AZHOS

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Proof of Existence for Supply Chain Finance

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Abstract

The value chains of the chemical-pharmaceutical industry span the entire globe. Complex supply chains and long storage times are responsible for a drastic increase in tied-up capital. Customer optimizations, such as the introduction of just-in-time production or the enforcement of long payment terms, further extend the period during which producers have to finance their circulating assets. Even in times of potentially cheaper financing, the access remains limited due to the stricter requirements imposed on banks and financial institutions by the Bank for International Settlements (BIS). In addition, the expense of settlement modalities makes it more difficult to finance working capital.

Cross-border exchange of resources and inter-company coordination costs make the processing of financial transactions more complex and innovative technologies like blockchain can only slowly enter this industry. While there are significant values tied up in the supply chains, shareholders expectations of returns are rising and with them the demands placed on company management. This is shown in the linking of variable remuneration components for Management Board members to capital ratios. In this key figure-driven market environment, AZHOS offers a new form of supply chain financing based on blockchain technology.

AZHOS has twenty years of experience in supply chain optimization, with data gen-

erated from thousands of data points in tanks and warehouses worldwide. By utilizing latest measurement technology with industry standard compatibility in combination with immutable measurement data stored on the blockchain, AZHOS provides a unique Proof of Existence in a trust-free environment, to enable a consumption-based financing of goods.

This document describes the automation of supply chain finance processes and the infrastructure to be created, the design of the AOS token and the establishment of a financing network for the chemical industry.

Description

This document contains the Azhos whitepaper V 1.1.0 Azhos will constantly keep it up-to-date to the best of its abilities so that it reflects the latest developments and events.

The whitepaper is intended solely to present AZHOS's business model, the economic context and the financial basis of the STO and is intended solely as a supplement to the Prospectus. The whitepaper therefore does not serve as a basis for an investment decision in the AOS token.

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Acronyms

ERP	Enterprise Resource Planning - System
GI	Goods Issued
IoT	Internet of Things
O	Order
OC	Order Create
OR	Order Response
PoD	Proof of Delivery
PoE	Proof of Existence
PoI	Proof of Inventory
RFID	Radio-Frequency Identification
SAP	Software Anwendungen Programme
SCM	Supply Chain Management
SN	Shipping Notice
STO	Security Token Offering
VMI	Vendor Managed Inventory

Chapter 1

Introduction

1.1 AZHOS

The banking crisis of 2008 has a global impact on the financing capability of companies up to this day. Even if the financial crisis seems to be overcome, the granting of corporate loans remains restricted due to stricter equity capital regulations imposed on banks. At the same time, the globalization of value chains has led to a general increase in tied-up capital due to long storage times and transport routes for raw materials and products. The international exchange of resources also makes the processing of financial transactions more complex and increases inter-company coordination and transaction. To oppose these developments, there are various cooperative instruments in addition to traditional financial instruments, like the Supply Chain Finance concept. These innovative financing concepts are implemented within financial networks that are exclusively dedicated to the management of financial flows McKinsey quantifies the current global market potential for supply chain finance solutions "[…] with 2 trillion USD in financeable highly secure payables globally and a potential revenue pool of 20 billion USD". Reasons for the fact that market potentials in the range of supply chain financing are besides insufficient awareness of novel financing approaches, the persistent barriers between the financial market and industry. As a result, the market lacks access to new innovative solutions. Another factor for the underutilisation of the potential is to be seen in the immense scope of the deliveries of goods of the global supply chain, which is reflected in the inherent transaction costs of financing processing. The founders of AZHOS have already been successfully active in the field of supply chain automation for the chemical-pharmaceutical industry for twenty years and can fall back to extensive experience with the culture and processes in the industry during this time. The team is complemented by renowned expertise in the fields blockchain and finance technology. The combination of the knowledge about the market situation, the existing know-how in the recording and processing flows and the specific benefits of blockchain technology, enables AZHOS to utilize a novel automated financing option on bulk and packaged goods.

1.2 Chemical and Pharmaceutical Industry

Chemical products surround us in almost every second of our everyday lives. Hardly any other industry has such a diverse and comprehensive product portfolio, a comparably customer spectrum or is linked more closely to a large number of other industries. The chemical industry is further characterized by the high added value of its products and production processes. Chemical products pass diverse processing steps at different locations around the globe until they are expended by customers or end consumers. End-to-end transparency of the supply chain is therefore considerable important. The chemical-pharmaceutical industry is characterised by globally networked supply relationships, as well as a high willingness to invest and innovate and a forward-looking view of capital ratios. For the year 2018 the German Association of the Chemical Industry(VCI) expects a further increase in research and development volume to 11 billion EUR by German chemical companies alone. Compared to the all-time high of 10.8 billion EUR in 2017, a new record will be achieved. Also or precisely because of blockchain technology, the industry is feverishly working on new fields of applications and the formation of various research groups and organisations.
Buyers of chemical products depend on the continuous availability of their raw materials. In order to guarantee the required constant availability and quality of supplies, the main focus is set on monitoring, automating and digitizing entire supply chains through measurement technologies and sensors along the path. By implementing these technologies, shipments can now be controlled and executed as needed, to ensure the flow of goods meets the customer's requirements. In addition to consumption-based provisioning, an automated consumption-based financing is the next step in releasing capital tied-up in the supply chain and thus reducing capital and transaction costs.
In fact, in today's production economy, the terms of payment only cover parts of the time where the capital is tied up in current assets. In addition, there are production and transport times or consignment stocks. The time span between leaving the producer's warehouse, the delivery and storage at the customer's warehouse, up to reimbursement, can therefore easily cover several months.

By applying techniques like factoring these periods could be shortened, but this is only possible with considerable administrative effort or not at all. Despite the potential financing volume of hundreds of billions of euros of global capital tied-up in the supply chain. While buyers benefit from long payment periods and consignment agreements, sellers have to bear the costs in the form of financing current assets.

1.3 Digital transformation

The Internet of Things (IoT), is predestined for supply chain optimization and an omnipresent development in the producing industry. With the current technical development, and an ongoing trend to cheaper devices, the willingness of companies to implement "smart" processes increases noticeably.

The main part of today's digitization efforts is partaken in the field of the "Connected Industry", whereby the development towards the smart supply chain with all its potential plays a special role. In the course of this digital transformation, the importance of data pools and the entities they control is further growing.

The difficulties of implementing digital transformation processes lie to a large extent in the discrepancy between strategic implementation efforts and the possibilities of operational units to follow them. This applies both to the chemical-pharmaceutical industry itself, as to its service providers. Especially in the field of supply chain automation and disruptive technologies like distributed ledgers, there is a lack of so-called "real-world assets". This means that actual data sources, e.g. sensors or measurement technology, are limited or even do not exist. At the same time, certain changes can only take place successively due to the deviation between the actual and target conditions mentioned above. Conversely, core processes and their functions must first be analyzed and mapped to the functionality of new technologies such as blockchains and smart contracts. The need for integration of real-time data quickly becomes obvious.

In this constantly growing market segment, combined with the largely unused possibilities of smart contracts, AZHOS offers a solution for automated financing of bulk and packaged goods.

1.4 Business Model

AZHOS provides the needed instruments to enable a consumption-based, automated financing solution of bulk and packaged goods, which could so far not be realized at reasonable expense or in a legally permissible manner. AZHOS has decades of experience in the automation and digitization of supply chain processes and active access to real-time data from production and storage facilities around the world. Using the described data points, consisting of sensors and measuring technology as well as remote-terminal-units at the production or consumption site, it is already possible to call up stocks of bulk goods in real time in order to process them for automated delivery or the settlement of consignment stocks.
The concept of an automated consumption-based payment, is adapted from the experience in the field of Vendor-Managed Inventory (VMI) and only possible due to the features made available by DLT. Real time inventory levels and stock changes are linked to shipping notes and order confirmations and processed in a way, that they can be used to automate payments by affiliated financial institutions - capital previously tied up in the supply chain. The goal of AZHOS is to process existing real-world data, storing them on the blockchain, as well as its processing with smart contracts. The provision of the signals necessary for financing, storing them on the blockchain as well as their processing with smart contracts, is the main added value of AZHOS.
AZHOS works closely with representatives of the industry and the financial sector to implement the project. In addition to established financial institutions, it is planned to expand

the circle of financing providers to other institutional investors by creating a financial network.

Chapter 2

Recording of Inventory

2.1 Capturing and Processing Inventory

The AZHOS team has its origins in the digitization of supply chain processes and automation engineering, with a particular focus on vendor managed inventory, a concept in which the supplier takes over responsibility for the replenishment of the customer warehouse. In order for the producer to be able to fulfil its obligations, real time insight into the stocks at the customer's site is necessary. These insights are made available by service providers or customers via their own measurement technology, which corresponds to the requirements of the respective location, at worldwide deposits on the producer or customer site.
Unlike packaged goods, which can be counted and scanned with manageable effort, the quantification of bulk goods needs specific measurement technologies. Storage and filling levels of silos or tanks are individually captured by applying various methods according to the requirements at the respective location. The decision which technology to use is individualy determined by material, local peculiarities and environmental conditions.
For example, radar sensors, this class of sensors is used for bulk goods. Radar signals react to two basic electrical quantities: The electrical conductivity and dielectric property of a substance. Even very weakly conductive materials guarantee a sufficiently large signal reflection. Radar sensors measure distances continuously and contactlessly. The distance corresponds in reverse to the filling level. The measuring principle is that the sensor antenna emits the smallest radar signals as short pulses, which are reflected by the medium and received as radar echoes. The transit time of the reflected radar pulse is directly proportional to the distance travelled. If the container geometry is known, the exact filling level can be calculated. Accurate real-world data is necessary for supply chain automation and a valid data source for the supply chain financing of goods.

In the case of bulk goods, one of the most important prerequisites is the technically distinct documentation of the inventory levels. In addition to the mere acquisition of data, the conditions on site, individual logistic processes and a failure-proof data transmission are taken in account. Once the real time stock has been recorded and transferred, they

are linked and visualized with the master data of the location (storage capacities, replenishment times, forecast data, etc.). Through a further integration (connection of the ERP systems of supplier and customer), an automated replenishment is already possible today and daily practice in the industry.

Furthermore, a link between determined inventories and existing shipping notes creates an exact verification (Proof-of-Inventory), which is stored on the blockchain and can be used for further processing.

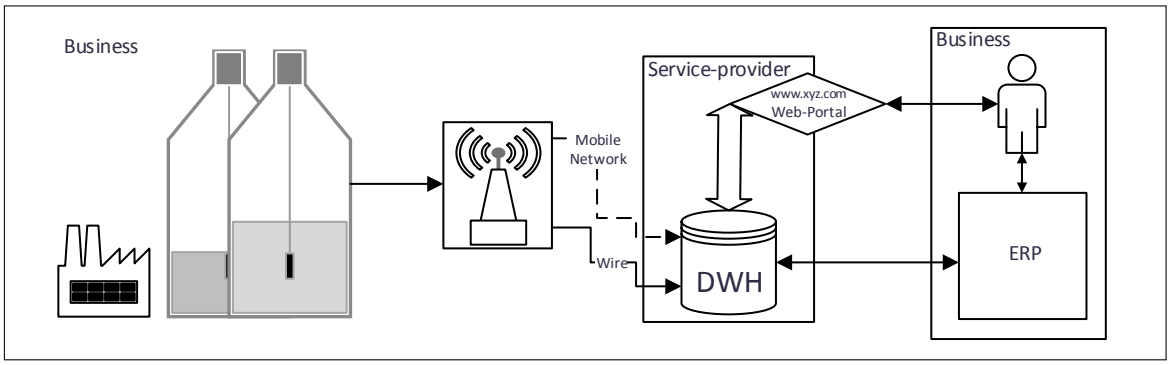

Figure 2.1 Classic signal flow

2.2 Vendor Managed Inventory

To explain the VMI concept, the material- and the financial-flow must be considered separately. From a management-of-goods point of view, the products are created by the supplier and either transported to a consignment warehouse or directly to the customer-site. In both cases it is equally possible for the customer to remove the goods from the warehouse in the event of current production requirements. Because the supplier effectively owns these assets until the goods are removed from the warehouse by the purchasing company and therefore also finances them, this results in a ”cash flow/goods flow asymmetry”: While the goods are available to the customer, he does not have to finance them as usual - the assets are not recorded in the customer’s books and therefore do not tie up equity or borrowed capital. If the goods are not delivered directly to the incoming warehouse of the customer, but to a consignment warehouse, the service provider takes over the entire material flow management. This means, that detailed logistics knowledge is necessary and the corresponding logistics infrastructure (e.g. department stores, means of transport or warehouses) must be present. The service provider is remunerated for its services and a fee is due for material flow processing. As part of the VMI solution, the logistics service provider could assume an additional financing role in addition to the pure material flow management in the consignment warehouse. For this, the service provider usually requires the support of a financial institution.

The stocks of packaged goods can be determined by sales and parts lists from the ERP and sequentially transmitted to the producer via suitable software interfaces. Inventory from bulk goods, on the other hand, are considerably harder to gather. Therefore, as an

additional prerequisite for the VMI of bulk goods, it is necessary to be able to view the stocks held at any time using sensors. Supplemented by the master data and conditions at the customer location, determined stock levels are then visualized for the users on the producer and customer site. In addition to inventories and infrastructure, further information can be obtained after processing, in house or through service providers, such as current orders, deliveries and expected arrival dates as well as consumption and order histories.
The shipping note confirmed by the customer with a time stamp and the corresponding inventory change is known as Proof-of-Delivery. The Shipping note contains data on the weight, quantity and condition of the transported goods and is used for comparison at the destination. The Proof-of-Inventory (PoI) validates the actual existence of the goods by measuring physical changes in stock at the storage location. The PoI, linked to the documentation on the deliveries, is the scaffolding for the consumption-based financing in the sense of AZHOS supply chain financing.

Determined real time inventories in combination with master data provide the foundation for process automation. This requires a connection to the client ERP-system. In addition to industry standards, numerous certified and auditable interfaces are used. Within the framework of automation, different approaches to solutions can be pursued. On the one hand, on an inventory basis and on the other hand, on the basis of planned or historical consumption forecast-data. An automatic purchase order, takes place when a predefined threshold value is reached. If necessary, several parallel orders are triggered in order to ensure that the customer is supplied with the required materials at all times. This enables the supplier to adjust his production planning individually and, for example, to plan customer consumption peaks in advance via his production forecast. The system automatically generates the necessary orders for the planning period. For this purpose, the forecast data is cyclically compared with the actual consumption and adjusted as required. The technology used is therefore fault-tolerant and flexible, even during unplanned production peaks.

2.3 Consignment Stock

A further aproach is consignment stock, this describes a supplier's warehouse at the customer's location. It adds another component to the VMI concept. The supplier takes over the obligations of replenishment for a shared warehouse at a customer-location. The products remain the property of the supplier until they are removed from the consignment warehouse by the customer. The invoicing of consignment goods takes place at defined times, e.g. on a monthly basis.

To enable consignment settlement, the customer must supply the vendor with the actual withdrawal data. This can be done either manually or by integration of service providers via access to actual consumption data through measurement technologies described above. This ensures that the consignment warehouse is adequately supplied and that consignment accounts are drawn up at all times. The manual handling of consignment stocks leads to an increased need for coordination between the parties.
VMI procedures eliminate time consuming and expensive accounting procedures for consignments. Silos and warehouses are equipped with sensors, so that deliveries can be verified at any time by the supplier's shipping note and grant exact withdrawal-data from customers.

Chapter 3

Supply Chain Finance

3.1 Tied-up Capital

In view of global markets and supply chains, companies that have benefited from high margins and competitive advantages over decades are facing growing cost pressure. Optimization of fixed and current assets and management of cash flows is therefore becoming increasingly important. One focus is on shortening the Cash Conversion Cycle (CCC) and thus releasing capital that was previously tied up in inventories or receivables. Another more comprehensive approach is the optimization of the order-to-cash process, which starts at the time the producer receives the order. Modular systems already allow an automated order management.

AZHOS reduces the amount of tied-up capital by allowing producers to receive instant payments upon fulfilment of certain criteria, such as the withdrawal of bulk goods from the consignment warehouse.

A so far customary advance payment of the producer, in the form of capital tied up in inventories or receivables, can be drastically reduced by the early flow of liquidity. The customer's terms of payment remain unaffected, so that he continues to benefit from his accustomed payment terms.

The design of the financing - payment of the supplier's claim by the financier and later repayment to the financier by the customer - represents a mere asset swap from a supplier´s viewpoint and thus does not burden the equity ratio, as beeing the case with interim financing by credit.

3.2 Automated Supply Chain Finance

Goods movements and production processes between companies are initially untransparent for external financial service providers and thus create high administrative costs, when financing goods.

As far as the quantification of packaged goods is accomplishable with sufficient effort, the quantification of bulk goods requires complex equipment at storage locations. Today, the majority of the major chemical companies in the world are connected via existing infrastructure.

So far, the data collection described above has primarily been used to streamline ordering and delivery processes and to ensure sufficient production stocks.

Azhos enables the integration of automated financing processes by linking data already used in logistic processes and storing it on the blockchain for further processing. This enrichment of supply chain data automation enables cost savings due to simplified processes and releases capital previously tied up in working-assets. In other respects, it enables transaction-related valuations of risk-weighted assets that previously could not be carried out at reasonable expense for bulk goods.

Chapter 4

Utilizing Blockchain

4.1 Process Flow

By using modern sensor technology and storing the data on a blockchain at a certain point of time, AZHOS enables later validation of the physical existence of bulk goods. AZHOS creates an information and financing network between suppliers, customers, banks and financial institutions. The financing of bulk goods has so far not been possible due to legal restrictions and the actual processing modalities of thousands of deliveries per day. In the same way as automated, demand-driven shipments are executed, AZHOS provides an automated, consumption-based financing. An example-case of Supply-Chain Finance over AZHOS is described below:

Abbreviation	Meaning:
OC	Order Create
O	Order
OR	Order Response
SN	Ship Notice
A-SN	Advanced - Ship Notice
SC-F	Supply Chain - Financing
T-EM	Tokenized e-money
DR	Delivery Receipt

1. Measuring points at the customer's location independently record filling and stock levels of the monitored storage locations at previously defined time intervals.

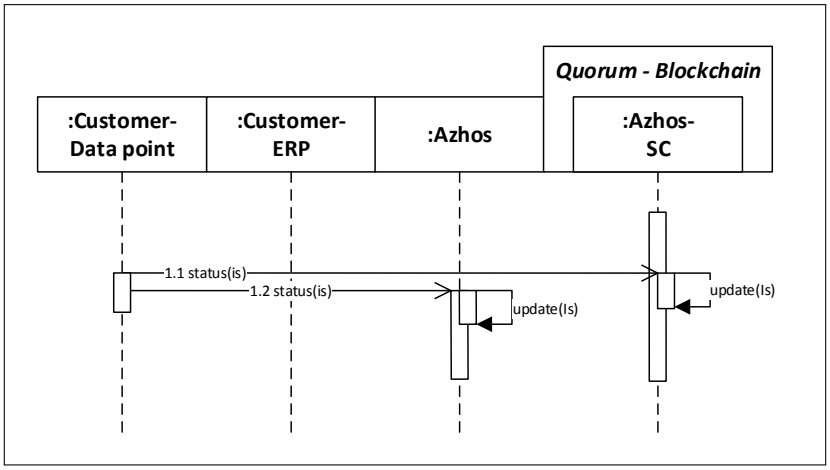

Figure 4.1 Update Stock

2. In case of the determination of a need for goods, an order is proposed to the customer ERP (Order Create; OC).

3. If the proposal is accepted, an Order Create is then transferred to the supplier-ERP to trigger a corresponding delivery.

4. The supplier ERP-system confirms the incoming Order Create (OC) and makes an Order Response (OR).

5. After the Order Response, a Shipment Notice with the planned Shipment time (SN-planned) is issued to AZHOS.

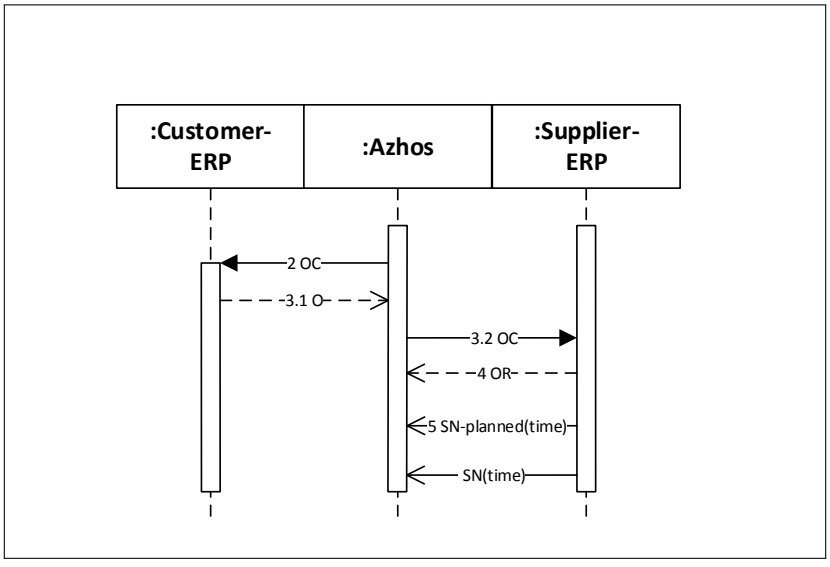

Figure 4.2 Order Process

6. The Shipment Notice (SN) is enriched with additional data and forwarded as an Advanced Shipping Notice (A-SN) to the customer.

7. Upon receipt of the Shipping Notice (SN) in the AZHOS system, the financing process is triggered in the AZHOS Smart Contract (SC). The AZHOS SC informs the SC of the corresponding financial institution, that the financing can now be carried out (start SC-F).

8. The financial institution transfers the tokenized e-money to the supplier. (T-EM payment).

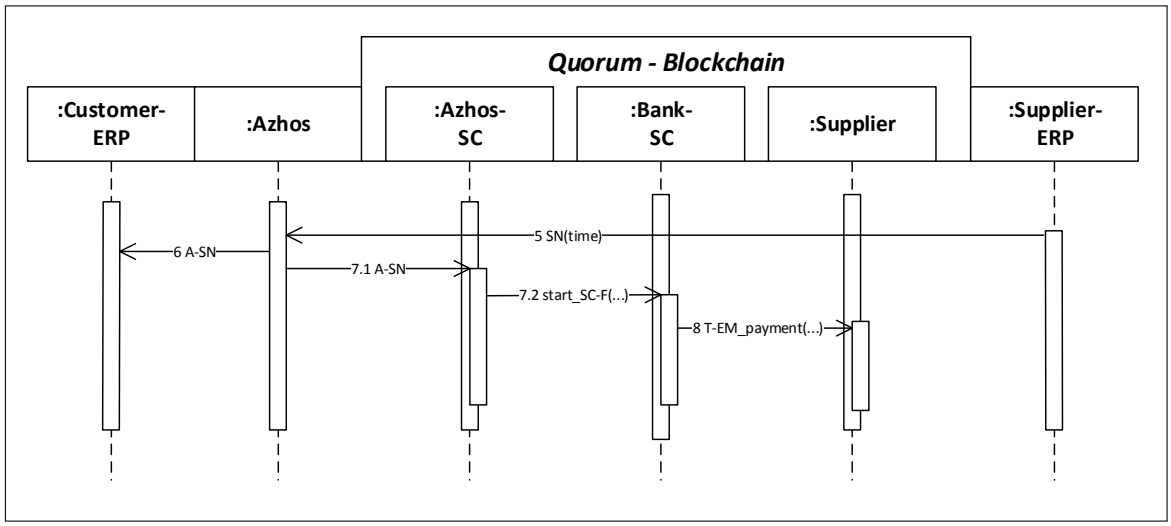

Figure 4.3 SCF Process Sequence

9. Even before the Delivery Receipt (DR) has been recorded by the customer, the sensor can be used to determine the stock level in the monitored object.

10. As soon as the Delivery Receipt (DR) arrives at AZHOS, it is linked to the previous determined inventory change and communicated to the corresponding Smart Contract.

11. The Smart Contract combines Delivery Note, Delivery Time and scope of delivery to create the Proof-of-Inventory.

12. The Proof-of-Inventory is stored in the Smart Contract of the financial institution and the financing can be carried out.

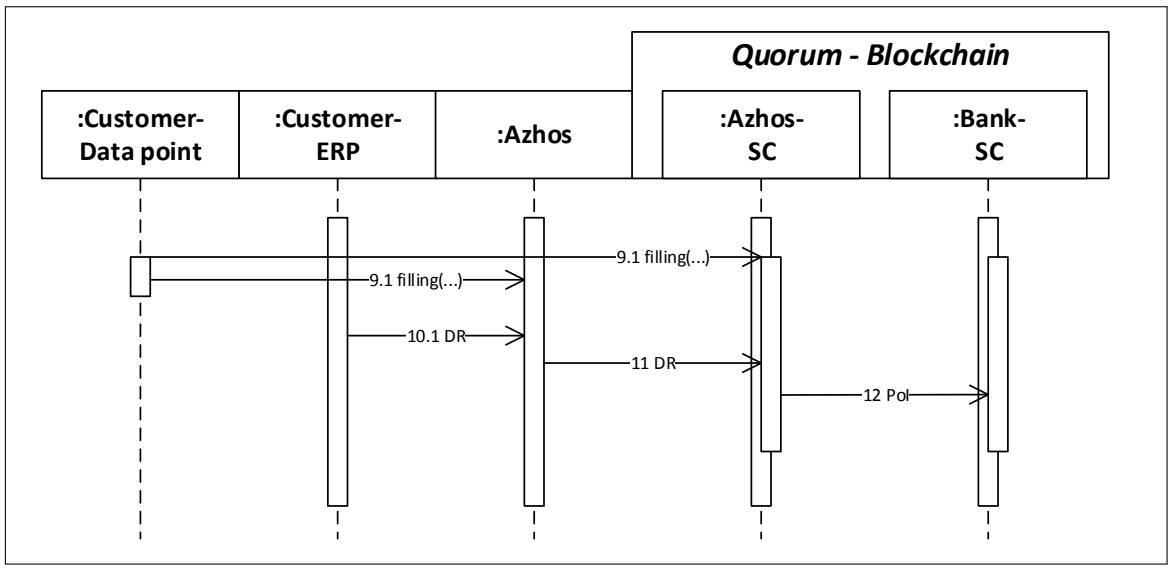

Figure 4.4 PoI Process

13. The customer pays the outstanding amount to the financial institution after the usual due date. The customer also uses tokenized e-money for this purpose or pays directly with fiat money.

14. The Smart Contract of the financial institution passes the financing-fee on to the supplier (Request_fee).

15. The financial institution then settles the transaction fee with AZHOS (fee_share).

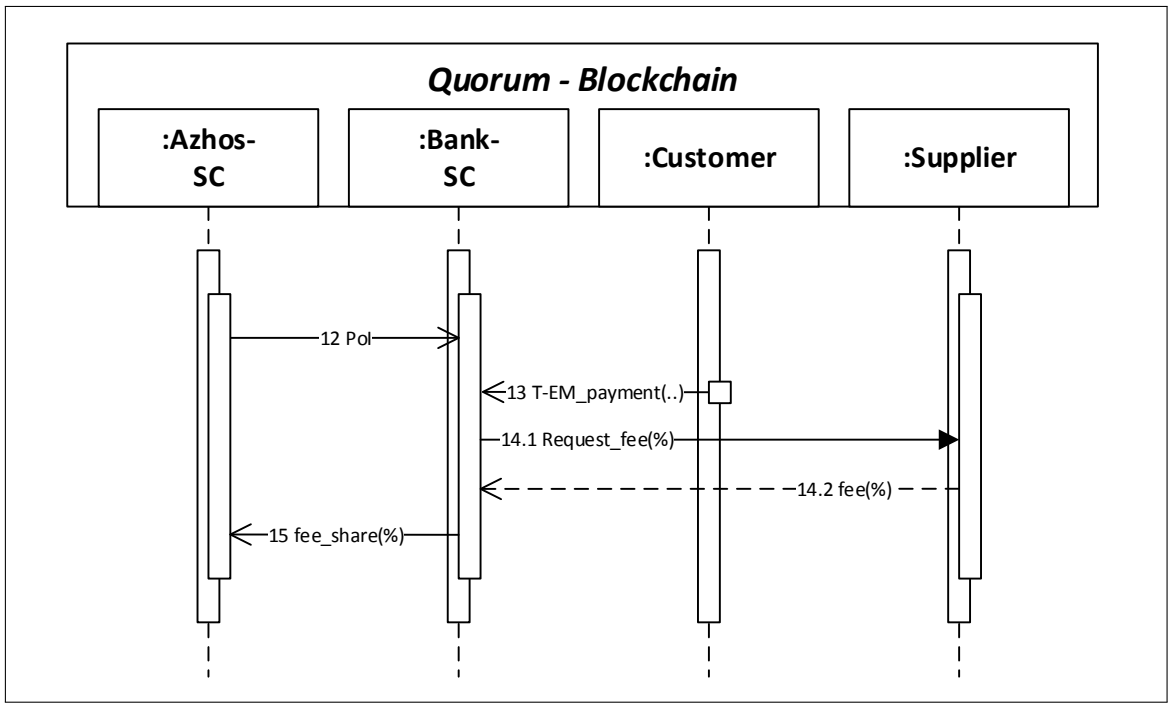

Figure 4.5 Tokenized E-money Repayment

4.2 Tokenization Process

Financial institutions guarantee the value of tokenized e-money, representing the value of a corresponding fiat currency.

To get tokenized e-money, users make an apparently normal transfer to a target account. The fiat money is being transferred to a omnibus account in the background, which is being managed by a tokenizer entity. The entity then issues an equivalent amount of tokens for it. The tokens are managed via a Smart Contract.

Integrated Smart Contracts can interact with other Smart Contracts. On one hand, tokens can be transferred with the basic mechanisms of the blockchain and on the other hand, complex logic can be implemented that handles payment processes between two or more parties, e.g. multi-signature wallets or other capital market instruments.

If the user requests a token payout, he can do this directly and without detours via a Smart Contract call. The entity burns the tokens and releases the fiat money to the specified account.

A regulated institution is required for the tokenization process. The basic requirement is an Electronic-Money-Entity license (EME), or a banking license.

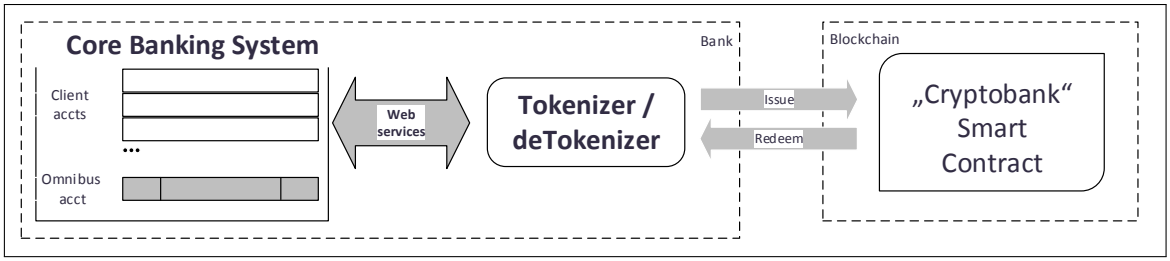

Figure 4.6 Process of Tokenization

Programmable properties of the tokens are, for example, an overdraft credit function or fiduciary function that sends the held token back to the sender or onward to the recipient when certain conditions occur (expired timeout or transaction execution of a releaser address).

4.3 Private Blockchain

AZHOS utilizes the Quorum Blockchain, which is developed under the patronage of JP-Morgan. This enterprise-oriented version of Ethereum offers an enterprise-ready distributed ledger and smart contract platform, ideal for any application requiring high speed and high throughput processing of private transactions within a permissioned group of known participants. It addresses specific challenges to blockchain technology adoption within the financial industry and beyond. It is also designed to develop and evolve alongside Ethereum, as it only has a minimum of changes to Ethereum's core. Therefore, Quorum is able to incorporate the majority of Ethereum updates quickly and seamlessly.

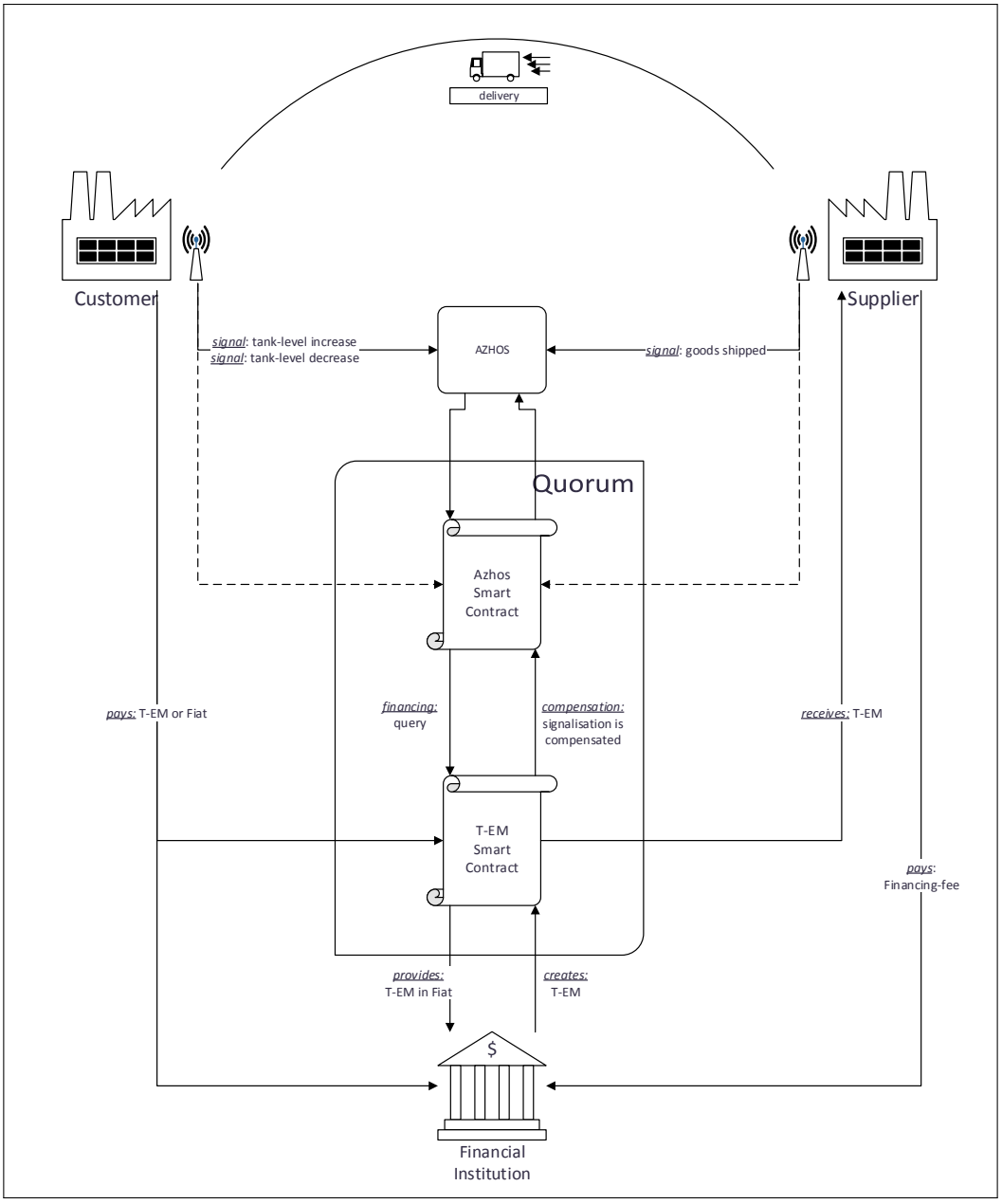

Figure 4.7 Azhos Quorum Blockchain

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Glossary

Bulk Goods	Goods such as oil or chemicals that are not packaged in any type of container.
ERP System	Modular software system with which the resources and processes of a company can be coordinated and managed.
Consignment Stock	Describes a practice where a supplier owns the goods in a warehouse at a customer site. The customer is not billed by the supplier until he removes goods from the warehouse.
Crypto Currency	Native currency of a Blockchain.
Proof of Delivery	The shipping note confirmed by the customer and the corresponding inventory change on site.
Proof of Existence	Data stored together with a timestamp on a blockchain. With the immutability of a blockchain, time of storage and existence at the time of storage can be proven. A comparison between off-chain data and on-chain data can prove, that the compared data set was not changed at a later stage in its existence.
Proof of Inventory	A link between determined inventories and existing shipping notes, stored on the blockchain.
SCM	The practice of implementing, planning and optimizing processes in a supply chain.
Smart Contract	Code which is executed on the blockchain and whose results are verified by it. E.g. a Token Contract.
STO	Not clearly defined. As an example, an entity binds a Security to a token on a blockchain.
Token	Digital money substitute medium that is created through a Smart Contract on a blockchain. A blockchain token represents the good or value predetermined by the issuing entity.
Token Holder	Someone who owns the private keys to the crypto address, to which tokens are assigned.
Token Standard	A defined set of functions a Token Smart Contract should provide. E.g. see ERC20 for the Ethereum blockchain.

VMI	A practice in which a supplier manages the supply and the delivery of his products at the site of his customer. The practice is tightly linked to Consignment Stock practices.
(Crypto) Wallet	A cryptographic key pair consisting of a public and a private key. From these keys blockchain addresses are derived and are used to assign native crypto currencies and tokens to owners.