the product perished
- the “best by” date expired
- the shelf is dirty
- other (in this case, the employee will have to explain this reason in a separate text field)

- There is no product on the shelf → take a photo. The employee will then have to select the following responses:
  - The product is not available in the warehouse
  - The product is displayed incompletely (the employee can take a photo and input the quantity of displayed goods or select lacking components).

A BPM Kit on the backend manages the response workflow. The BPM Logic Module stores the created status trees and executes the actions chosen by the employee. The BI Kit then allows these employees to monitor the business process performance by generating execution reports.

Execution Control Steps

OSA’s alert system is designed as a complete end-to-end solution for the entire problem-response process. This way, we exclude the risk of human error and make sure that the task is completed without any issues.

An alert first arrives into the task list of the employee responsible for executing an action in response to the alert. This employee can only react within the OSA prescribed limits of business process, which we fully register and record in the User Data Storage on our backend. At every execution step as the alert is being processed, the system assigns a particular status to the alert execution.

For example, a status tree may begin with the task of taking a photo of an empty product shelf to register generated alert in OSA's artificial intelligence engine. Or, if the store uses our image recognition technology, the technology may be the first to spot the out-of-stock product and issue the alert. If this happens, our service will automatically assign an “unavailable on the shelf” status to the product. Then, the platform will examine the warehouse stock's database for this item and automatically assign an “unavailable in the warehouse” status after making sure that there is zero stock of this product in its inventory.

The logic that the client feeds into the Task Kit will manage the alerts list for the end customer. We include a variety of options for the alerts in this list, and clients can select the alert list display style that will best match their organization's workflow.

For example, one of our clients might need an employee to build an itinerary for an in-store inspection after getting a series of alerts. In this case, our system will organize the alerts list to build the most optimal itinerary, one that agrees with decisions made by the on boarding team. Another client might need an employee to prioritize alert reactions based on the largest loss in volume or value. OSA would sort and display alerts in order of the largest profit loss per product.

At any given moment, our clients will be able to generate a performance report for the employees responsible for executing tasks. The report will be based on the actual nature of the alerts and their statuses. Clients can filter and sort through the alerts in the report based on reaction criteria, time of reaction, and other attributes of alert execution functions and people involved. The client should first create a workflow for this report in the BI Kit, and its profile would be stored by the BI Logic system. When the workflow is ready, employees who serve a

task execution role will be able to generate the report for their organization.

Forecasts Categorization and Delivery

We use forecasting for two of our platform's key strategies. The **reactive strategy** covers alerts for problems that have already occured, while the **proactive strategy** creates alerts for events which are likely to occur in the future. Let's examine the reactive strategy first. All the alerts that OSA generates can be categorized into two key groups:

- **Alerts based on direct data**. For example, data sent to the client's accounting or logistics systems that measures the amount of product units available in a warehouse's stock. To generate an alert for this, we would compare the warehouse stock with our system's data on the sales rates for this product.
- **Alerts based on indirect data**. We might, for instance, figure out that a product is currently missing from the shelf in a retail store unequipped with optical recognition software for automated shelf monitoring (more than 90% of the cases). In this situation, we will use indirect data relevant to the specific store, such as hourly product sales combined with various other attributes and data sources. In the case of sales data, we forecast potential sales based on data from previous timeframes. If the actual sales data for an item drops significantly, it is very likely that the product is not available in-store.

The forecasting period is vital here. The less time it takes us to resolve the problem, the more business value the resulting alert will deliver to our clients. Before we created OSA, the minimum forecasting timespan in retail was 24 hours. We've managed to decrease this time to within one hour with frequent sales data collection from participating stores. We also use around 30 other sources of big data selected as important from around 100 at the calibration stage to speed up this forecasting time even more.

Now to the proactive forecasting strategy. After we accumulate an alerts history on various business processes for a client, we can use our machine learning framework to forecast potential alerts for future events. As a proactive strategy, the alert will recommend preventive measures.

How Do We Create Forecasts?

How do we forecast and ensure high forecasting precision?

1. We use component-based forecasting, consisting of combinations of information or ensemble methods.

2. We use substantial amount of relevant historical data to train our models. During training, our models discover non-obvious trends in product sales, including seasonal factors, weather, marketing activities, tie-in sales, etc.

3. The working model for forecasts continuously adjusts itself depending on the current sales data, and we've shortened the sliding window for this adjustment down to one hour.

4. The alerts our model generates are selectively or completely validated by in-store teams, depending on the team size and the number of participating stores. If a model discovers a mistake, it requests feedback from the in-store teams and automatically incorporates it during the next adjustment cycle.

We use complex models, each of which have a configuration that is optimized for performing specific tasks and analyzing specific data sets. To make our approach differ from conventional forecasting protocols, we started experimenting with imitational modeling, creating simulated models of real life stores, which are based on historical data from other supply chain retailers.

OSA also represents product sets in a personalized purchase history with semantic vectors in forecasting.

For this process to be effective, it is highly important to cleanse the time series data of various

Figure 10. **Forecast Types**

Traditional time-series-based forecasting techniques	Alternative forecasting techniques

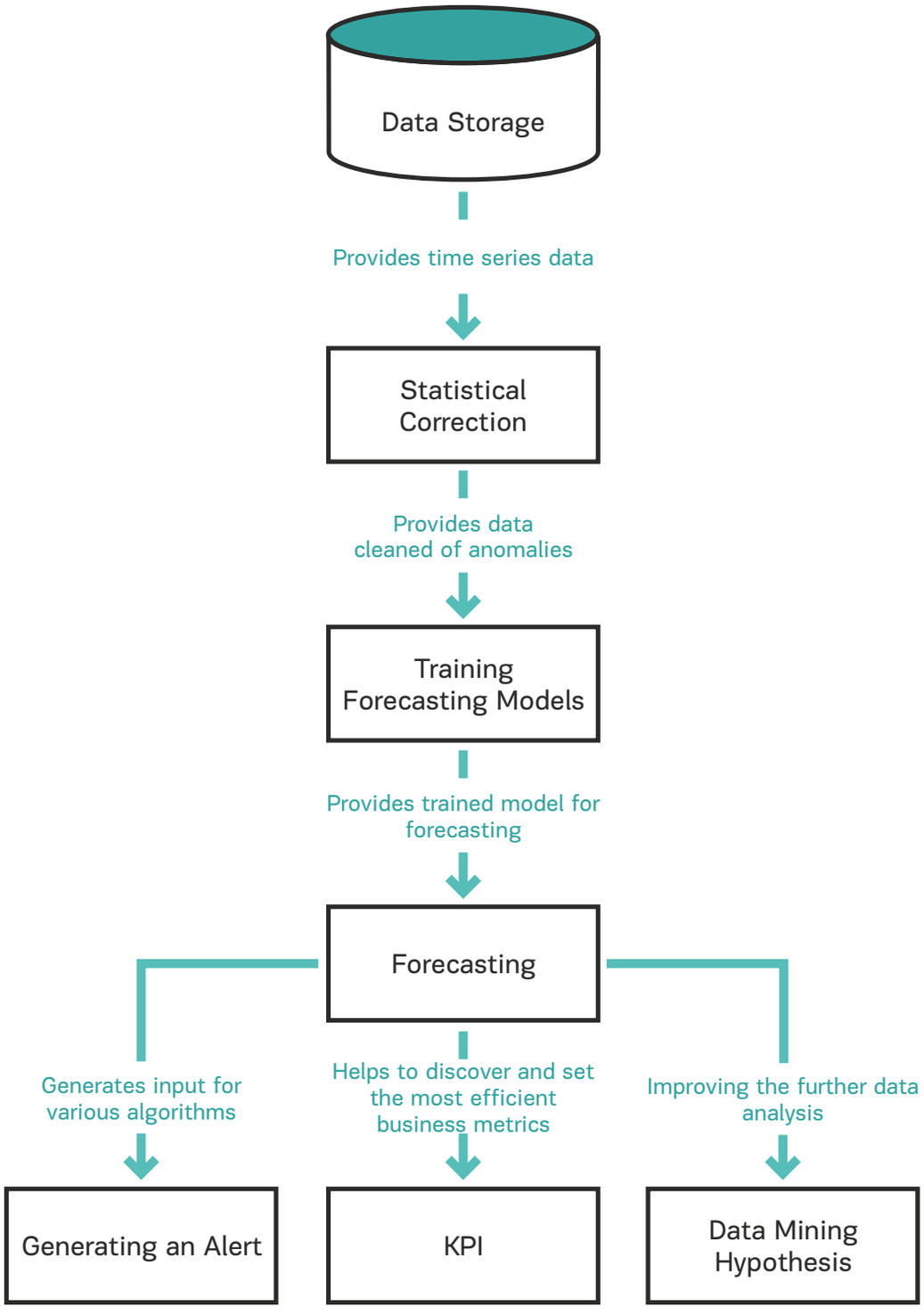
• Adaptive selection from a pool of:
  • Moving average, moving median
  • Exponential smoothing, Holt-Winters models
  • ARIMA(X)
• Artificial neural networks (ANN)
• Gradient-Boosted Trees
	• Simulation modeling
	• Semantic vectors for purchase history

anomalies, and so, we perform statistical data correction at the first stage of a forecast's lifecycle.

After cleansing the time series, we launch a number of data forecasting models that are trained to perform various product-related tasks. Using these models, we build a forecast for each product on an hourly basis.

Finally, we use the resulting forecasts to form various alert types as well as to calculate the necessary KPIs. As a key feature of this process, we also use forecasts to research data trends for the time series in question.

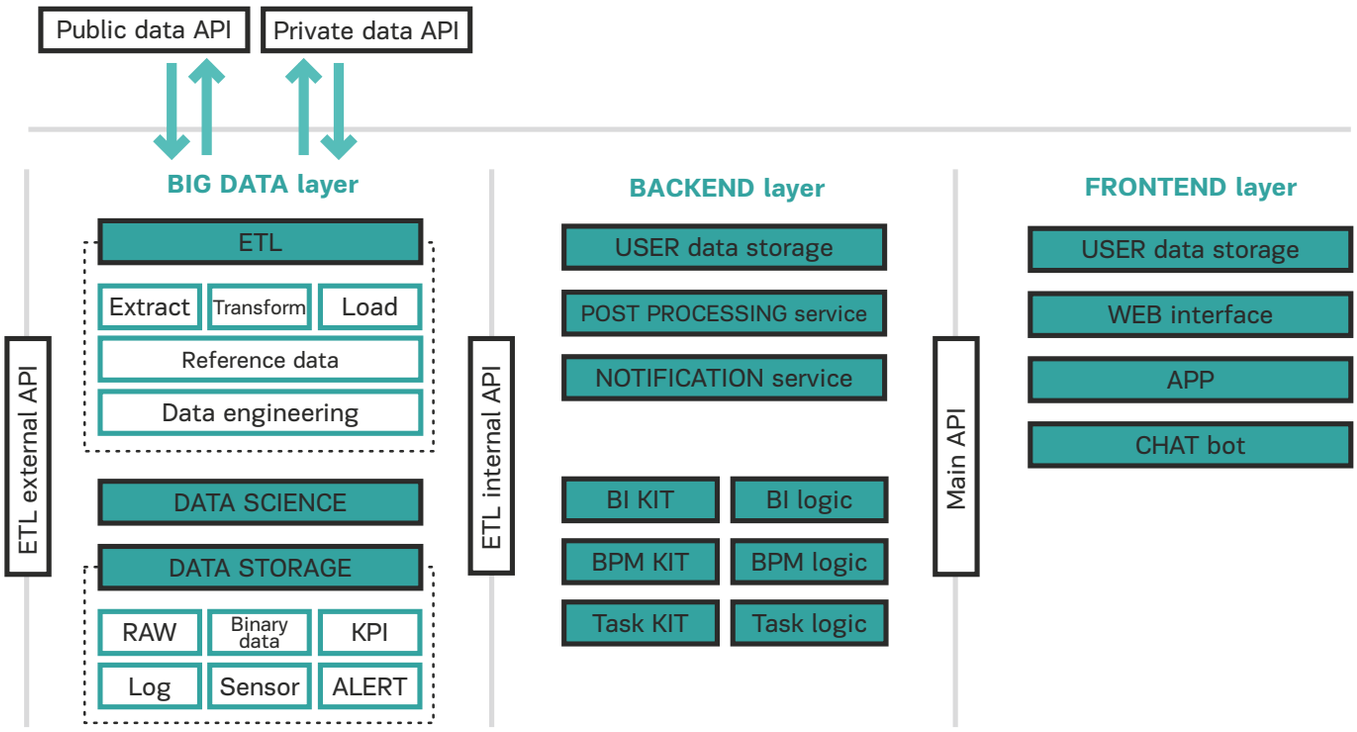
Figure 11. **Forecast Creation Lifecycle**



OSA Core Technology Explained

This section explains the major technological elements of our platform, which we outlined briefly in the introduction. We start with the big picture by laying out the three major technological layers of OSA Core. Then, we expand our explanation into OSA's three major technological competencies: optical recognition, neural networks, and data science.

Figure 12. **Deep Dive into OSA Core**



The Main Layers

OSA Core can be visualized as a set of functional layers in our service's main architecture.

The **Big Data Layer** consists of a collection of data sets, processing services, and two APIs. The first of these APIs, the ETL External Data API, connects all of these services to the outside world, while the second, the ETL Internal Data API, is responsible for transporting data between various data services and the platform's backend.

The **Backend Layer** supports our business logic and executes various business processes. After the Big Data Layer generates alerts and forecasts, the Backend Layer delivers these to a client's employees and generates custom reports for these employees depending on their business role.

Clients use the Backend Layer to render real-time analytical data for any problem or occurrence they want, depending on individual employee or team responsibility area for a specific process that was agreed by the onboarding teams.

The analytical function that pools data is updated on regular basis, giving employees sufficient time to react to any changes. In our experience with 10 successful onboardings in Eastern Europe, very few retail business units can provide quick enough data updates to fully qualify for the real-time nature of the system. So if there's any bottleneck here, it is usually the client's data

sources, not OSA Core.

Finally, the **Frontend Layer** performs all the typical backend tasks of delivering our added value units to the implementation team interfaces. Currently OSA platform uses only web interfaces for this task. However, there are also mobile and desktop applications and chatbots in our Product Roadmap and our technology development teams are already working on the architecture that will support them.

Now let's examine each layer in greater detail.

The Big Data Layer

When working with big data, the most difficult challenge is making order out of controlled chaos. We built our **ETL module** for this reason. ETL stands for Extract, Transform and Load, and it refers to a process that integrates data from multiple sources to create a unified reference data catalog. The data in the catalog comes from various third party and/or client data sources, and it could include numbers, locations, and other varied business parameters within the store itself. There are two types of 3rd party data, both having their own application programming interface (API).

We can also extract this partner data from public data sources, commonly referred to as "open data" [Auer & others][14]. Such data is usually distributed based on an open license akin to those used for software by an open-source community. It will be fed into the OSA ETL module via the **OSA Open Partner Data API**, a protocol we created specifically for this purpose. Luckily, the amount of relevant open data available for creating added value for our clients is constantly growing [Wood][15]. More and more governments and private entities release the data they own to the public under an "open" license. As an example, imagine this data being used for traffic information or reports on electric power outages.

In addition to open data, we also acquire data from various commercial services providers (this data includes things like weather forecasts, events scheduled in close vicinity to the store, etc). Usually, such data providers require us to take necessary steps to protect this data from unauthorised access, so we use our ETL module to process this data through the OSA Protected Partner Data API. If our client decides to use automated data acquisition via API, we use the **OSA Protected Partner Data API** to get data from data sources on the client's side.

Partner Data API

With its bidirectional functionality, the **Partner Data API** can send or receive data. Our cooperation with image recognition partners provides a great example of this bidirectionality. First, we supply an in-store photo of goods to an image recognition partner's server. Afterwards, this same partner provides us with image recognition results, and our Partner Data API serves as the avenue for both transactions.

In addition to our Partner Data API and ETL module working together, our Big Data Layer has two comprehensive system APIs that send processed data to and from our Big Data ecosystem. The **Internal ETL API** exchanges data between the big data modules and various backend modules inside the OSA data infrastructure, and the **External ETL API** exports data from big data modules to the client's third party data processing platform, such as the external BI, BPM, or ERP systems.

One client, for example, might have business intelligence solutions like Tableau, Qlik, or Oracle already installed. Obviously, such specialized full scale BI solutions have multi-million dollar budgets and can provide more space for customization than OSA's BI.

Understanding this, we happily provide our clients with real-time data transfer from our various

Big Data modules into their standalone enterprise BI solutions. Therefore, the client will have the advantage of using an enterprise standard BI that is augmented by data exported from our data engineering and data science modules.

The Reference Data Catalog

The Reference Data Catalog (RDC) stores data that the ETL module has extracted and processed. Reference data is data that we acquired from the client and various data partners and then prepared to be used by the data engineering and data science modules.

RDC contains data sets with unified product descriptions, product nomenclature, and a library of product images and visualisations. This approach solves the following issues for the retail industry:

Issue 1. Retailers and vendors use different names for the same product. This problem is complicated when a vendor starts working with various retailers. Ultimately, this makes creating sales reports for single products unnecessarily difficult. Our RDC merges various product names into a single, unified identifier. This simple solution substantially improves the quality of resources required for data analysis.

Issue 2. The effectiveness of forecasting models depends, among other things, on the variety of collected data and the set of factors that OSA takes into account during forecasting. Retail data research is usually limited to product data that is mentioned in a receipt (brand, product name, quantity, time of purchase, etc.). Such limitations usually narrow the scope of the forecast and its accuracy. To fix this, we use the OSA Reference Data Catalog to substantially improve the quality of the forecast. For instance, we can discover a growing trend in certain product sub-category because the RDC keeps track of product interrelations along with product names.

Issue 3. Significant product updates may serve to frustrate the end user. We combine RDC with optical recognition to automate product searches based on the end user's in-store preferences.

The Data Engineering Module is another major element of OSA's solutions that generates added value for our clients. It consists of a set of mathematical algorithms that our network consistently runs through a data reference pool in search of irregularities. As soon as it discovers an irregularity, it issues an alert with the Notifications Service on our backend, which is then delivered to the relevant end user on the platform's frontend.

The Data Science Module adds further value to our system. Whereas data engineering is a powerful tool based on simple math algorithms, data science is based on a probabilistic model and thus offers a more sophisticated approach to data analysis. Put in non-technical terms, data engineering is about understanding past and current events, while data science is about forecasting the future. Therefore, more than just generating alerts, the Data Science Module also generates forecasts.

The Data Storage Module has a name that speaks for itself. This module is an umbrella for various storage submodules, such as raw data, binary data, KPI and alert storage, sensor data, and log data.

The Backend

The User Data Storage is distributed between both the Backend Layer and the Frontend Layer. It stores various data generated by end user as well as metadata related to this user's role, organization, and the user's position within the organization. The Backend side of User Data Storage manages profile info, login and password info, the organization's name, employee

roles/positions, access rights, and BI and BPM profiles.

Also distributed between the Backend and the Frontend Layers, the **Main API** ensures that data flows smoothly between the two layers. Currently, the Main API works only internally within our ecosystem. However we haven't ruled out opening it to third party users in the future, as well as enabling third party voice-recognition personal assistants like Apple's Siri, Amazon's Alexa, Samsung's Bixby, or Microsoft's Cortana.

The Post Processing Service Module creates a unified data environment for our end users. It makes sure our end users get all the information they might need, taking into account their position and role within the organization. This service also stores all data profiles and is responsible for updating them regularly.

Notification Service stores customer notification preferences and preferred notification channels so that it can send relevant system notifications to tech support and alerts/service information to the end user.

Our backend's Business Intelligence, Business Process Management, and Task modules share common architecture, namely - **Kit** and **Logic**. The Kit allows end users or authorized client representatives to set up customized data models and establish rules for work and dataflows. The Logic then executes these rules and provides the end user with validated data.

Business Intelligence Module provides templates and widgets for data visualization. We use a highcharts data visualization library to provide BI functionality, a professional library that provides all the key visualization templates. We use line, column, bar, and pie widgets for graphing purposes most frequently.

The Business Process Management Module (BPM) manages reactions to various issues and tasks within the OSA platform. The reaction process is actually an algorithm, standardizing workflow to streamline tasks and problem solving. Standardization enables employee evaluation, as well as automated monitoring and reporting. We use the BPM Kit to create workflow reactions and the BPM Logic to store and apply workflow templates. The key principles of our BPM architecture are:

1. All the BPM features are limited by the event reaction model
2. Alerts, the key event types, can have various iterations, depending on the algorithm that generated them
3. Events can also be standalone tasks not directly related to optimal shelf availability
4. An event reaction manifest is a workflow, structured either as a linear sequence or as an oriented graph
5. The reaction can be a composite (i.e., it can include a consecutive set of reactions from several employees)
6. The BPM Kit allows clients to design workflows with various action choices: action/task confirmation, photo capturing, photo recognition, number inputs, comment additions, task delegation. We are also working on adding new actions
7. The platform stores a workflow's current status. Essentially, this means executing employees can postpone and resume tasks at will. It also means that our platform can issues real-time progress reports for the employees who execute these tasks.

Task Management Module manages the task list of an employee executing platform commands, and personalized KPIs define the employee's task list, its layout, and the task's prioritization rules. At its core, the module focuses on minimizing mistakes in task prioritization.

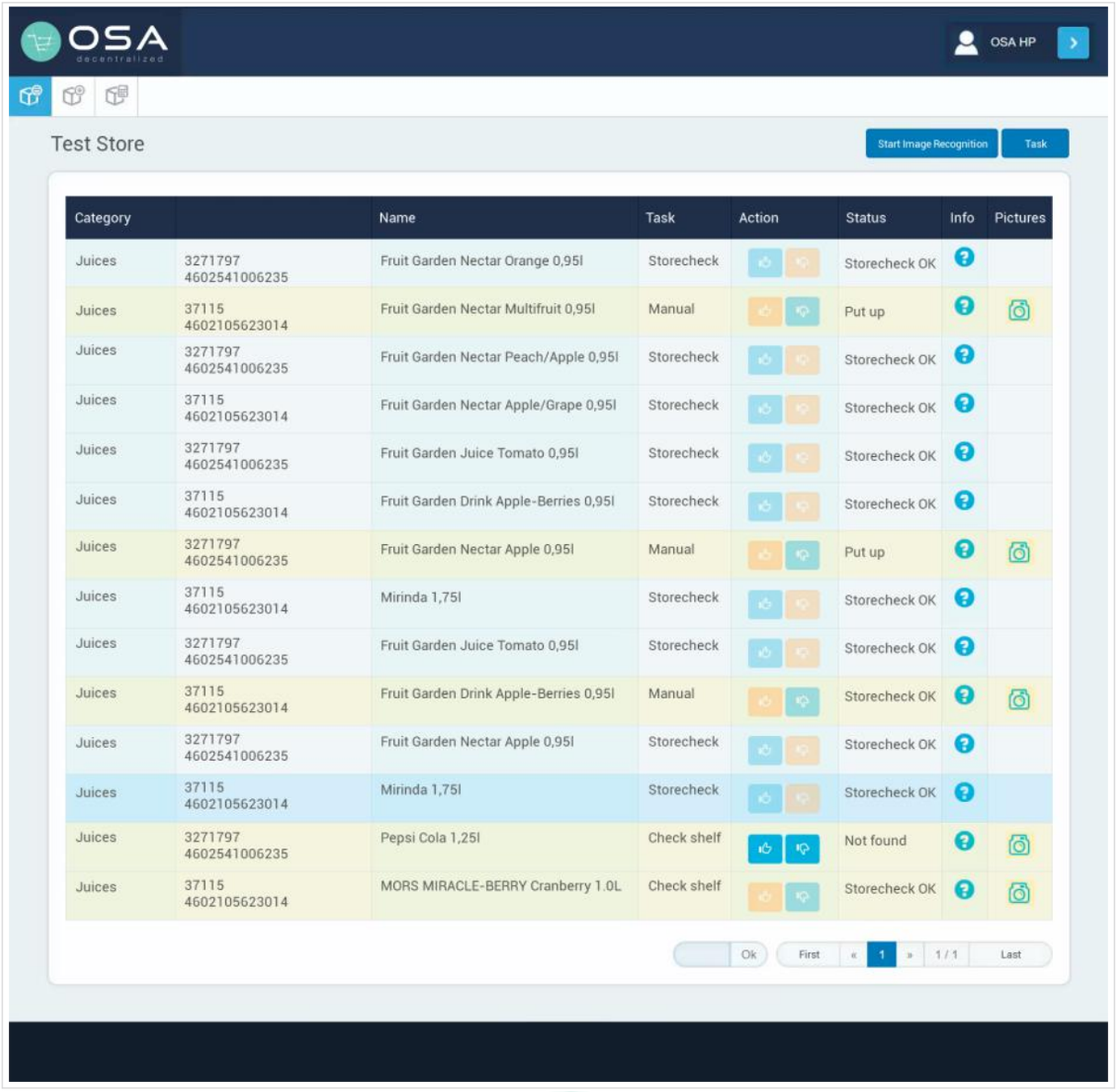
The TM Module has the following default modes:

1. Basic mode: the tasks get sorted according to their lost sales potential
2. In-line mode: the tasks are prioritized to provide maximum possible product offering on the shelf
3. Map mode: helps managers to optimize product movements within their stores' retail space. To do that our platform conducts background analysis of the retail space configuration to perform automatic optimization of the merchandiser routes within the store.

The Frontend

Our frontend provides an interface for users to interact with platform functions depending on their needs and their role within the business. We plan to expand the service delivery channel from current OSA's web interface to mobile applications for iOS, WatchOS, and Android, desktop applications for Mac OS and Windows and create chat bots for Facebook Messenger and Telegram.

Figure 13. **Screenshot of OSA Web-based End User Interface**

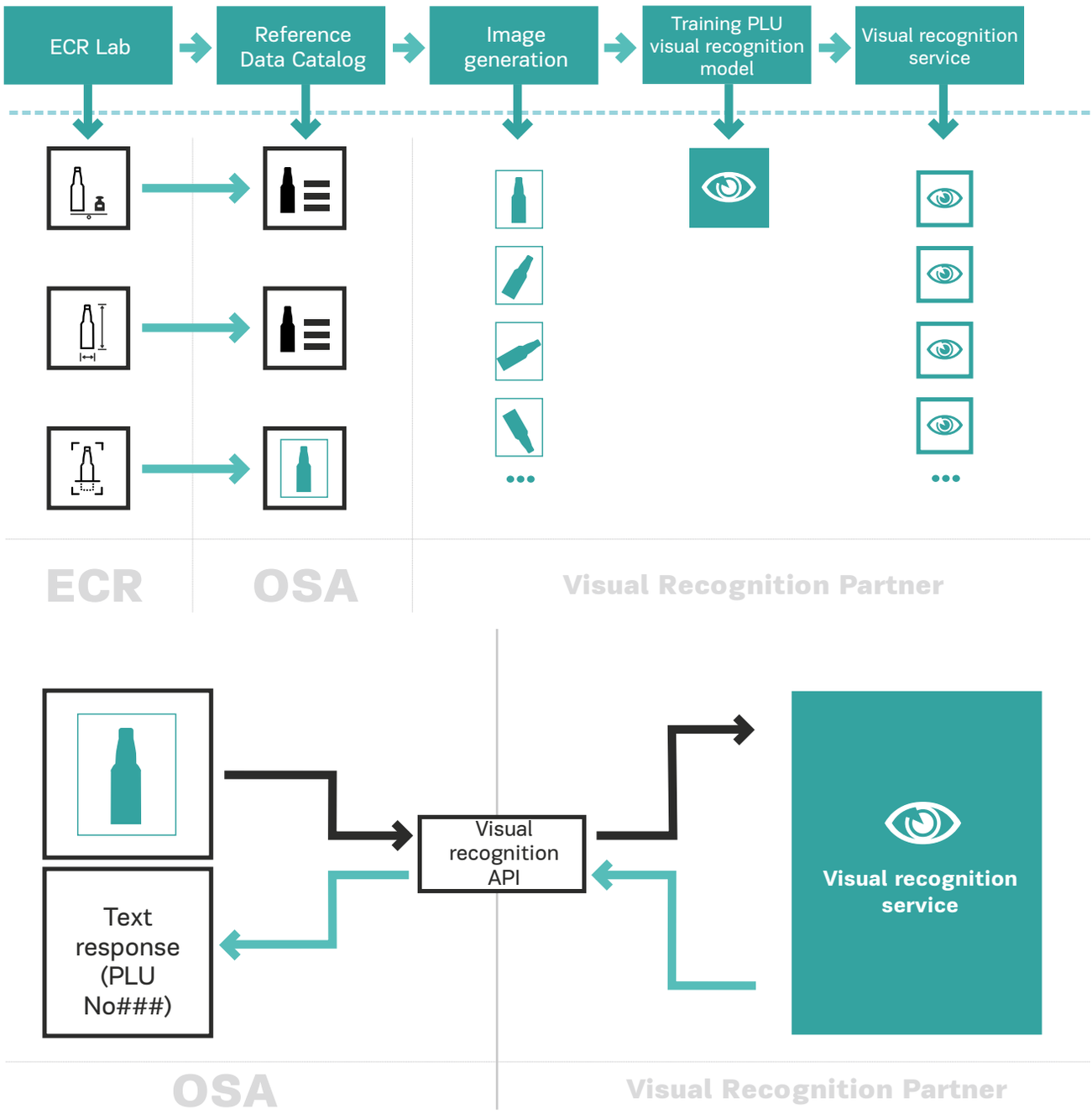


Our frontend and backend communicate via the OSA Main API. In the future, the Main API will support third party client applications, as well, which could range from white label versions of OSA's platform to any third party applications that have implemented the Main API.

The frontend also hosts parts of the **User Data Storage**, which is responsible for transferring content to and from end user devices. This data might be a photo of product shelves, an end user's personal data, cached data necessary for expediting a service on the client's side, or timestamps describing end user's actions.

Image Recognition Pipeline

Figure 14. **The Image Recognition Process Explained**



The ECR Lab extracts information on a product's visual, textual, numerical, and marketing attributes. During the optical recognition process, the Lab retrieves the master copy of the product packaging in PDF form or as some other graphic, either directly from the vendor or by scanning the packaging. The system automatically recognizes and immediately registers the product's attributes and transfers this information to the OSA Master Data Catalog.

The Reference Data Catalog then aggregates all of the information regarding a product and its attributes, namely: ingredients, properties, dimensions, description, packaging, optimal storage conditions, associated marketing, promo campaigns, and nuanced attributes pertaining to specific product categories (e.g., free of artificial flavors and colorants, sugar or salt free, safe for use during pregnancy, etc.). The catalog will also track changes to these product attributes as the goods make their way through the supply chain and its stores.

Any and all visual information from the Reference Data Catalog is transmitted to an image recognition provider, who then creates a 3D model of the product. This model is used to generate a set of images to train the AI to recognize the 3D-rendered product's real life counterpart on store shelves. To ensure this recognition, the model is composed of multiple pictures with different lighting compositions and shooting angles, and each image is tagged with the item's product identifier and in-store or supply chain coordinates.

After images are completely rendered, the network transfers them to the neural network to train the visual recognition model for the corresponding products. Once this training is finished, the image recognition functionality is available 24/7.

The Partner Data API is responsible for establishing a two-way connection between the image recognition provider and the OSA Core. To utilize the image recognition function, a client would send a product image to the OSA Core network, which would then retrieve a response from the image recognition provider with the product's coordinates and general information.

OSA Machine Learning Framework

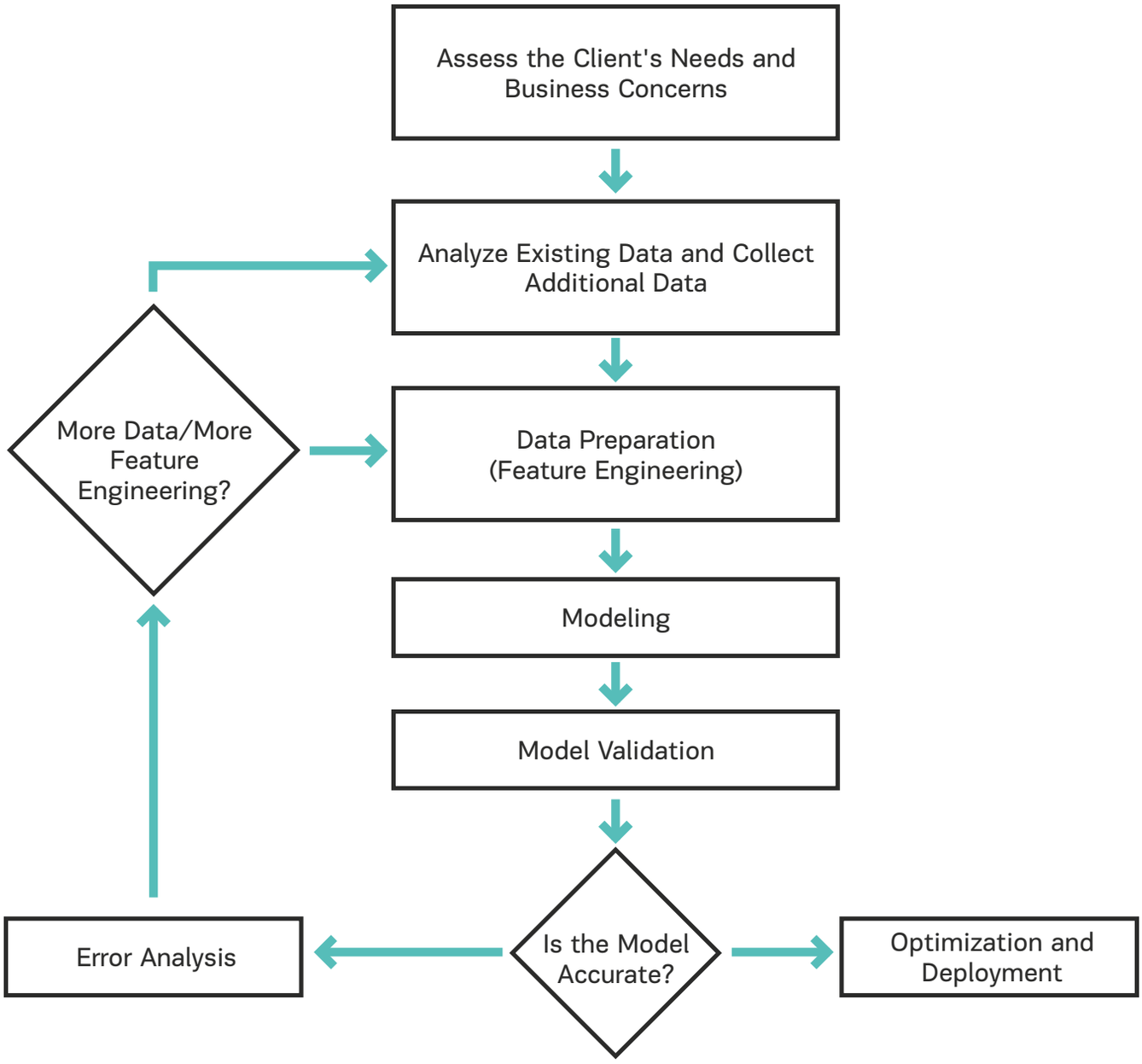
OSA's machine learning uses a framework of formalized machine readable logic to replace manual functions and human decision making processes. As one might guess, the ultimate goal of our machine learning framework is to replace manually-executed network tasks and minimize product management errors, thereby increasing the speed and accuracy with which the system oversees optimal shelf availability for our clients. The figure below demonstrates a typical ML workflow within our system.

Understanding the Business Problem. At this stage, we get together with our key stakeholders to define the client's main business problem that our algorithms are meant to solve. The methodology to analyze an issue may vary from ethnographic interviews with the relevant personnel to industry group debriefings. The purpose of this stage is to discuss the issue with the client to better understand how we can help them, even if this means testing out or discovering new features for our model.

Analyzing existing data, collecting additional data. At this stage, we ascertain the exact data OSA will need to deliver a successful product. For example, a client's store might be located next to a competitor. Thus, a product's fluctuating demand may be dependent on the competing store's discounts and promotional campaigns. We analyze these factors and product trends external to a client's store to help them pinpoint why other stores are selling products that they've failed to move.

Feature Engineering. This process involves transforming the data we collected at the previous stage into a format that allows OSA to train machine learning/AI models. Using a misplaced bottle of apple juice analogy, the features of this product might be the following:

Figure 15. OSA Machine Learning Workflow



- What is an item's product category?
- What is the price of competing products in this category?
- How long was a product absent from the shelf?
- When did the product arrive to store?
- What is the stock/inventory of this product in a certain store?
- How many times should this product have been purchased since the last time an actual sale occurred?

This feature engineering uses neural networks to discover relevant competing products. For instance, OSA can collect cashier receipts and train our neural network to understand which goods are typically purchased together.

Modelling. This step involves using the neural network's various machine learning techniques like neural networks, gradient boosting trees, and adaptive selection. Inspired by neuroscience, neural networks are computer systems that consist of interconnected nodes, much like your brain's interconnected network of neurons. Gradient boosting trees build prediction models by producing an ensemble of weak decision trees, after generalizing them by optimization of an arbitrary differentiable loss function for classification and regression. Adaptive selection algorithms choose the best model from a pool of pre-existing ones in order to adapt it to a changing environment.

We train our models using these techniques. The training process results in a set of rules, coefficients, and interconnections which the machine learning acquires from each data set. We use test data sets and training data sets to guarantee the model's prediction quality and accuracy after implementation. When training data sets we also train our data model, which will then be validated using a test data set.

Model Validation. At this step in the process, we use model validation to pick relevant test data and determine appropriate metrics to use for the model. These metrics include system precision, the system's product recall, ROC AUC, F1, and MAPE. Let's use our favorite juice box example to explain the metrics we use for model validation:

- *Precisio*n — how likely is OSA to correctly predict that the juice box is absent from the shelf?
- *Recall* — how often did OSA detect that the juice box was absent out of all times when it actually was absent?
- ROC AUC (Receiver Operating Characteristic — Area Under the Curve) — the probability that a model will more likely rank a randomly chosen case of juice boxes absent than a randomly chosen case of juice boxes present
- F1 — the harmonic average of the precision and recall
- MAPE (Mean Absolute Percentage Error) — a forecast accuracy metric that defines the difference in percentages between a juice box brand's sales forecast and the actual quantity of juice boxes sold
- Recall at a certain precision level — defines the correlation between recall and the set precision levels

After picking the relevant validation metrics, we apply them to validate the model. If the validation is successful, we deploy the model and it becomes part of our machine learning framework. If the relevant metrics yield insufficient outcomes, then this signals OSA to perform additional data collection and feature engineering.

Data Science Pipeline

OSA's Data Science Core includes components that provide different types of alerts.

Forecast Algorithms provide a series of forecasts for products based on each time series and hour. The time series are tailored to each in-store product. The more forecasts the system produces, the more we'll be able to build complex models and improve our feature engineering to define and resolve problems with product on-shelf availability.

The Promotion Detection Algorithm identifies if there are any promotions available elsewhere for each in-store product. Usually, retailers have access to *planned* promotional data but no *actual*, real-time promotional data, but this algorithm gives them access to such data to gage product pricing against competitor models.

Related Products Detection Algorithms identify competing (substitutive) and accompanying (complementary) products by using neural networks and point of sale data. This information will help to define whether a sales problem results from understocking or sales bias towards product substitutes (e.g., if consumers are buying Nesquik instead of chocolate milk directly).

The Feature Engineering Component transforms data to create features for further classification model training.

Active Learning Components gather relevant, labeled data to increase model efficiency metrics. This component defines which labeled data is the most useful for the model before like data is collected in-store to build on the model.

The Classification Algorithm provides trained models with relevant product information based on in-store labelling.

The Labeled Data Validation Component is used to guarantee that data labelling is accurate and meets system standards. It includes visualization tools accompanied with photos made by in-store users to check whether labeled information is correct.

Data Storage is an external component that includes all the relevant data collected from available sources, such as retailers, producers, and 3rd party data providers. The Data Science Core extracts initial data from this storage component and, after extraction and analysis, re-stores the calculated data back into the Data Storage.

Blockchain and Tokenization of Our Services

Data integrity persists as the primary concern of any big data ecosystem in retail. This concern spans the integrity of data inside the ecosystem itself (infrastructure, servers, data storage) and the integrity of the data sources that feed information into the ecosystem. In 2016, we started researching blockchain technology for its potential role in solving data integrity problems within OSA's own network.

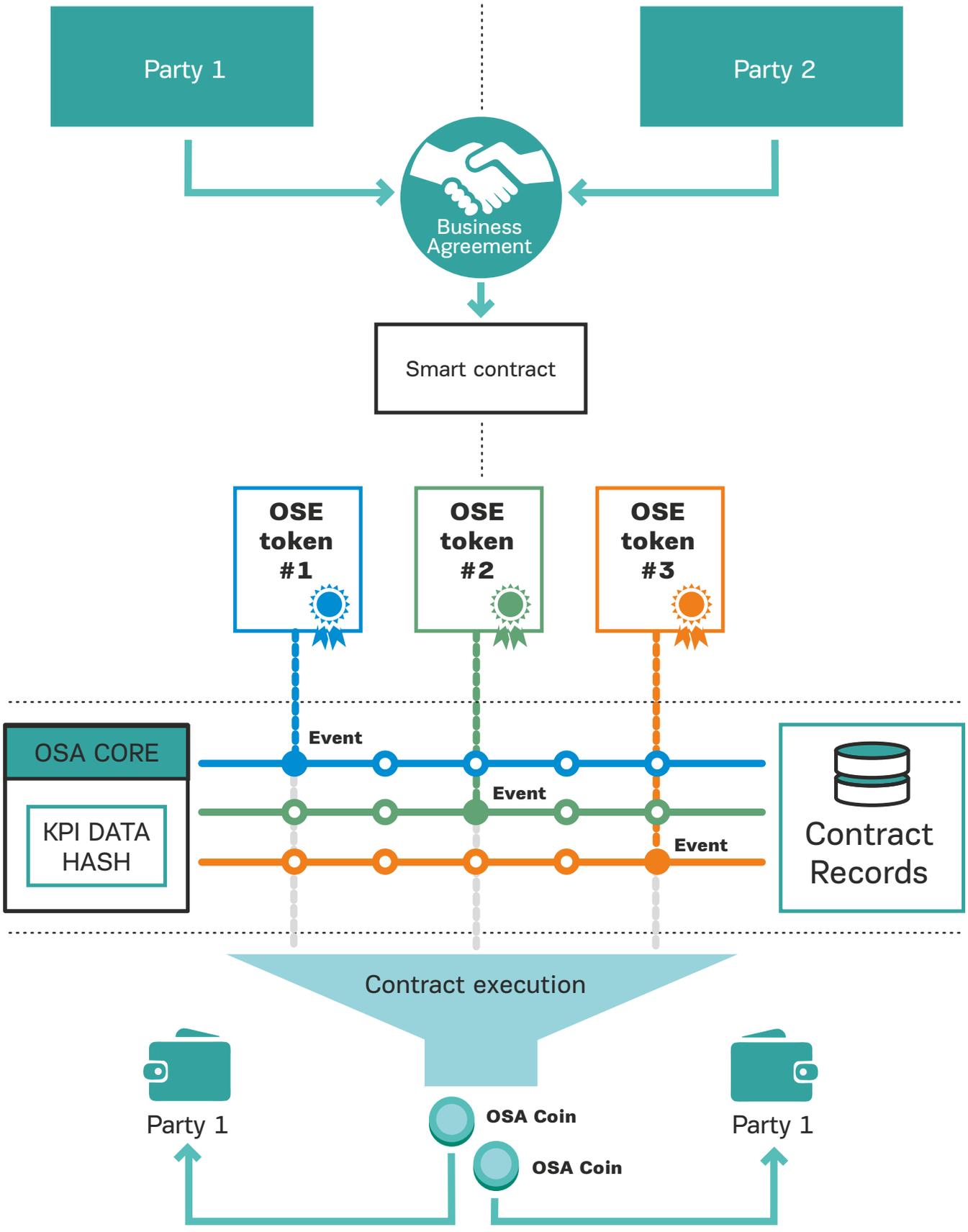
The end result of this research, the OSA Decentralized Platform, is a completely re-engineered version of the OSA Hybrid Platform. It incorporates various iterations of blockchain technology (e.g., distributed ledger technology, smart contracts), and we engineered its tokenomics to ensure that it generates added value for each stakeholder and that value creators are properly compensated for their contributions to the network.

OSA's modus operandi is to predict, locate, and react to the myriad events that occur throughout various stages of the supply chain process. Each event - and our enhanced understanding of such an event - contributes to improved optimal product availability.

In this section, we introduce OSA coin, the native crypto currency of OSA's private blockchain. On top of this blockchain, we also introduce OSE tokens, a series of tokens for each business event that will occur within OSA's ecosystem. Each OSE token represents a business KPI for a specific use case in an individual store, such as the number of juice boxes that should always be available on-shelf in the beverages section of a specific store. The KPI measures the price of the smart contract to gage a function's worth relative to other network functions. We explain our smart contract kit below in this section.

Developing and implementing a private blockchain takes time. That is why for the purposes of this token sale we introduce a temporary ERC20-based **OSA token**. OSA token will be operational until our private blockchain is ready for the production stage. At that point OSA tokens will circulate alongside OSA coins at the rate of 1:1 - one - to - one and will gradually replace them. Total quantity of OSA tokens and coins will remain unchanged, - each issued OSA coin will replace 1 OSA token.

Figure 16. **OSA Smart Contract Infrastructure**



How will OSA token become OSA coin?

Tokens run on top of existing blockchains, Ethereum being the most popular one, with its ERC20 token architecture custom built for the purposes of token sales. Unlike tokens, coins are based on their own blockchain. In order to create such a blockchain the core team of a new coin can decide to develop it from scratch. Alternatively, and this is the preferred option for most core teams in 2018, they can fork a blockchain which already exists.

As OSA is about inventing new use cases for blockchain technology, not reinventing the blockchain itself, we decided to fork. Given the requirements of the OSA DC marketplace requirements, the key criteria were identified as the ability to process endless number of transactions, including micro value transactions, in real time, and very low cost of gas, again, to accommodate micro transactions. After preliminary analysis, our blockchain architects landed on a shortlist of three possible blockchain technology providers: Ethereum, NEO and NEM.

Mijin by NEM

Of those three, we selected Mijin by NEM. Mijin is based on NEM blockchain that runs crypto, which is among the world's top-20, by market capitalization. Mijin is a corporate permissioned blockchain. It combines the hash rate and flexibility of distributed ledger with the confidentiality and security of a private protected peer-to-peer network.

Why Do We Use Permissioned Blockchain?

In case of OSA, lots of sensitive data will be travelling through our blockchain. This includes number of customers at a certain store, their routes and routines, preferred goods and services, etc. Undoubtedly such commercially sensitive information cannot be shared with the public without some preliminary moderation.

A permissioned blockchain offers an access control layer to the organization implementing it. Of course, this feature comes together with a certain degree of centralization. However, the role of the server or the access node in the permissioned blockchain is limited only to managing the access privileges. Such a server does not have an influence on the content and data integrity within the blockchain it serves.

Therefore, a permissioned blockchain will provide confidentiality and data protection to OSA clients, while still guaranteeing the integrity of the data travelling between vendors, retailers, technology partners and our system.

Proof-of-Importance

Mijin is based on a proof-of-importance (PoI) consensus algorithm. Proof-of-importance is a subtype of proof-of-stake (PoS) consensus. Like PoS consensus, PoI relies on the amount of coins each node owner has to vest in the blockchain to become a masternode. However, NEM introduced an additional parameter titled "local trust value" on top of the traditional PoS.

Local trust value relies on a set of mathematical formulas and the ranking algorithm called "NCDawareRank" to calculate the exact reputation of each masternode. These technical measures will make OSA blockchain more resilient and resistant to attacks by malicious nodes.

Transition from OSA Token to OSA Coin

In Q2 2019 OSA will launch its MainNet on Mijin blockchain. Speaking in terms of traditional product life cycle — if TestNet is akin to alpha release of a product MainNet is the commercial launch. From the date of the launch we will start exchanging the circulating Ethereum-based OSA tokens to Mijin-based OSA Coins at 1:1 rate. This will be implemented in order to speed up the transactions time and make them cheaper.

Usability of OSA Token

However, since the launch of OSA MainNet we will gradually exchange and burn all OSA tokens, so that within several years OSA coin becomes the main currency of our ecosystem.

One of the major drivers for the liquidity of the OSA token will be community expectations based on how well OSA performs its roadmap.

Contributors, holding more enough of OSA tokens (exact number TBD) will be able to file an application to become the masternode until a deadline that will be announced separately. After that deadline the applicant masternode will have to acquire OSA coins in order to qualify.

Liquidity of OSA Coin

After its introduction, OSA coin will become the base currency of our ecosystem. Our clients, be it vendors wishing to ensure optimal shelf availability of their goods or retailers seeking to use OSA solutions to maximize their margin and increase customer loyalty, will enter into smart contracts. The currency of those contracts will be OSA coin.

Each time a new vendor joins our platform and signs their first smart contract, this vendor has to acquire new OSA coins either from an exchange or from individual participants of our ecosystem who already earned them in some way. The more vendor traction we will have, the more transactions there will be on OSA blockchain, and the better will be the usability of OSA coin.

The increasing amount of transactions will also cause a second liquidity booster — incremental growth of masternodes on OSA blockchain. As we know from the section on masternodes: launching a new masternode on OSA blockchain requires vesting certain amount of OSA coins to establish proof-of-importance. This amount is quite substantial and equals the fee from a certain number of transactions (TBD) of the average smart contract transactions on OSA blockchain, to be determined at the time of the detailed technical forecast.

This means the prospective owners of OSA masternodes will also become substantial financial contributors of our ecosystem, providing usage boost for OSA coin at its growth stage.

Smart Contract Kit

After completing our token sale, we will unravel the OSA Smart Contract Kit. Whenever a vendor and retailer implements OSA and creates a product availability KPI, they will enter into a smart contract. Each KPI will have an assessment scale, and if a participating retail chain meets the KPI standards set by the vendor, that retailer will receive fixed or dynamic payment in OSA tokens.

Figure 17. **OSA Smart Contract Kit**

Events	Conditions	Remuneration
• Calculating KPI at a certain moment in time • Activation of sensors (sensor data collection) • Retrieving image recognition results • Creating, editing, or deleting a document within the EDI (including creating new document or deleting exsting) • Accessing OSA Data Storage • Writing data to the database	• Event occured / not occured • And / or /not • Equals / more / less	• Fixed • Dynamic

A fixed remuneration means that the KPI has one threshold. For example, if the amount of juice boxes available on a store's shelf was more than 10 for at least 340 days of this year, then this store met its KPI and will be remunerated with 100 OSA coins.

Dynamic remuneration means the KPI is variable, consisting of various thresholds. Returning to the juice box example, juice box availability could be scaled as such:

Figure 18. **Dynamic Remuneration for Juice Boxes**

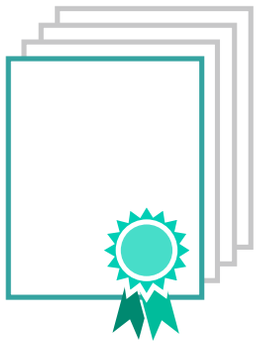
Days when a sufficient number of juice boxes were available on the store's shelf	Dynamic remuneration scale
365	120 OSA Coins
Over 340	100 OSA Coins
Over 320	60 OSA Coins
Below 320	No remuneration

Obviously, dynamic remuneration is more efficient for both parties as it provides more flexible incentives for the participating retail stores to meet their KPIs. Thus, dynamic remunerations deliver more value to the vendor.

OSA Tokenomics

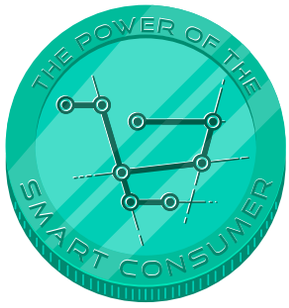
One of blockchain's clearest benefits is its ability to provide transparent, fair share to each of the network's stakeholder. Our tokenomics can be grouped into three major categories: smart contracts and the parties signing them (i.e. vendor and retailer), a platform fee that's fairly split between ecosystem participants and contributors, and the master node that supports the entire blockchain network. Let's take closer look at each of these categories.

Figure 19. **OSA Blockchain Fees Structure**



OSE token

Z "Variable fee is thecontract price agreed bythe parties



OSA Coin

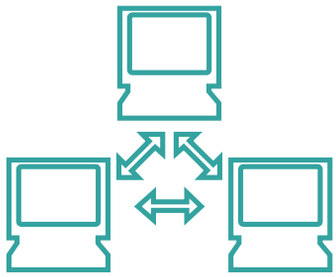
N1 is team remuneration

N2 is compensation to masternode owners

N3 is OSA infrastructure fee

N4 is technology partners' compensation

N5 is data providers' compensation



Master Node

X Pays OSA Coins to becomemaster node»

Y Gets OSA Coins forproviding master nodeservices»

Token A for Event X in Service Y The variable fee (Z) is the contract price agreed upon by the participating parties	N represents the platform fee, where N1 is a team remuneration N2 is compensation to masternode owners N3 is OSA's infrastructure fee N4 is technology partners' compensation N5 is data providers' compensation	Master Node Pays X OSA coins to become a master node Gets Y OSA coins for providing master node services

The Smart Contract

Using OSA's Smart Contract Kit, we will tokenize optimal store availability KPIs for vendors and participating retail stores. Obviously, both vendors and retailers will be responsible for negotiating a smart contract price and token payout based on the KPI and the level of service expected. The contract price is set in OSA coins at the parties free will. We can provide guidelines for establishing a contract price that is fair and motivating; however, OSA does not influence or control over the vendor and retailer's agreed-upon price.

Each tokenized KPI will be come on top of OSA blockchain. The tokens that record KPIs (OSE tokens) won't be listed or traded on exchanges. Rather, they record the KPI's values so that proper remuneration may occur between the parties upon meeting the requirements.

The OSA Coin and OSA Platform Fees

The OSA coin is the lifeblood of the OSA blockchain, the transport layer for OSE tokens, and the trigger that enables the OSA Smart Contract Kit. On top of these functions, OSA coin is also the major economic medium of the OSA ecosystem. After its introduction in 2019, we will convert all OSA tokens from this token sale to OSA coins and replace OSA token with OSA coins, meaning any willing party will be able to exchange OSA tokens into OSA coins as well as to acquire OSA coin and participate in our ecosystem.

The market will derive the economic value of OSA coin from the arithmetic averages of all the platform's smart contracts that are based on its blockchain plus OSA's platform fees consisting of remuneration to various participants of the added value chain of the OSA platform. The non-exclusive list of OSA's platform fees includes:

1. **OSA team remuneration.** Yet another essential element of any commercial blockchain ecosystem. The proceeds of this token sale cover our current financial needs. However, so that OSA can sustain itself in the future (5 or 10 years from now), we need to secure additional sources of financing for our team.

2. **Compensation for masternode operators.** We will describe masternodes in detail below in the next section. But for now, masternode compensation incentivizes node operators to support the ecosystem.

3. **OSA infrastructure fee.** Outside of blockchain and distributed computing, our ecosystem needs legacy technology to support all of its APIs, the fundamental elements OSA Core, and our office printer. The infrastructure fee makes supporting these old-school services possible.

4. **Compensation for our technology partners.** This type of fee makes OSA ecosystem attractive to various technology providers and incentivizes them to provide our customers with the cutting edge technologies. In particular, it covers costs for image recognition platform (Neuromation (www.neuromation.io), our primary provider in this field).

5. **Compensation for data providers.** These fees allow OSA to draw from the best data sources available on the market, which ensures outstanding business results.

We have intentionally chosen to refrain from listing exact percentages for each of OSA's platform fees. Doing so would be premature and hasty on our part, as final fee metrics will be largely market-driven as providers and users agree on rates for each service. For example, we might establish partnerships with a major business data provider that creates substantial value for our customers. Obviously, based on the principles of supply and demand, this will likely increase the access fee for these data providers in our value distribution model.

To provide another example, the price of cloud storage and cloud computing services might decrease, as storage technology, microprocessors, and core computational applications become increasing advanced and cost-efficient. This will cause OSA's infrastructure fee to drop.

The Master Nodes

By and large, Proof-of-Work blockchains are becoming less popular. As Proof of Work energy consumption raises international concerns, innovators in the cryptocurrency space have questioned sustainability and dependency of mining method for ensuring distributed consensus and network integrity. This is why we have opted to use master nodes under a Proof-of-Stake system to secure OSA's network.

Under a Proof-of-Stake model, validators are chosen deterministically by the network to validate transactions and solve the mathematical problems that generate new blocks. These validators serve the same function as miners, except they don't compete with other validators to mine blocks. Rather, they stake the network's native currency (in this case, OSA coin) in a core wallet that runs the network's software, and then the network chooses them to validate transactions and build blocks based on how many coins they have staked and for how long they've staked them.

All participants of a P2P network are called nodes. On a PoS or PoI consensus-based blockchain some nodes perform additional technical and administrative functions, like storing the most current version of the ledger or voting to determine the future features of this blockchain. They are called "supernodes" or "masternodes".

Establishing 50 masternodes will be sufficient for stable functioning of the OSA blockchain. Obviously, we will cover this "required minimum" using our internal resources. Adding new masternodes will make OSA blockchain faster and resilient. Within the current configuration we are ready to accommodate up to 2000 masternodes.

Any willing individual or corporation that was cleared by the access node can launch a masternode on OSA blockchain. On top of that, each masternode then has to vest certain amount of OSA coins and keep this vested amount available at all times. Failure to do so will lead to permanent disqualification of this masternode.

Besides the minimum vested amount requirements, each masternode will also have to comply with certain information security, privacy and data integrity requirements. The core team of OSA will conduct regular audits to verify masternodes on all those parameters.

Failing masternodes will be disqualified permanently. Additionally, our partners at Hacken will run a community-based rolling bug bounty program to make sure we, not hackers, are the first to discover our bugs.

How Will Masternode Owners Get their OSA Coins?

Like miners in proof-of-work consensus systems, masternodes get compensation for performing technical and administrative functions. When we mention the "disqualification" of a masternode above, it only means this node will become a regular node and won't receive the masternode fee.

This rule will be applicable if the owner of the node in question only will only fail the masternode rules of our blockchain and will not commit any crime or fraudulent act, which might lead to (1) the violating node being disconnected from the system, (2) launch of the criminal proceedings by the authorities of the relevant jurisdiction.

Power of the Smart Consumer. B2C.

Vision

We aim to create a new era of retail: SMART CONSUMER RETAIL

- **Smart Consumers:** They make intelligent choices based on unique personal requirements and needs using reliable and transparent product information - i.e. full ingredients list, comprehensive product attributes and features, product ratings, origin, provenance, storage and handling, price, etc., - available to the shoppers at their fingertips, via digital electronic assistant. Product's ratings shall be based on or peer-to-peer recommendations. We envision, that product (and – manufacturer and retailer) ratings will become the key currency in grocery retail, forcing the manufacturers to improve products quality to better satisfy consumers' needs and retailers to improve the service levels.

- **Consumers' Power:** We shall unite consumers into a single powerful community, giving them the power over both the manufacturers of consumer goods and the retailers. So that consumers will be able to tell what products they really want, when and where and at what prices.

- **Responsible Consumers:** Over time, the OSA-trained electronic assistant will be able to manage the amount of purchased products in order to reduce the domestic spoilage levels, saving up to 30% of all purchased products that currently get wasted.

- **Healthy Consumers:** we shall aim to partner with AI in medicine and health protection, and combine consumers health tracking data with recommended products. This will allow us to create AI that shall identify previously unknown patterns and develop a healthy diet for each person on the planet according to his/her individual characteristics, to provide preventive health protection. With that we shall defeat obesity, diabetes and cancer!

Introduction

Retail industry, ever since its conception, constantly evolved, changing paradigms along the way. Revolutions change the previously accepted rules and create new economy. Right now the global retail is in the mid of 3rd revolution.

Power of Brands

First revolution of the fast moving consumer goods retail (FMCG) – called the Power of Brands, started with the appearance of the big brands, which became an essential part of mass culture. This revolution coincided with the baby boomers generation rise. Big brands significantly facilitated product choices and lead to stereotypical purchasing behaviors in the stores.

Overriding trust in big brands allowed the shoppers to avoid the necessity of having to compare multiple available product choices every time when doing shopping. The flip side was the shoppers' willingness to surrender the control over products' ingredients.

A compromise was reached, where the brand had to offer an acceptable range of attributes, whilst constantly maintaining media presence, and the consumer had to surrender products comparison, products choice and the ingredients control.

Power of Retail Chains

Consolidation of the retail chains brought about second retail revolution – the so-called Power of Retail Chains. This revolution coincided with the generation X rise. Retail chains offered tangible logistical benefits to shoppers, by placing everything needed into one shop, thus

significantly reducing time spent on shopping.

Having amassed sufficient scale, the retail chains obtained significant leverage over both shoppers and the manufacturers of consumer goods.

This lead to a compromise where the retail chains offered the shoppers an acceptable product range and simple logistics. In return, the shoppers had to surrender the search for the alternative product range and price control.

These revolutions have lead to creating conflicts between generations: each compromise was by and large maintained by the generation that reached it, whereas the following generations would reject this compromise as unacceptable. Therefore, the bigger the time lapse is between generations, the higher are the ensuing tensions.

Shopping experience is most influenced by the following 9 issues:

1. Trust in brand / product / seller
2. Trust in product composition and ingredients
3. Trust in proper product storage and handling
4. Easy to find the product
5. Easy to select product
6. Easy to choose product
7. Price control (price awareness)
8. Shopping is a routine
9. Grocery shopping is time consuming

Need for Change

The intensity of clashing pressures varies depending on generations it affects. It grows inversely to the shoppers age and reaches its maximum between generations X and Z. In 10 years from now these generations will make up the majority of economically active population and generate the biggest amount of purchases.

Generations X and Z therefore are the key interested parties in breaking down the existing structure of compromises in the FMCG retail industry. It so happens that these generations are the most professional users of the digital environment.

Power of the Smart Consumer Explained

Third FMCG retail revolution is technology driven. Technological developments allow shoppers to break through both big brands information monopoly, and the retail chains logistical monopoly. This revolution impacts Millennials and Generation Z.

Available technologies allow shoppers to search and compare infinite numbers of products, based on pre-defined preferences, and both manufacturing and logistics will have to adapt to the new digitized consumer needs.

We are now seeing only the first wave of this new revolution. The shoppers massively use social networks and topic chats to provide product and seller related feedback and comments. This effectively destroys brands' informational monopoly.

But the revolution will only get in full swing when the shoppers obtain a set of comprehensive solutions to their 9 key concerns with shopping listed above.

Solutions to Shoppers Concerns

In approaching the development of the shoppers solution framework, we have grouped the shoppers concerns around the technological pillars that are capable of solving them.

Group #1 Blockchain

Combines the following shopper's concerns:

1. Trust in product composition and ingredients
2. Trust in proper product storage and handling

Solution for this group of problems in based on blockchain ledger registry of manufacturing, transportation and handling processes for each product. These processes are traced via sets of sensors, assigned to every product unit and can easily be retrieved on demand.

This allows shoppers or their personal digital assistants to verify that the particular product is fully made up of organic components and was shipped and handled in full adherence to the prescribed conditions.

Group #2 Product Master Data Catalogue

Addresses the following shoppers concerns:

1. Trust in product composition and ingredients
2. Easy to select product

This group of shoppers' concerns is addressed by creation of the unified Product Master Data Catalogue. Product data in the Catalogue is enriched with all attributes that are specific to the product's performance characteristics. These characteristics can be objective, subjective, relative or contextual. These attributions allow to link product to usage experiences of each individual consumer.

This allows shoppers or their personal digital assistants to make sure that any chosen product, for example: 1) does not indeed contain salt or another specified ingredients and 2) was liked by the majority of other shoppers with similar product preferences. Further on, taking into account the required weight or volume of the chosen product, personal digital assistant can work out the most efficient logistics.

Group #3 Dynamic Reputation Rating (Game Logic)

1.Trust in brand / product / seller

It is nearly impossible to digitize all the factors that influence shoppers' satisfaction from the purchase. Yet, the vast majority of these factors are centered around processes, motives and strategies of the manufacturers and / or retailers. In some cases, these are indirect subjective evaluations or completely unknown factors.

Attempting to generate this data we rely on the game theory methodology. We develop a dynamic ratings system, which is then used to generate additional attributes and features for every product (or manufacturer of consumer goods) and retail store (or retail chain). Ratings can be grouped as global, local and individual – and can be applied in the specific decision making or problem solving process initiated by shopper or personal digital assistant. Ratings system is immune to tampering.

Using this option, shoppers or their personal digital assistants can choose required level of expected 1) service when selecting the appropriate store or chain, or 2) product quality /

performance, when choosing specific product.

Group #4 Personal Digital Assistant (Intelligent Interface)

The following shopper concerns fall into this category:

1. Easy to find the product
2. Easy to choose product
3. Price control (price awareness)
4. Shopping is a routine
5. Grocery shopping is time consuming

This group of concerns is addressed with the help of personal AI managed digital assistant. It is trained by accumulating, analyzing and processing personal shopper's data, including the purchasing history, shopper's preferences. Personal digital assistant is capable of processing available product offers during and either independently planning purchases, formulating purchasing strategies and deciding on purchases, or supporting the shopper in making his purchasing decisions. Assistant also provides optimal products logistics and delivery. All data is encrypted and released to Platform or third parties upon explicit shopper's consent or on the need-to-know basis, to enable services provision.

How do we organize decisions in the personal digital assistant?

Each of the sections described above is a modular set in the Core of the cloud Platform. Together they make up the Core. Core Platform analyses shoppers' requirements, assesses the modules' relevance and applicability and provides optimum modules combinations to best address them.

Modules and services interact on the Platform in a way of micro transactions fueled by internal crypto currency.

Platform's strategy lies in generating maximum affinity and reach, within minimum time lapse. To achieve it we will offer Platform services for use by other partners. Partners can build digital shopping environment for specific target audiences. We will effectively offer our marketplace to the owners of retail stores, brands, sites or mobile apps – literally to any service that has a more or less constant target audience – to develop their own digital environments for personalized shopping.

Digital Environment for Personalized Shopping

Digital environment for personalized shopping is developed based on the so-called «customer journey» of identified shoppers target group. Key objective of the customer journey is to lead the shopper through the purchasing process, leading to successful purchase. The environment consists of the platform services which are used as LEGO modules to best reconstruct particular customer journey.

Each service or module solves a separate problem along the customer journey, ultimately leading to scoring a positive impression from purchase.

Platform envisions using the following services to develop the customer journey.

Profile AI Kit is a set of intelligent user profile generators, based on generated personal data. They manage personal data access, encryption and crypto currency transactions.

Ingredients Data Tracker keeps blockchain secured track record of sensor data related to product ingredients provenance, and feeds this data into the Platform.

Delivery Data Tracker registers blockchain secured sensor data related to products storage and handling conditions along the supply chain to the shop shelf, and during delivery from the shop to the end consumer, and feeds this data into the Platform.

Storage Data Tracker registers blockchain secured sensor data related to products storage and handling conditions on the shop shelf, best before date and feeds this data into the Platform.

Search, comparison and choice AI Kit – set of instruments for the real-time intelligent product search, comparison and recommendation, based on predefined user criteria.

IR & AR Kit recognizes products captured by mobile camera or from photos and accompanies recognized objects with augmented reality elements. It also manages recognition models training.

AR Kit manages and activates augmented reality objects using fixed markers (QR).

VR Kit creates and manages virtual reality environment.

Logistic Kit interacts between local, glocal and global shipment and delivery options, plans routes and timings.

Shopper assigns which data will be used by his personal digital assistant, which data will be available to selected partners and / or global services (i.e. global ratings data).

Smart Shopper Economy

The lowest denominator of any module on the Platform is a separate service unit. Service unit obtains necessary entry data, processes it and passes it back to the customer or up to the next service unit in customer journey. Entry data has an X cost associated with it. As it gets processed, data gets added value N, this is the cost of service execution. Charged service value is X + N. Complex tasks will require a sequence of service units to be executed on the Platform.

Shopper pays for the service provision in a way of a micro transaction in the platform's cryptocurrency, OSA coin. Platform collects the payment for the services execution. Engaged 3rd party environment owner may choose to receive or not a mark-up, after all his objective is to take the shopper on a successful customer journey and receive profit from the sold goods or services.

Platform economic model will balance between 1) OSA coins flow into shoppers' wallets and 2) needs of the Platform to deliver services.

We consider using three options of balancing mechanisms:

1. Coefficients management – services cost is balanced within every environment
2. Diversification of income:
    - Possibility of open access to data by third parties – i.e. allow platform services to analyze shoppers purchasing data
    - Introduce payment for shopper data collection – i.e. every time a shopper points camera on the shop shelf, the platform will purchase taken photos for processing and rendering purposes
    - Sponsorship of certain services by a brand / store / environment owner.
3. Provide shopper with flexibility and ease of managing his Platform account between cryptocurrency and FIAT currencies.

OSA DC Business Model

Business model "Freemium" based on revenue share:

At the beginning the business model is set up to allow retailers get free of charge service while consumer goods manufacturers pay for the service, whilst increasing sales volume of its products and optimizing costs, including conducting expensive regular retail audits. Both participating retailers and manufacturers get sales increase.

When a particular retailer requires additional services on the platform, OSA charges for service based on revenue share agreement.

Consumers (shoppers) are approached through B2C service - and are compensated both by retailers and manufacturers.

OSA business model is "triple win".

Participating businesses profit from improved efficiencies and synergies, provided by OSA solutions.

Consumers and shoppers benefit by paying less for products in participating retail, not having to waste time looking for the products suiting their needs and staying healthy by making intelligent and smart product choices.

Our planet benefits from dramatically reduced waste levels.

Commercial and marketing Strategies Under Consideration

Project consists of two parts – B2B and B2C.

B2B commercial strategies:

Our scaling strategy is based on 3 pillars: 1/ through existing consumer products and retailer chains customer base (global / regional corporations); 2/ through establishing local offices and operations in key markets and approaching local customers; and 3/ through establishing local partners base (we are in negotiations with D&T and EY, IT integrators and other consulting providers).

- We are very well connected within the consumer product retail industry. We are the strategic partner of ECR (association that unites biggest retailers and manufacturers in 48 countries of the world). We will leverage all ECR events and other opportunities to showcase our solution and attract clients. Participation in the previous ECR events in Russian Federation (2015 - 2017) and in Italy (2017) has attracted tremendous interest from the manufacturers and the retailers alike. We had to put many negotiations on hold as we lacked resource to scale and properly manage the new customers and pending the ICO completion.
- We are a member of biggest retail association – NRF. We have not yet fully leveraged NRF and we are confident that it presents significant opportunities for finding new clients.
- Our team consists from well-connected and well experienced consumer product retail industry professionals, knowing how the big corporations operate and who and where to best contact in order to get things going.
- As we have been doing for the last 2 years - we will continue to participate in leading retail events - CGF, ECR, NRF, FMA and others.

- We plan to become the sponsor of CGF and ECR supply chain and AI activities.
- We will continue participate in leading AI events.

B2C commercial strategies:

Through contracted retailers loyalty programs

PR campaign for various communities

Partnering up with B2C startups

By providing technologies and content for leading device manufacturers to enhance their capabilities (Samsung, Apple)

OSA DC Corporate Structure

The corporate structure of OSA DC project includes the following companies:

OSA Decentralized Limited ("Company") is a business company incorporated in accordance with the laws of the British Virgin Islands. The Company organizes and conducts a process of the OSA tokens sale, will create the OSA tokens and distribute them to the community. The Company will also contract with entities and agents for the development of the OSA platform and its underlying software, as well as for marketing of the OSA DC ecosystem in order to foster a community around it;

E.E.C. EXTRA ENTERTAINMENT CORPORATION LIMITED is a business company incorporated in Cyprus. Its purpose is to develop, operate and maintain the OSA platform and to help foster a community around the OSA platform. This company will hold IP rights related to the OSA platform and will issue licenses to the Company and other affiliates. Such assignment of IP right to the separate entity will strengthen OSA corporate structure and eliminate risks related to holding of IP rights.

It should be noted that the OSA DC project is intended to exist for a long-term period, that means that the corporate structure and the companies' roles described above are not binding for the OSA DC management team and can be restructured or adjusted if and when deemed necessary.

Legal Status of OSA Tokens and OSA Coins

OSA Tokens and OSA Coins (the "Tokens") do not grant participation in the issuer (the "Company") or its assets. The Tokens do not provide token holders with any ownership or other interest in the Company. Acquisition of the Tokens does not present an exchange of cryptocurrencies for any form of shares in the Company or the Company's assets, including intellectual property. Token holders are not entitled to any guaranteed form of dividends, revenue distributions, and voting rights.

The Tokens do not represent a loan to the Company. The Tokens neither debt instrument or bonds of any kind nor any other form of loan advanced to the Company. Acquisition of the Tokens, whether through the Token sale or otherwise, does not grant to Token holders any right of claim on Company's financial or any other assets.

The Tokens are not securities in any jurisdiction. This White Paper does not constitute a prospectus or offer document of any sort, is not intended to constitute an offer of securities or a solicitation for investment, does not pertain in any way to an initial public offering or a share/equity offering, and does not pertain in any way to an offering of securities in any jurisdiction. The Tokens are not intended to be marketed, offered for sale, purchased, sold, or traded in any jurisdiction where they are prohibited by applicable laws or require further

registration with any applicable governmental authorities. We do not recommend buying the Tokens for speculative investment purposes.

The Tokens do not represent any other financial or investment instrument. In particular, the Tokens are not and shall in no case be understood, deemed, interpreted or construed as: (I) any form of financial derivatives; (II) any commercial paper or negotiable instrument; (III) any form of investment contract between the relevant holder and any other person; (IV) any commodity or asset that any person is obliged to redeem or purchase; (V) any note, debenture, warrant or other certificate that entitles the holder to interest, dividend or any kind of return from any person; (VI) the rights under the price difference (margin) contract or any other contract whose purpose or its intended purpose is to ensure profit or avoid losses; or (VII) structural units in the collective investment mechanism or in the institution of joint investment, including trusts and investment funds.

The Tokens are not currencies in any jurisdiction. The Tokens are not currencies issued by any central bank or national, supra-national or quasi-national organization, nor is it backed by any hard assets or other credit.

The Tokens are non-refundable. Unless otherwise is provided by applicable legislation or strictly set out in the legally binding documentation on sale of the Tokens, the Company is not obliged to provide Token holders with a refund related to the Tokens for any reason, and Token holders will not receive money or other compensation in lieu of the refund.

OSA Token Sale

OSA Token Explained

Figure 20. **OSA Token Quick Fact**

Token Name	Optimal Shelf Availability Token
Ticker	OSA
Website	www.osadc.io
Hard Cap USD	$40 million
Minimum buy-in	No limit
Blockchain	Ethereum (ERC20 token)
Hardcap is fixed in USD. The distribution of OSA token is calculated weekly according to the ETH/USD rate, published on kraken.com. Tokens are minted at the end of the token sale in accordance with the hardcap. Tokens that were allocated for the sale but weren't sold will be burned. Up-to-date information related to the tokens issue is available on osadc.io in the OSA TOKEN section.	
ETH-to-OSA rate during token sale	1 ETH = 3 000 OSA On July 21st, we entered the public sale stage of OSA token sale, and the token price was raised to 3 000 OSA per 1 ETH
Accepted currencies:	ETH, BTC, LTC, BCH, ETC

Token Sale Roadmap

Figure 21. **OSA Token Sale Roadmap**

Date	Event
March 20 - May 21, 2018	Private Presale, Whitelist registration opened
May 21 - July 3, 2018	Public Presale
July 4 - July 20, 2018	Public Presale, Stage 2
July 21 - August 31, 2018	Public OSA Token Sale
30 days after the token sale ends*	Tokens distributed to contributors

*We reserve the right to extend the distribution of the tokens up to additional 30 calendar days, in particular, in the case we deem necessary to conduct additional ALM and KYC checks in respect of certain contributors.

Milestones

Figure 22. **OSA Token Sale Milestones**

Amount	$Mln	Purpose
Token Sales contribution	1,80	Blockchain technology development & integration
	4,24	IT and Data Science development to cover with service entire suppy chain
	10,00	Master Product Data Catalogue fulfilment including Image Recognition model per product (Russia, 80 000 products)
	13,60	Decentralized platform infrustructure development (Alpha version)
	15,00	Enhance OSA HP functionality (App, ChatBot, New Interface, Voice Management)
	22,20	Master Product Data Catalogue fulfilment including Image Recognition model per product (USA, 100 000 products)
	25,60	Consumer Edition Alpha version
	30,00	Business development USA, Korea, China, Japan
	40,00	Master Product Data Catalogue fulfilment including Image Recognition model per product (Japan, China, Korea,138 000 products)
Business Expansion Plan	41,10	Catalogue infrustructure improvement
	43,10	Blockchain infrustructure furhter development (Smart Contracts and payments inside the OSA EcoSystem)
	45,50	B2C applications infrustructure development
	48,70	Product Rating system creation (based on Game Theory: consumer feedback, ingridients rating)
	56,40	Decentralized platform infrustructure development
	58,20	Marketing, promo, PR
	69,00	Master Product Data Catalogue fulfilment including Image Recognition model per product (150 000 products)
	76,20	AI Digital assistant B2B & B2C. Product tracebility functionality by ML
	80,00	Enhance DataScience and IT teams
Financed from generated profit	87,20	Product catalogue enlargement (100 000)
	85,20	IP cameras functionality development for Image Recognition (IR) services
	86,90	Image Recognition services enhancement
	91,60	Augumented Reality (AR) fumctionality development and AR devices integration
	98,60	International Machine Learning R&D center set up (fundamental science research) to develop AIaaS for consumers and manufacturers
	101,30	New AI services (Promo)
	104,20	New AI services (Pricing)
	106,20	New AI services (Assortment)
	108,80	AI bockchain payment system development for Retail
	120,00	Product catalogue enlargement (150 000)
	126,00	Business development
	132,00	Scale the business to UK
	138,00	Scale the business to Singapore and Malasia
	145,80	Scale the business to Japan and Korea
	154,00	Israel, Canada, Australia
	156,17	Marketing, promo, PR
	161,47	Scale the business to Latin America (Brazil, Mexico, Argentina)
	166,17	Reward system development including prescripive analytics and recommendation engine
	194,37	Scale the business to India
	196,87	Scale the business to Africa region
	203,17	AI suppliers contracting based on blockchain

Proceeds Distribution

Figure 23. **OSA Token Sale Proceeds Distribution**

39%	Product catalogue and image recognition development
21%	Core product development
18%	R&D
11%	Business development
3%	Team salary and advisor fees
8%	Marketing and promotion

Figure 24. **OSA Token Distribution**

22,5%	TOKEN SALE (Public)
22,5%	Business Expansion
17%	Partners & Advisors
15%	Team and Early Backers
6%	Retail Incentive
3%	Data Science Community Incentive
3%	R&D Incentive
3%	Legal and Finance
2%	Bounty
6%	Secure Fund & Vesting

22,5% of tokens allocated to contributors during the public pre-sale and public sale, including bonuses accrued, will be locked for ten months following the token distribution. Upon the end of each month following the token distribution, 10% of the locked tokens, including bonus tokens, will be gradually released from the lock-up.

The remaining 77,5% of tokens will be locked for twelve months following the tokens distribution and gradually unlocked during a 4 year period; during this time, tokens will be released every twelve months. Of those, only 11,5% can be unlocked within the twelve months after the token distribution to be spent on platform development needs--this is contingent on positive market dynamics.

Tokens allocated to partners and advisors will be gradually unlocked starting the 2nd year after tokens distribution according to individual agreements. Tokens allocated to team and early backers will be locked for a period of 1 to 4 years with a gradual lock-out.

The number of Tokens released from the lock-up will correlate with the platform development milestones and the growth of OSA's services.

Market Expansion Plan After the Token Sale

Figure 25. **OSA Market Expansion Roadmap**

2015

- January • OSA Working group is formed by FMCG retail experts
- April • Startup team creation
- October • Partnerships with L'Oreal, Efes, JTI to implement OSA Hybrid Platform
- November • First retail chain integration

2016

- July • Partnership with Coca-Cola to implement OSA Hybrid Platform
- August • Proof of concept (POC) begins
- October • Partnership with Danone to implement OSA Hybrid Platform
- November • POC finished: 5.4% sales growth for our partner companies

2017

- January • Partnerships with Mars and SunInBev to implement OSA Hybrid Platform
- July • Partnership with Neuromation
- • Partnership with DLA Piper for business support in the USA
- August • Demo presentation to the VP of P&G global and to ECR Europe
- September • Onboarding of new retail chains (Metro C&C, among others)
- October • Company registration in the USA
- November • Awarded 1st place at the Intercontinental Startup Battle in Silicon Valley
- • Awarded 2nd place at d10e in Davos, Switzerland
- • Selected as a Top-5 Project at Live Sharks Tank in San Francisco, CA
- December • Demo presentation for Deloitte's head of global retail practices (followed by discussions for global cooperation)
- • Workshop with ECR Czech and Tesco retail chain in Prague
- • OSA Hybrid Platform partners and integrates with 10 retail chains and 12 manufacturers

2018

- January • Workshop with Economic Institute of France in Paris
- February • Meetup with Double Chain
- • Meeting with Deloitte
- March • USA office established in California
- • Awarded 1st place at d10e in Seoul, South Korea
- • Office setup in Korea
- August • Token Sale
- September • Business development team enhancement in USA
- October • Office and business development team set up in China
- • AI & Blockchain labs workshops in Asian academic institutions
- November • Office and business development team set up in Japan
- December • Retailers approach for Proof Of Concept B2B solution in USA, China, Japan, Korea
- • AI & Blockchain labs workshops

2019

- January • AI & Blockchain lab in Asia with top universities in region
- March • Marketing of OSA decentralized in focus markets
- April • POC in USA
- June • POC in China
- July • POC in Japan
- August • POC in Korea
- • Further business expansion in USA and China
- • B2C solution marketing in USA and China
- October • Further business expansion in Asia
- November • Decentralized platform deployment and promotion in focus markets

Three focus areas:

1) Scaling the existing solution detailed in this white paper. Focus on solution integration in the US, China, Korea, Japan and Russia.

2) Developing our technology to create AI as a service for end customers and businesses. Delivery and in-store management of this service

3) Product information app to ensure that consumers are making healthy purchasing decisions.

The OSA Team and Story

Our Strategy and Vision Lead, Maximilian Musselius, graduated from Lomonosov Moscow State University. He speaks six languages and is the Executive Director of Efficient Consumer Response (ECR) Russia. Max created one of the most successful ECR units in the world, leading him to secure a position as the Co-chairman of ECR Europe. While leading ECR for the last decade, Max developed and implemented EDI technology for the entire industry in his region, launched the Master Data Catalog Initiative, and organized six annual conferences and seven separate quarterly working groups.

Since 2008, Max has been tackling a challenge that plagues Russia's retail industry more than most: the understocking issue in organized retail that affected 19% of all product inventory (ECR data), one of the worst in the world. In response to this, Max assembled a working group of ECR members to launch a pilot to work towards a solution.

Among these members was Alex Isaiev, an ambitious FMCG veteran with over 17 years of experience in a variety of roles, ranging from sales, to marketing, to supply chain management. Alex was a key account manager at Japan Tobacco International at the time, searching for a project that would serve as a hallmark for his midlife professional career.

The duo pitched their idea to Barry Leventhal, the internationally renowned data science expert. Barry responded with suggestions on what technology the team should use. He also connected Alex and Maximilian with a development team based in the Ukraine who had previously approached him with a related product idea.

The Ukrainian team was an early stage startup, established by Yuri Dukhnich (Product Lead), Oleksii Potapenko (AI Lead), Oleksii Bezruchenkov (Backend Lead) and Ihor Koval (Frontend Lead). The project had excellent technology and product ideas to support it, but it lacked brand name, sufficient funding, and a business development team. Luckily, Max and his ECR working group had a budget, management experience, and connections to the world's largest FMCG brands. After a number of meetings, both teams decided to join their efforts.

At this point, the team had developed their minimum viable product (MVP) and started looking for a retailer who would agree to launch a pilot. The first retail chain to bite was Perekrestok, one of Russia's leading retail chains. Denis Shulga, the Supply Chain Director of X5 Retail Group, the managing company of Perekrestok, and Yuri Leonov, the Commercial Director of X5 at that time, helped to onboard OSA's MVP, to which all ECR members allocated a small budget.

With the pilot's launch, it became clear that the new venture needed the full-time commitment of its key founders. Max couldn't offer this dedication, for he was and still is committed to his industry stewardship role at ECR Russia alongside his strategic role with OSA. On the contrary, Alex decided not only to join full-time, but also to invest his personal funds into the company's growth, thus cementing his role as the team's leader. The team is now financially self-sufficient, while ECR, represented by Max Musselius, provides only strategic industry guidance.

After Perekrestok's successful pilot in November 2016, other members of ECR approached the OSA team to enquire about launching pilots for their own stores. At this time, the team decided to explore the potential of optical recognition technology to solve inefficiencies in in-store monitoring.

In 2017, the team reached out to Andrew Rabinovich, who developed computer vision and machine learning algorithms for photo and video annotations at Google for roughly a decade. When we reached out to collaborate, Andrew was working at Magic Leap and advising the AI-blockchain startup Neuromation, helping to pioneer synthetic data as unique data-sets for deep

learning algorithms in optical recognition. Andrew then connected Alex and Max with Neuromation's founder, Maxim Prasolov.

This networking played in each party's favor, as Neurmation ended up becoming the main optical recognition service provider for OSA. Maxim Prasolov and his team also inspired Alex to conduct a token sale for the OSA platform. Since 2016, Alex, Max and Yuri have looked to blockchain as the technology to prevent data loss and forgery, two problems that continue to negatively affect retail industries in developing countries. Unlike many ICOs that don't have a working product, OSA's Hybrid Platform has already delivered tangible solutions to multiple retailers. Given this success and the practical application of blockchain for supply chain tracking and inventory management, it's easy to justify OSA's token sale and the function of its blockchain ecosystem. Among other goals, the purpose of the token sale is to expand the OSA team, business, and technology on a global scale.

In 2018, the team rebranded their project as the Optimal Shelf Availability Decentralized Platform (or OSA DC) to reflect the new trend in the project's development. Before this rebranding, Ruslan Pyshnyi and Esther Katz joined as Strategy and Communications Lead and Chief Communications Officer, respectively (Esther previously held this same position at Neuromation).

Currently, OSA is onboarding five pilot integrations in Russia with METRO Cash & Carry, Magnit Retail Russia, Dixi, Azbuka Vkusa, Verniy, X5 Retail Group.

During our product development, the team confronted three large scale crises. Each of these enabled us to better understand our business, improve our product quality, and expand our team.

The first crisis marked a gap between our business development and product development teams. It became obvious that the tech team could improve its understanding of the nitty gritty of business operations, while the business development team definitely needed to brush-up on the product development side of things. As a result, we invested several months in swapping expertise between teams and reinventing our product.

The second crisis led us to abolish our product planning's release timeline. The market started demanding faster reaction to its product requirements, so we ended up implementing Agile sprints. This approach enabled us to adapt a more flexible product implementation that included continuous customer feedback.

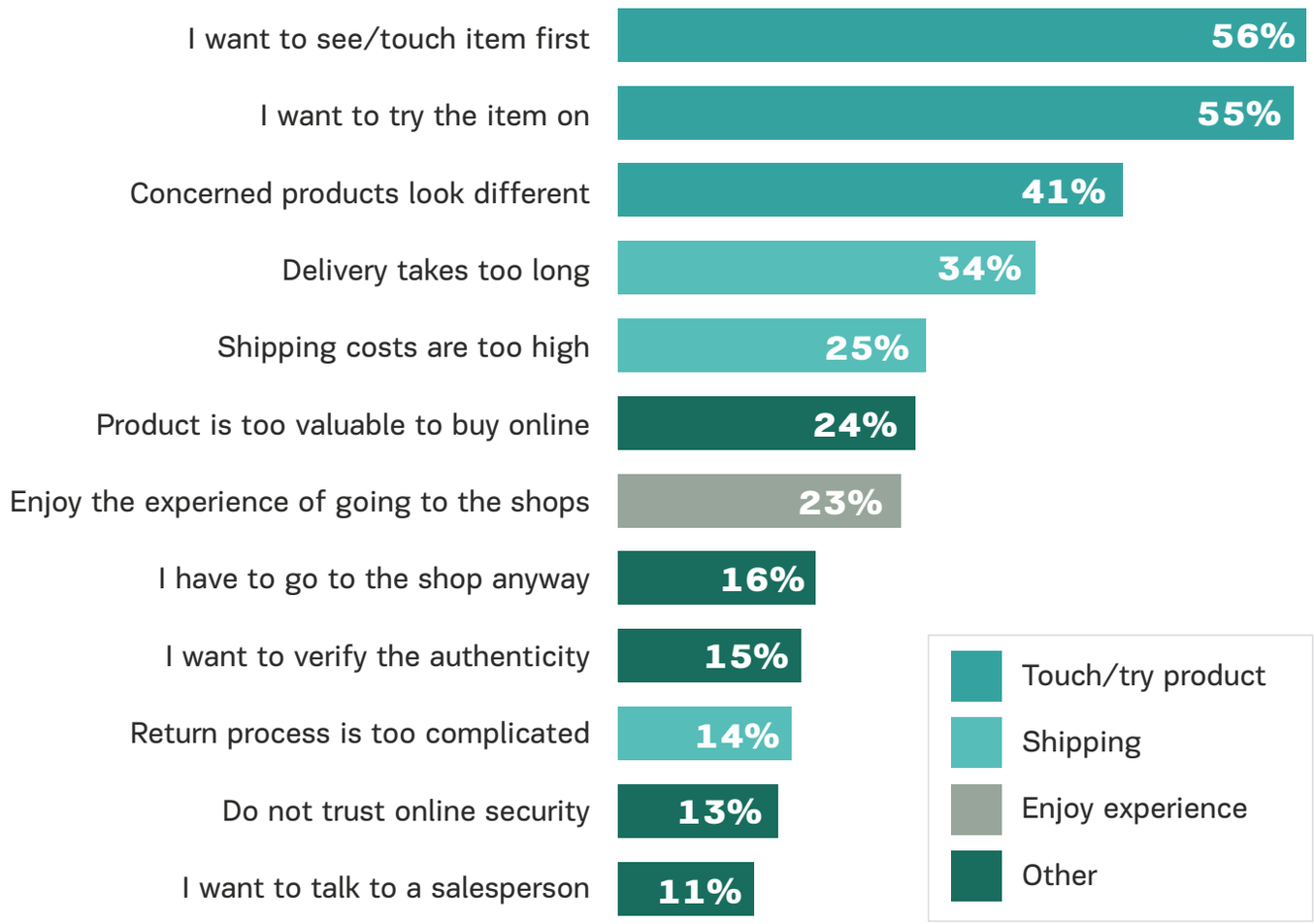
The third crisis demonstrated that our client's needs are growing faster than our capacity to implement solutions. This caused us to look at our product from a different angle, shifting from a single product solution to the entire OSA platform. Within this platform, we concentrated our efforts on improving infrastructure and key functions, leaving secondary features, such as IR, to third parties. Blockchain has become a perfect instrument for enabling this infrastructure.

Why Does it Matter?

On an international scale, online retail is certainly becoming increasingly popular, and it's expected to eventually supercede offline retailers as the dominant model in the industry. However, we expect traditional brick-and-mortar retailers to stick around longer than analysts predict. Currently, offline retail attracts 91% of total retail sales volume, and even with the advent of online alternatives, it continues to grow by an impressive 5% annually [Invesp][16].

This growth is, in part, due to in-store shopping's undoubtable advantages, ones that consumers are not going to easily give up (would you, for instance, buy produce online if you can't look at, feel, and measure the quality of that produce?). A full list of in-store shopping advantages are listed below:

Figure 26. **Reasons consumers shop in stores instead of online**



Source: Global Online Customer Report, KPMG International, 2017

Nevertheless, modern technology is constantly reinventing a retail landscape that continues to play a pivotal role in the daily lives of its customers. Like hyperloop city stations interwoven with real-time data of modern cities, the new retail paradigm will provide ambient shopping experiences assisted by cutting edge AI, IR, and machine learning technology.

Data engineering algorithms like OSA's own will make sure customers enjoy instant and highly relevant purchasing recommendations instead of mere advertisements. These recommendations will be based on a customers individual profile, which they will voluntarily submit. And they'll do so not from force or manipulation, but because they trust the technology's developers and the ecosystem in which these services operate.

We are building the OSA Decentralized Platform with the philosophy of trust in mind. We launched our project in 2017 after 3 years of researching our value proposition and working with our pilot prototype. In 2016, our team's collective experience and efforts culminated in our pilot with one of Russia's most respected retail networks, which was also sponsored by the world's most consumed FMCG brands. And we have even more retailers and vendors lined up to test our technology.

Now, our only limitations are gathering the best data and technology available and hiring the best engineering talent. Since major international technology corporations are also hiring in this field with their multimillion dollar budgets, it's hard to stay competitive. Nevertheless, we managed to organize a unique team of developers and engineers who know their stuff--and we've already built lasting solutions for leading retailers worldwide.

Our token sale is all about scaling. And we would like to use this opportunity to scale OSA not only in relation to its budget; we also in relation to market vision and exposure of our project on the global retail technology market. Just three years since its conception, our technology has already outgrown its domestic market. Please help us to take our vision to the international stage. We believe this journey will be fruitful to all involved, to both the OSA team and to you, our respected reader and future community member.

Avanti con amore!

References

1. A. C. McKinnon, D. Mendes, Nababteh, M. In-store logistics: an analysis of on-shelf availability and stockout responses for three product groups. International Journal of Logistics Research and Applications. Volume 10, 2007 — Issue 3: Logistics Research Netwok Conference (LRN 2006). https://www.tandfonline.com/doi/abs/10.1080/13675560701478075
2. Daniel Corsten, Thomas Gruen, (2003) Desperately seeking shelf availability: an examination of the extent, the causes, and the efforts to address retail out ‐ of ‐ stocks. International Journal of Retail & Distribution Management, Vol. 31 Issue: 12. https://doi.org/10.1108/09590550310507731
3. Calvin Lee. Demand Chain Optimization: Pitfalls and Key Principles. https://www.gsb.stanford.edu/sites/gsb/files/publication-pdf/white-paper-demand-chain-optimization-pitfalls-key-principles.pdf
4. Daniel Corsten, Thomas Gruen. Stock-Outs Cause Walkouts. https://hbr.org/2004/05/stock-outs-cause-walkouts
5. Fred Nickels. The 3 R's of Retailing in the Digital Age. http://independentretailer.com/2016/05/11/the-3-rs-of-retailing-in-the-digital-age
6. PwC. Achieving Total Retail: Consumer expectations driving the next retail business model. http://download.pwc.com/ie/pubs/2014-pwc-ireland-achieving-total-retail.pdf
7. Gene Bodenheimer, Mitigating packaging damage in the supply chain. http://www.packagingdigest.com/supply-chain/mitigating-packaging-damage-inthe-supply-chain140910
8. Rick Lingle, Damaged packaging a potential source of serious revenue loss. http://www.packagingdigest.com/packaging-design/damaged-packaging-potential-source-serious-revenue-loss
9. McKinsey. The Age of Analytics: Competing in a data-driven world. https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Analytics/Our%20Insights/The%20age%20of%20analytics%20Competing%20in%20a%20data%20driven%20world/MGI-The-Age-of-Analytics-Full-report.ashx
10. Total retail sales worldwide from 2015 to 2020 (in trillion U.S. dollars) — Statista: The Statistics Portal https://www.statista.com/statistics/443522/global-retail-sales
11. Kurt Kummerer. Average Customer Acquisition Cost By Industry http://kurtkummerer.com/customer-acquisition-cost
12. The Future of Grocery by Nielsen https://www.nielsen.com/content/dam/nielsenglobal/vn/docs/Reports/2015/Nielsen%20Global%20E-Commerce%20and%20The%20New%20Retail%20Report%20APRIL%202015%20(Digital).pdf
13. Khalid Saleh, Global Online Retail Spending – Statistics and Trends https://www.invespcro.com/blog/global-online-retail-spending-statistics-and-trends
14. Sören Auer, Christian Bizer, Georgi Kobilarov, Jens Lehmann, Richard Cyganiak, Zachary Ives. DBpedia: A Nucleus for a Web of Open Data https://link.springer.com/chapter/10.1007%2F978-3-540-76298-0_52
15. Colin Wood, Open Data Market Is Growing, Study Says. http://www.govtech.com/data/Open-Data-Market-is-Growing-Study-Says.html
16. Invesp http://invespcro.com/blog/global-online-retail-spending-statistics-and-trend

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