

DISRUPTIVE TECHNOLOGIES AND THE INTELLIGENT **SUPPLY CHAIN®**

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The digitization of supply chains represents an enormous challenge for most companies. The resources and investment required, as well as inexperience with new technologies, are just some of the obstacles.

We all know that technologies evolve at a rapid and exponential pace. In fact, it is sometimes difficult to stay on top of trends and the new technological solutions available, especially in the food and beverage (F&B) industry.

This white paper examines three new and disruptive technologies—blockchain, artificial intelligence (AI) and the Internet of Things (IoT)—and their impact on highly complex F&B supply chains.

New technologies for the taking

BLOCKCHAIN

What is blockchain, other than one of the most hyped buzzwords of the twenty-first century? Technically speaking, blockchain is “a means of recording continuously produced data in the form of blocks connected to one another in chronological order of their validation, with each block and its sequence being protected from modification¹.” In the world of cryptocurrencies, blockchains serve as decentralized public registers to conduct secure transactions without the need for a third-party authority such as a financial institution.

In fact, the beginnings of blockchain are intimately linked with Bitcoin, the cryptocurrency that was the first to use blockchain in a concrete way. Blockchain allows secure transactions between users anywhere in the world. For Bitcoin to operate as it was intended—without banks or competent authorities—there must be a registry of exchanges and transactions (money exchanges for this currency having once



¹<https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000034795042>

reached a record \$215 million per day) in a shared ledger. That's precisely what blockchain provides, using a system of consensus based on game theory and smart contracts.

To conclude a Bitcoin transaction, several validations are required, such as available funds, the identity of the recipient, etc. These transactions are then recorded, validated and stored in blocks, consisting of several transactions and a key in the form of a mathematical "hash" related to the previous block. All of this allows users to verify whether a block has remained the same or been changed.

Security is therefore an essential part of blockchain technology. The only way to change data would be to access the thousands of computers containing the information, bearing in mind that the information is now in the past.

It is therefore improbable that someone could access data or modify it, not only because it would be an enormously complex task, but because the person would be instantly detected.

There are two types of blockchains, each filling a specific need:



Public blockchain

used by cryptocurrencies such as Bitcoin, which was the first to apply the technology on a broad scale



Private blockchain

operating on a private network in which a large company, for example, could modify the protocol at any time, with restricted and secure access

Blockchain at OPTEL

Let's take our company as an example. At OPTEL, we specialize in end-to-end traceability (E2E), from raw materials to the consumer. We use software and hardware and, historically, we house data on site or on our clients' premises. We want to ensure the security of our clients, their information and their data.

As an ultra-versatile technology, blockchain can easily adapt to any industry. For OPTEL, blockchain technology brings significant and global benefits to our multidisciplinary clientele:

Transparency Users can see the history and evolution of products in the supply chain in real time.

Data security: The data becomes immutable; it cannot be altered or deleted.

Interoperability: Users can share information between systems, where such sharing was not possible before; however, the basic premise is that the data is structured in a standard format.

All this makes blockchain an interesting technology for OPTEL to apply in certain business contexts.

Challenges for the food and beverage industry

Let's take, for example, a large F&B company that sells food to retailers and has to negotiate a sales contract. The company has its database, and the retailer has its database, and a limited amount of information is exchanged between them.

The two entities could add and share their information in the same decentralized database (blockchain), with the help of smart contracts that validate each transaction. The two partners would then receive the same information in real time, allowing them to negotiate easily and openly.

The evolution of new technologies

What about the future? Is this technology here for good? If we rely on the Gartner Hype Cycle, we are currently in the introductory phase of blockchain technology in different markets. Next will come what Gartner calls the "peak of inflated expectations²," followed by a period of disillusionment. After that will come a period in which sustainable products and services are developed – the last stage of mass acceptance – which should happen in five to seven years.

The technology could use the time to be perfected. From OPTEL's point of view, two key elements are missing: the application layer, because blockchains need an interface and a software program, and the creation of ecosystems in which people can share structured and standardized data.

Once we've tamed the technology, blockchain has the potential to become a global, real-time working tool, no longer restricted to Bitcoin. For instance, thanks to the Intelligent Supply Chain®, OPTEL will be able to use disruptive technologies like blockchain to solve major problems in the food and beverage industry, by providing greater visibility for all players in the supply chain.

ARTIFICIAL INTELLIGENCE (AI)

Another emerging technology that has been making headlines is artificial intelligence (AI).

Combining information technologies, mathematics, neurosciences and much more, artificial intelligence can solve highly complex logical and algorithmic problems by surpassing human intelligence in its ability to learn, make decisions, analyze and even reason.

AI runs on data from a variety of sources, such as information systems, factory production modules, social media, smartphones, transactions, GPS information, etc.

The food and beverage supply chain is typically very complex because ingredients are sourced from all over the world and the finished products are often exported. In addition, the F&B market is highly competitive and works on small margins. The supply chain is the function par excellence that needs to become more intelligent and efficient.

Much confusion exists as to what AI can and cannot do, and how to apply it. Often the problem to solve is poorly defined, the data is badly structured, and the defined algorithm is not directly related to the problem at hand. Thus, AI is a formidable tool that needs to be properly used to be fully effective.

²<http://www.lesaffaires.com/dossier/encourager-la-commercialisation-des-innovations/predire-les-technologies-prometteuses/597608>

Here are the steps to take before implementing an AI project:

1. Identify the business problem that needs to be solved. Clearly define the key performance indicators that will measure the factors influencing the problem.
2. Identify the causal variables that influence the problem.
3. Identify the key performance indicators that will be useful for validating improvement.
4. Structure and standardize the data that will be used in the project. Create a twin database, if applicable.
5. Apply an appropriate algorithm in the data environment.
6. Measure the results and assess your success.

Here are certain practical problem-solving applications for AI:

- Demand and price management: analysis of several variables and data on climate changes, the economy, embargoes and currencies, etc.
- Waste reduction; maximizing the use of raw materials and recuperating or reselling surplus
- Marketing process offering promotions and personalized options, customer-engagement programs and information on your product's consumers
- Farm management tool: weather, soil quality, risk evaluation, seed and fertilizer strategies adapted to products, watering, process history, product characteristics, etc.

How do AI and Blockchain coexist?

As we have seen, to carry out an AI project, it's important the data environment be well structured and standardized in a centralized database. A centralized database makes querying easier, like when performing a Google search.

By contrast, a decentralized database such as a blockchain is by its very nature decentralized and distributed. No standards currently exist for structuring industry data. In addition, the nature of blockchain databases renders database queries difficult and inefficient.

In other words, using a blockchain to conduct an AI project is not recommended. In fact, it would be the worst database to house an AI project.

What's important to conclude is that blockchain and AI are complementary technological tools that solve problems of a different nature.

The Internet of Things (IoT)

Intelligent devices have been part of our daily lives since the 1980s (e.g., vending machines that track the inventory and temperature of the products they contain). The Internet of Things (IoT) integrates the connectivity of everyday objects that use technology to communicate and interact with the external environment via the Internet.

All objects can be connected to the Internet, which allows for remote surveillance and planning. For example, consumers could have 24/7 access to the inventory of the food in their fridge, and they would receive alerts or notifications about items to buy. Complementary to AI, the Internet of Things acts as an important management and optimization tool for businesses.



Benefits

- Ability to collect data on consumers, allowing companies to know them and identify their needs to better target them
 - Business management and optimization: easier access to information and data as well as optimal connectivity of existing processes and tools
 - Easy locating and identification of food products throughout the supply chain, bringing greater visibility
 - Reduced maintenance costs and inventory volume, optimization of the ordering process and more precise monitoring of operations
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To sum up, these three disruptive technologies all have an important role to play:

1. The Internet of Things collects data
2. Artificial intelligence gathers and analyzes the data
3. Blockchain secures the data

For the food and beverage industry, blockchain, AI and the IoT are all useful technological tools to achieve end-to-end traceability of the supply chain, creating greater visibility from raw materials to the end user. Together, these three innovative and high-performing technologies revolutionize supply chains.

By combining data collection at all levels of the chain to internal and external variables, to the

demand versus the available supply, and to many other factors, your systems will make better-informed decisions. Thus, you will be able to connect your products to the end user and the end user to your products.

Unprecedented connectivity; increased visibility; security; disruptive, enabling technologies like blockchain, AI and IoT—the perfect ingredients for an optimized supply chain.

OPTEL has combined these ingredients and its three decades of expertise to create the Intelligent Supply Chain®, providing *true* end-to-end traceability as no other company can.

For more information on OPTEL's traceability solutions, visit www.optelgroup.com.

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