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Blockchain for Seafood Supply Chain Traceability

- Use Case & Insights

Preview

The interest in blockchain, started with the Bitcoin boom, has sparked many companies and institutions around the globe to try to develop new business models. This white paper introduces Samsung SDS' blockchain-based supply chain traceability service, the role of blockchain in promoting seafood sustainability with a use case and how it plans to take the blockchain service forward.

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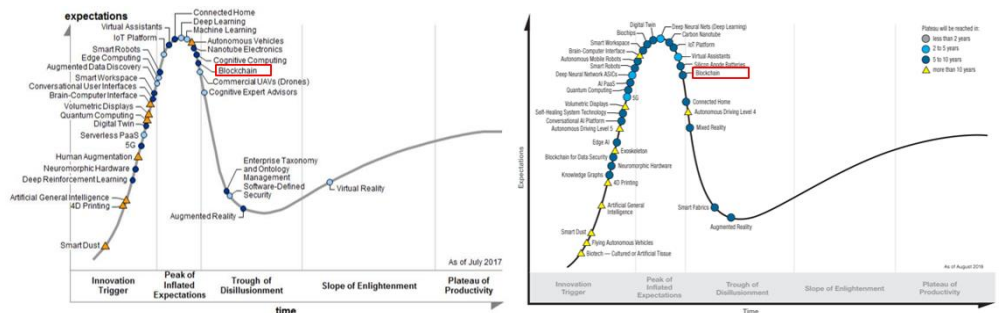
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01 Introduction

From R&D to Commercial Deployment

Blockchain was first known to the public as a technology that underlies secure transactions of cryptocurrencies. Then with the unprecedented Bitcoin boom in 2017, blockchain started to draw much attention from not just individuals but from businesses and governments. Many attempts have been made to see if it's actually feasible to adopt blockchain in administrative tasks or business activities.

[Figure 1] Hype Cycle for Emerging Technologies, 2017-2018

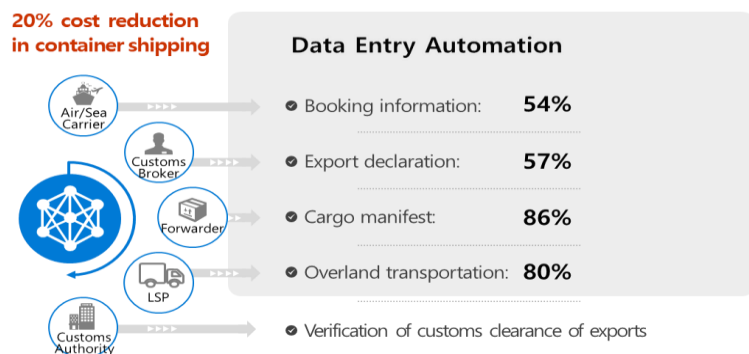


Source: Gartner (July 2017, August 2018)

The blockchain boom is also found in the Gartner Hype Cycle. Although blockchain technology drew a huge amount of attention back then, there wasn't a clear business model, as with other technologies on the Peak of Inflated Expectations of the Gartner Hype Cycle.

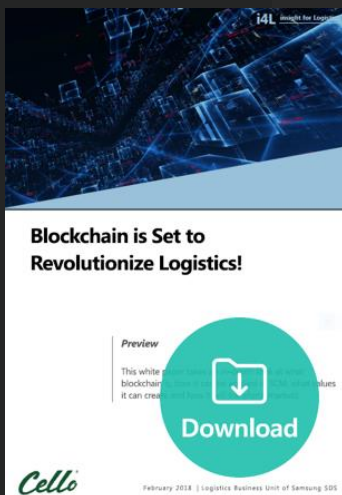
During that time, Samsung SDS carried out a research on what impact blockchain would have on logistics and formed the Blockchain Container Shipping Consortium with 38 businesses and institutions including customs authority, shippers, container shipping companies, port authority, banks, etc. Together, they ran a proof of concept (PoC) of Samsung SDS' blockchain platform on export shipping processes and found its benefits in terms of integrated visibility, process improvement and greater transparency into transactions.

[Figure 2] Export Process Automation & Cost Reduction



Source: 『Blockchain Export Customs Clearance Service Pilot』 Report, Korea Customs Service

White Paper on Blockchain in Logistics





Found blockchain-based
**process
automation** can
help **reduce costs**
and started
**traceability
services.**



In 2018, Samsung SDS partnered with Korea Customs Service to develop a blockchain platform for export customs logistics services. And together, we found blockchain-based process automation can help reduce costs as described in Figure 2.

At the same time, Samsung SDS started supply chain traceability services by leveraging immutability of blockchain technology as blockchain-enabled traceability can be applied in different areas and in different ways.

Among many different areas blockchain-based traceability can be applied, Samsung SDS decided to work on seafood traceability first for reasons below:

- Seafood is the main source of protein for Koreans. Korea is among the top fish consumer country.
- Illegal fishing causes seafood extinction.
- Concerns are rising over food safety and environmental pollution.
- Consumers are calling for a sustainable seafood market.

This white paper explains the current issues facing the seafood industry, the features of blockchain traceability services and how the traceability platform developed by Samsung SDS can help solve the issues.

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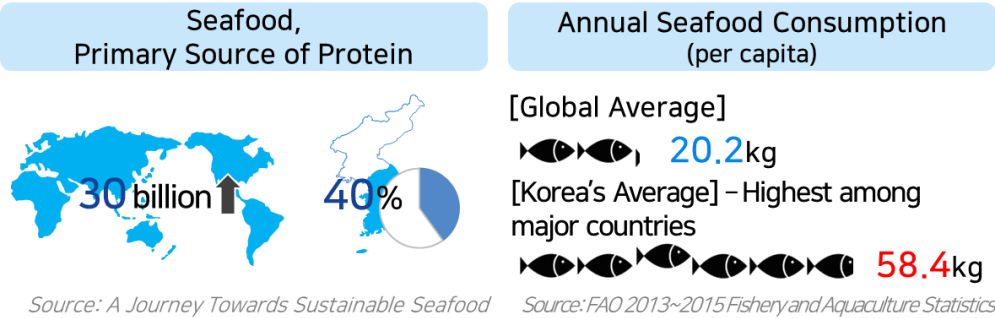
A Changing Global Seafood Industry

Overview & Key Issues

In its 2018 report titled A Journey towards Sustainable Seafood, the World Wildlife Fund (WWF) mentioned that approximately three billion people in the world or more than half of the world's population rely on seafood as their primary source of protein. In Korea, 40 percent of its protein intake is from seafood.

According to Fishery and Aquaculture Statistics 2016 published by the Food and Agriculture Organization (FAO), global per capita consumption of fish grew 3.2% on average over the last 50 years. It was 20.2kg between 2013 and 2015 and continues to grow. During the same period, per capital consumption of fish in Korea was estimated at 58.4kg, the highest among major countries.

[Figure 3] Seafood Consumption



Fish Species on the Brink of Extinction

Meanwhile, ocean species are disappearing faster as seafood consumption has increased dramatically along with the exponential population growth in developing countries. Plus, extensive overfishing has significantly reduced fish stocks.

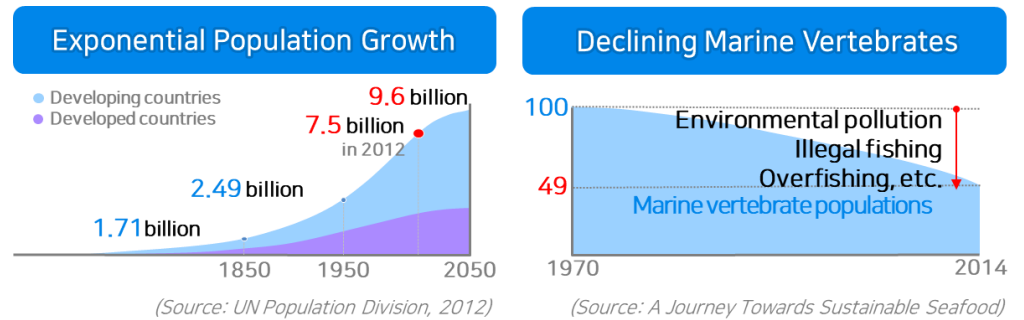
The UN Population Division estimated in 2012 that the global population, which was 2.5 billion in 1950 will grow to 7.5 billion in 2012 and reach 9.6 billion by 2050.

According to the WWF's estimate, environmental pollution, illegal fishing and overfishing caused the marine vertebrate population to decline by 49 percent between 1970 and 2017.

In addition, concerns keep rising over food safety since the damage to the nuclear power plant in Fukushima and the subsequent detection of radioactivity in fish and vegetables.

For those reasons, stocks of fish, the major food staple for humans, are quickly declining. And concerns are rising that they might extinct in the not too distant future.

[Figure 4] Major Threats to Ocean Life

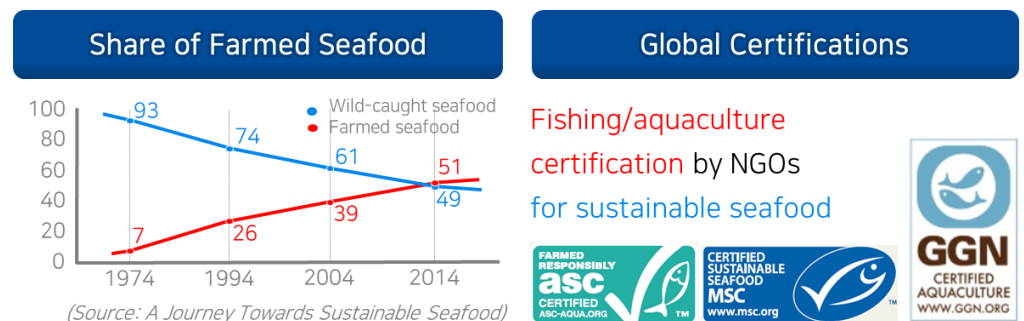


Ways to Protect Ocean Resources

In response, the international community has increased fish supplies via aquaculture, developed a clear set of standards on seafood production and adopted certification system to recognize compliant companies with the standards.

As a result, while 93 percent of the seafood consumed was from fishing in 1974, aquaculture accounted for 51 percent of all seafood supplies in 2014. In response, led by NGOs, guidelines have been set on eco-friendly seafood production to fight against illegal fishing and certified firms are given the right to use eco-labels.

[Figure 5] Creating a Sustainable Seafood Environment



Another Non-Tariff Barrier

Along with those efforts, a growing number of consumers and global retailers are recognizing the importance of sustainable aquaculture, contributing to a wide adoption of the international farming standards by sourcing certified seafood products first.

As explained in Figure 6, retailers such as Walmart, Costco and Carrefour as well as hotels chains including Hyatt Hotel have set guidelines on purchasing and handling certified seafood products and they are increasing the quarter of sustainable seafood sourcing.

[Figure 6] Growing Awareness in the Seafood Market

Carrefour	Costco
<ul style="list-style-type: none"> Plan to sell ASC or MSC-certified fresh fish only 	<ul style="list-style-type: none"> Sell ASC-certified fresh fish only Aquaculture Improvement Project (AIP)
Walmart	Hyatt Hotel
<ul style="list-style-type: none"> Require all fish suppliers to source from fisheries that are certified or engaged in aquaculture improvement project by 2025 	<ul style="list-style-type: none"> Set global guidelines on food sourcing Purchase more than 15% of its seafood supply from certified fisheries or farms

Source: KMI Trend Analysis Vol. 88

Furthermore, major advanced countries today are taking non-tariff measures, such as customs procedures, inspection & quarantine, etc., in order to guarantee food safety and sustainability. A key example of this is the Seafood Import Monitoring Program (SIMP) of the U.S. The SIMP has been introduced to prevent seafood products identified as being particularly vulnerable to illegal, unreported, and unregulated fishing (IUU) and/or seafood fraud from entering the U.S.

[Table 1] 13 Species Covered by the First Phase of the SIMP

<ul style="list-style-type: none"> Abalone King Crab (red) Shrimp Atlantic Cod Pacific Cod Swordfish Blue Crab (Atlantic) Red Snapper 	<ul style="list-style-type: none"> Dolphinfish (Mahi Mahi) Sea Cucumber Grouper Sharks Tunas: Albacore, Bigeye, Skipjack, Yellowfin, and Bluefin
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Source: SIMP Compliance Guide

The information to be collected under the SIMP includes producing entity (name and flag state of harvesting vessel, evidence of authorization to fish, type of fishing gear), seafood products, product form at the time of landing (quantity, weight, etc.), areas of wild-capture or aquaculture harvest and the importer's information.

These strict requirements mean that producers and exporters need to get global certifications and keep records of all supply/export processes from production to distribution while the data they submit as proof has to be reliable. Seafood farms or retailers not prepared for these changes will be facing non-tariff barriers, thus suffering more seriously.



A greater focus on sustainability means more **global certification** and **data reliability**.



03

Blockchain for
Greater
Reliability

What Does the Evolving Seafood Industry Tell Us?

Whenever food safety issues arise, one of the problems is that companies just argue that they sell HACCP certified products and no particular issues have been found in their recent inspection.

This is mostly due to the fact that people have no access or visibility into the end-to-end process, from sourcing to sales. Also, if a producer or retailer deliberately distorts key information like product origin or expiry dates, there are no concrete ways to identify and address the problem.

Given that there is a growing awareness of food safety in the market, what's needed is keeping accurate records on production/distribution and managing them reliably.

To be more specific, there are largely the following three major trends in the market.

First, consumers today have increasingly become aware of the importance of food safety and sustainability. They ask food producers and retailers to have a greater sense of responsibility in what they produce and to put some traceability system in place. They also ask for reliable information on the entire production and distribution journey.

Second, to meet the growing consumer expectations, seafood producers and retailers need to build an eco-friendly production/distribution system that also enables them to provide transparency and traceability.

Lastly, as global retailers are changing sourcing requirements and major importing countries are taking non-tariff trade measures, seafood producers need to acquire global certifications and adopt differentiation strategies.

Figure 7 shows what next steps need to be taken in response to these evolving trends.

[Figure 7] Evolving Trends in Seafood Industry & Next Steps

	Key Trends	Next Steps
01 Growing consumer awareness	<ul style="list-style-type: none"> • A system guaranteeing responsible production /distribution • Growing demand for food safety and sustainability 	<ul style="list-style-type: none"> • Provide integrated visibility into production and distribution • Enable people to track all records
02 Advanced seafood industry	<ul style="list-style-type: none"> • An eco-friendly production environment • Transparent and traceable production /distribution 	<ul style="list-style-type: none"> • Adopt standards in production/distribution mgmt. • Build a data sharing system
03 Trade barriers	<ul style="list-style-type: none"> • Global standard compliance in seafood sourcing and exports 	<ul style="list-style-type: none"> • Establish a key data management system • Take a strategic approach by developing data management/verification system

Source: Samsung SDS

Applying Blockchain to Enhance Reliability

Earlier, it was mentioned that we need a reliable production and distribution environment to keep up with changing market trends and that this requires system standardization and gold standard compliance.

The question is, can we really ensure data reliability if we let companies manage and share supply chain data by themselves? The answer is that you can't expect companies to always act in good faith. In other words, there needs to be some kind of a system that guarantees no falsification in the process of data creation, collection and management as well as a full transparent disclosure to consumers.

To sum up, a traceability system needs to enable people to have access to all production and distribution records, allow no alternation or falsification of the records and ensure global certifications and reliability. These requirements can be addressed with blockchain technology as it provides immutability, reliability and transparency. In fact, it is thanks to the benefits of applying blockchain technology that we're seeing a number of use cases particularly in supply chain traceability and food trust.

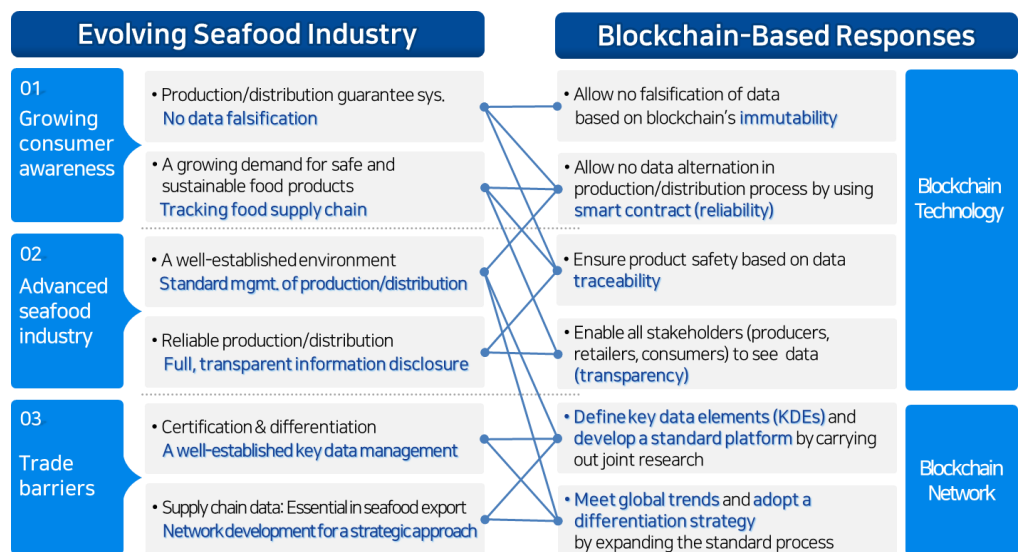
In addition, if we can create a blockchain network with other companies, public institutions or NGOs, global certification organizations and collect/manage data by complying with global standards, we will be able to provide a higher level of credibility. In this regard, blockchain technology is essential to creating a trustworthy production/distribution environment.



It's important to enable people to have access to all tamper-proof records, and this can be addressed by adopting **blockchain** technology.



[Figure 8] Applying Blockchain for Enhanced Reliability



Source: Samsung SDS

As part of the initial efforts to develop new blockchain services for the logistics and retail markets, we at Samsung SDS started to work on traceability service development based on its three to four years of expertise on blockchain technology. We found the following three things to work on:

First, check the feasibility of the new service

Second, develop a blockchain-enabled platform and launch a service

Third, create a network with businesses and institutions in the sector and expand the network

We've been working on these three since 2017. We're going to explain the first two in the next chapter with a case and then briefly introduce the last one in the later part of this white paper.

04

Use Case: Blockchain Supply Chain Traceability Service

A Successful PoC Run

In 2017, Samsung SDS started to discuss with the City of Busan to develop new businesses based on Industry 4.0 technologies such as IoT, blockchain and big data. As we reviewed a few candidates, focusing on Busan-based businesses, one that came up was tracking the supply chain of seafood products. We then ran PoC tests for Company A's fish cake products to check business feasibility.

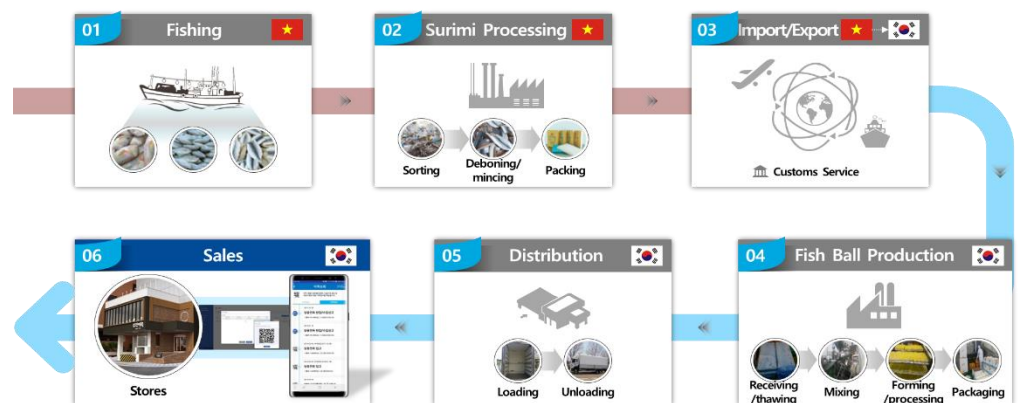
There were several reasons why Company A decided to join the PoC. First, they wanted to enable consumers to see the origin of surimi (the main material of fish cake products), as there was a growing concern over seafood safety since the nuclear plant disaster in Fukuoka. Second, they needed to increase customer trust that they don't involve any act of changing expiry dates.

Surimi, the main material used to make fish cake, was being mostly imported to Korea from Southeast Asian countries, such as Vietnam and India, and the U.S. For the PoC, Samsung SDS developed a blockchain platform where consumers can gain visibility into how Company A makes its fish cake products by mixing surimi with other ingredients and distributes them.

To ensure credibility of the origin data of surimi, we integrated the platform with UNI-PASS of Korea Customs Service via API and enabled buyers to see that all materials passed import declaration, inspection and quarantine. Also, we put a QR code for consumers to scan and check expiry dates registered in blockchain by themselves. This way, we eliminated any chance of changing data in the distribution process.

From the PoC runs, we checked the feasibility of the business since we were able to ensure credibility of the origin data as well as no data falsification during distribution process. It was also possible to quickly recall products by date and by shipping destination if issues arise by checking the lot.

[Figure 9] A PoC to Track the Supply Chain of Company A's Fish Cake Products



Source: Samsung SDS

Platform Development & Service Launch

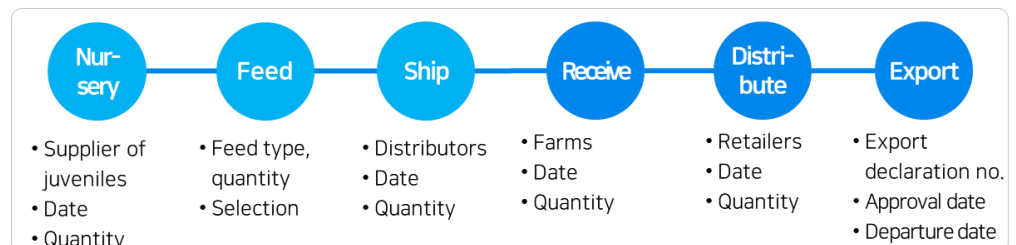
Among many businesses which contacted us after the success of the PoC run, we started to work with Company B, the first Asian company to obtain certification from the Aquaculture Stewardship Council (ASC), to develop a platform to track abalone aquaculture and its supply chain.

The ASC is an independent non-profit organization that manages the world's leading certification and labelling programs for responsible aquaculture of nine species. The organization is increasingly recognized around the world.

To obtain the ASC certification and pass annual audits and reassessments afterwards, we managed Company B's aquaculture data—e.g. farming records, energy efficiency, in/out quantities, feed, etc.—on a system basis to respond quickly to any requirements during assessment.

The most important step in platform development is defining key data elements (KDEs) and traceability data structure. Figure 10 below shows KDEs of abalone aquaculture supply chain.

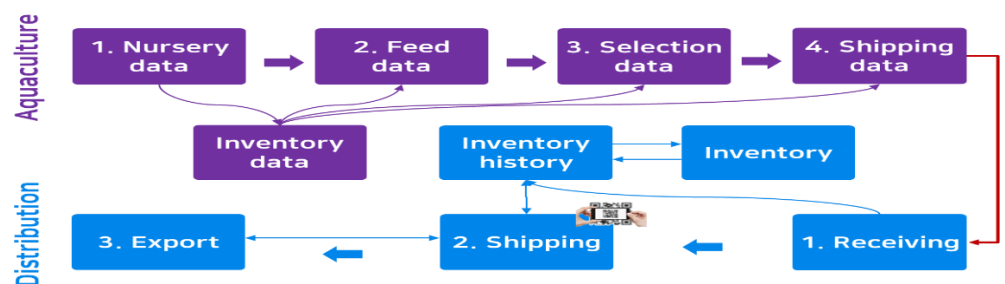
[Figure 10] Company B's Abalone Aquaculture KDEs



Source: Samsung SDS

In addition, to ensure data traceability, we made data at each step to be tracked with order number, progress number and lot number.

[Figure 11] Data Structure for Traceability



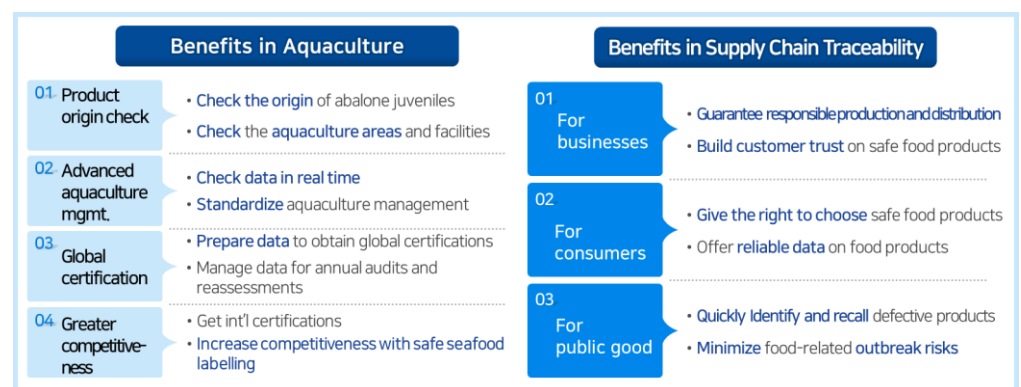
Source: Samsung SDS

With the blockchain platform, aquaculture farms can manage data on nursery (stocking young abalones in floating sea cages), feeds (seaweeds and kelp once a week), selection (once or twice a year) and distribution to retailers while retailers manage data on receiving, storage (inventory control), shipping, export, etc.)

All data is recorded in the blockchain and accessible at any time. Buyers can scan the QR code on the product package and see for themselves the key, tamper-proof data about aquaculture and distribution.

As such, the blockchain-based traceability supply chain platform helps aquaculture farms can better manage data and prepare for global certifications. At the same time, it gives consumers the right to choose safe food products while helping companies build customer trust.

[Figure 12] Benefits of the Blockchain Platform



Source: Samsung SDS

So far, we've looked at the blockchain-based supply chain traceability service developed by Samsung SDS. Now, let's briefly find out how Samsung SDS plans to take the blockchain platform service forward.

A Blockchain-Enabled Reliable Ecosystem

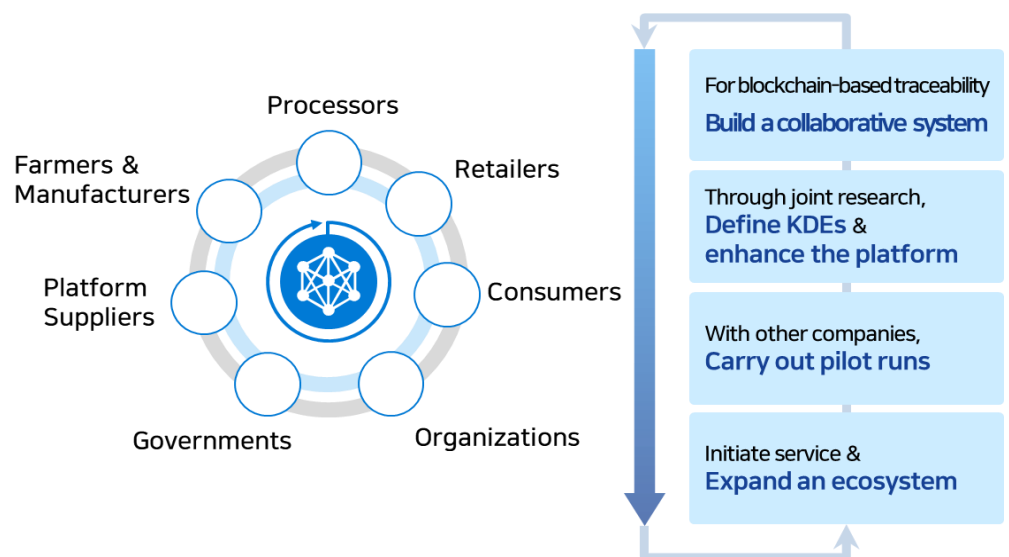
The heightened interest in blockchain, started with the Bitcoin boom, has led to a number of companies and institutions around the world to try to develop new business models. Samsung SDS too has embarked on its blockchain projects. One of those projects is the seafood supply chain traceability model.

If you look at Gartner's Hype Cycle mentioned earlier, blockchain was at the far end of the Peak of Inflated Expectations in 2018 and entered the Trough of Disillusionment last year. Indeed, it is true that the once heightened interest in blockchain has now much declined. However, as with other technologies, companies which have managed to make success cases after many trials and errors will continue to make investments and eventually come up with better blockchain business ideas.

With a growing awareness of sustainability in the global market, customers expect companies to be more reliable and responsible. Companies in turn will have to be more committed to greater transparency and traceability in terms of the information they provide to customers. If they develop new services by leveraging the benefits of blockchain, it will be a great opportunity to reinvent the market.

At Samsung SDS, we're going to continue to find like-minded companies and relevant institutions, collaborate with them and carry out joint research to create new services. This way, we're going to create an ecosystem that ensures greater credibility.

[Figure 13] Creating a Reliable Ecosystem



Source: Samsung SDS

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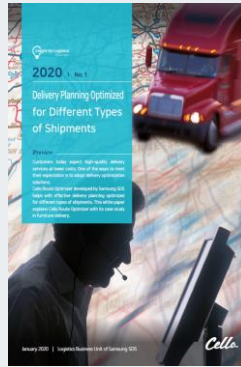
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- Container Yard Management (Cello CYM) Development
- Cello Smart IoT Platform & Business Development
- Blockchain-Based Traceability Platform & Business Development

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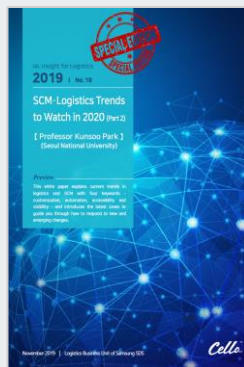
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