Trading Platforms for Digitalised Commodities

Michael Merz, PONTON

Abstract

This PONTON Paper presents an analysis of the impact of digitalisation and standardisation on the tradability of products that normally could not be traded on an online marketplace. First, we will analyse the parameters for commoditisation of products so that they can be traded in an automated way. Then we examine two cases of industrial products with corresponding trading platforms: Flexible electricity in the energy sector and trading of ball bearings as complex industrial parts. These two cases show an individual product or process profile but serve as an example for the power of standardisation of digitalised trading processes.

Content

Digitalisation, standardisation, commoditisation, and automation

A widely used term nowadays is **digitalisation**. We hear this buzzword across all sectors and all business processes. But what does "digitalisation" actually mean? The short answer is something like "get rid of paper in business processes". However, the actual, dusty, archaic keyword behind digitalisation is **standardisation**. Because there is no useful exchange of data without standardisation. I.e., whenever a larger group of organisations intends to reduce process cost and risk, they need to form a consortium and standardise a range of things: Data formats, business processes, communication protocols, product descriptions, governance, contractual stipulations, and many more aspects.

According to this definition "digitalisation" has been practised since the 80es when the first purchase orders were sent by automotive industry majors to their first-tier suppliers, because they all needed to agree on the same standard. And on the contrary, there is no true digitalisation achieved (in the sense of standardisation) if paper documents are exchanged as scanned images by email. The latter is rather 1990s than 2020s.

So, with an increasing number of people, businesses, computers, software systems, communication endpoints and their need to exchange data, standardisation is the core accelerator: In a standardised business process no human intervention is required. No chance for risk. What took weeks as a manual process can be accomplished within seconds. Humans standardise, computers execute.

Commoditisation and trading platforms

In the light of an ever-increasing scope of standardised interfaces, products, services, and businesses – what can we now expect from the next wave of digitalisation? The main drivers here are **commoditisation** and **trading platforms**.

Think of electricity in times of renewable energy sources and high volatility on the demand and supply side. At times, when the wind blows and most electric vehicles are on the road, the price for power is low, due to a production glut and dried out consumption. In the evening, however, wind and sun have gone, but all the EVs need to be charged up. Now the price for power increases sharply. Taking a look at this dynamic from a 2030 perspective, all parts will have been standardised: Consumer and producer interfaces, the product definition for "power" as well as the process to buy and sell, production and consumption through standardised interfaces.

Or think of highly standardised industrial goods, which are traded around the planet. Think of car parts, screws, ball bearings, electric motors, paint, etc. Standardisation means here **standardised product descriptions** so that the seller may say "I offer 1000 parts of X, delivered at location Y, CIF (Cost, Insurance, and Freight) terms". A potential buyer may just press an "accept" button and the deal is closed. Terms of trade and logistics are standardised.

So, what is the missing step in all these cases? The possibility to trade commoditised products in an automated way. Today, an exchange or a broker platform is only applicable to products with a simple product specification. Think of securities: An order for a share consists of

- the ISIN number,
- price,
- quantity,
- a buy / sell indicator.

that's it!

There may be further order qualifiers such as partial execution, credit terms, validity timespan etc., but at its very core, only four data elements are needed.

The same applies for products which appear more complex, but which can also be reduced to a product identifier.

It is unlikely that all kind of products can be entirely standardised and made tradable over exchanges. Think of fashion or art. Whenever individual taste or non-measurable product quality determine a product's value, the business transaction is probably always made between individuals. Market participants meet in person, on trade fairs, they negotiate an individual deal as it is the case today with unique products.

But, as we will show in this paper, the borderline between products tradable on an exchange and those not tradable is moving steadily towards the camp of the latter. This is exactly the effect of commoditisation.

In the following, we look at those types of products where everyone would object: "What? Trading ball bearings on an exchange – how is this possible".

And why am I considering this at all? Because at our company, PONTON, we have actively contributed to build trading platforms for the European energy market for nearly 20 years now. We started in the initial stages when energy – in form of electric power or gas – had been commoditized for trading. It started with bilateral handshake deals between producers, traders, and consumers before exchanges and broker platforms emerged. Over these 20 years, each year there was a new step taken towards standardisation for the trading process – be it on regulated markets or in bilateral trading (also called OTC – "Over the Counter"). Several tradable products have emerged over time: Apart from trading physical gas or power, financial futures, spreads, multi-legged derivatives are common today. Even the capacity required for gas deliveries through the pipeline grid is automatically executed on a capacity platform like PRISMA[1].

Apart from these core products, CO2 certificates, local electricity produced and consumed in the same community, the ability to balance the transmission grid, but also the ability of producers and consumers to adjust their production or consumption to compensate congestions in the power grids (called "flexibility") is an emerging energy product these days as both production and consumption have become increasingly volatile.

PONTON's strength not only lies in energy trading, but also in standardisation: We have been helping industries in many sectors to formalise data formats, processes, and data exchange. And here we come back to the initial statements: There is no useful digitalisation without standardisation. And if we need to standardise trading of industrial goods, it really feels familiar to us. As the energy sector is highly regulated, business processes, data formats, and communication protocols are, in many cases, predetermined by the regulator. The sector has a narrow scope for branding, individualisation or varying commercial conditions. Therefore, regulation, standardisation, commoditisation, and trading of goods go hand-in-hand in this sector.

No digitalisation without standardisation

As PONTON has experience in developing platforms for the trading of "exotic" energy products, we see the technology transfer towards less regulated sectors as an exciting exercise: To which extend can we commoditise the trading of goods without any regulator forcing us to do so?

[1] https://www.prisma-capacity.eu

In the following, we share some typical experiences in commoditising the trading of industrial products.

- We will start with the energy sector and here with flexibility trading as it was developed within the **NEW 4.0** and the **Enerchain** projects.
- As a step outside the energy sector, **Bearing X** is a typical case of trading commoditised industrial goods. Requirements are completely different here than in the energy sector, therefore, we ended up with a fully decentralised approach for the trading platform.

Industrial products and their commoditisation

Established markets show an incredible performance today: Stock exchanges execute trades within microseconds, billions of trades can be executed on a daily basis and gigabytes of data are produced when reporting these trades to all relevant parties. This is possible, as said, thanks to the fact that traded goods and the adjacent processes are highly standardised.

Members of a trading platform usually need to deposit margins to the exchange's clearinghouse which protects the market participants as central counterparty against losses in case of a participant's default. This again is a highly standardised process – also by the financial regulator. Settlement and delivery are standardised as well, using services such as clearing banks, custodians, and further third parties.

On the other hand, platforms for digitalised commodities are facing completely different challenges:

- The transaction rate usually starts with only a few trades per day.
- An industrial product like an electric motor has potentially 20 or 30 technical properties as one can easily imagine. Think of the size and shape, length and diameter of the axis, torque, sustainable power consumption, peak consumption, efficiency, type of bearing, weight, etc. Then, there are commercial criteria such as the maker, delivery period, liability period, additional services, type of packaging, delivery location, delivery terms, etc.
- Instead of trading continuously, auctions often better help to cope with low market liquidity.
- Also, the post-deal phase is less standardised compared to financial markets: In case of physical delivery, transportation needs to be considered, either as a separately traded good or as a product feature (Coffee originating from "Guatemala", delivered to "Europe").
- The financial settlement is not handled by clearing banks, nor is there protection against counterparty defaults.
- Onboarding a new participant to a trading platform is less regulated than in the financial market: As no one can be excluded for competition law reasons, onboarding is usually restricted to identity verification and a compliance self-declaration.

The only chance to cope with this overwhelming increase of features is

- First, to simplify the product feature set, for, e.g., to an article number – not the one of a single producer but a neutral one. This can be achieved through international standardisations organisations like ISO, ITU, IEC, ETSI or national ones like DIN or ANSI.
- Secondly, standardise the terms of trade: Whatever is not covered by international or sector standards needs to be cast in a contractual form: Terms of delivery and payment, packaging requirements, grades of quality, etc.
- Last, but not least, it is important to penalise non-performing counterparties: If a participant does not deliver or pay, or if this is late, a red flag may be raised. If this happens frequently,

the party is excluded from trading. Whoever uses the market platform must show commitment.

In some cases, standardisation will lead to a maximum reduction of a complex feature set to just one identifier. E.g., electric motors of type 45X777LWQ can be offered at EUR 49,-- apiece. For traders on the buy-side, it needs to be obvious if this is a deal for them or not. At this stage, automation kicks in: The trader might not be a person but a warehouse operation system. If it needs to take 10 items of 45X777LWQ on stock, it may order this automatically. Or it may prompt the deal to a human purchaser and order it on their request.

As we will see in the Bearing X example, using a trading platform of this kind specifically makes sense due to the combination of standardisation, transparency, and commitment.

Trading of flexible electricity – NEW 4.0 "EnergiePlattform"

NEW stands for "Norddeutsche Energiewende" (northern German energy transition). The idea behind this industrial showcase is to coordinate the production and consumption of electricity in the region of the city of Hamburg and the neighbouring northern state, Schleswig-Holstein. Hamburg is an intensive energy consumer with its large port and the many industrial plants located there. Electricity consumers like ArcelorMittal (steel producer), Aurubis (copper producer), and Trimet (aluminium) represent all together hundreds of MW of load on the local power grids. At the same time, consumption is quite volatile as melting furnaces do not run continuously. For example, the load ramp of Aurubis' furnace requires 70 MW to start up and only 20 minutes later it is shut down again.

On the other hand, there is the district of Schleswig-Holstein with less industrial consumption but gigawatts of wind power-based production capacity. Unfortunately, also the production side is highly volatile so that the NEW 4.0 region represents the world-wide challenge for renewable energy in a geographic nutshell.

As a member of the NEW 4.0 consortium, PONTON has developed the "EnergiePlattform", which is a local marketplace for short-term energy. Participants are energy producers and consumers who react to the supply and demand of power. Typical cases that have been tested are the following:

- For ArcelorMittal the ramping up of their furnace may be delayed by 10 minutes – which also leads to a delay of its ramp-down sometime later. For the unused energy, consumers are penalised by the grid operator, called the imbalance fee as their unplanned consumption behaviour has a destabilising impact on the grid. In the past, this penalty was considered as "cost of business". Today, using the EnergiePlattform, the 10 minutes of delay could be offered to neighbouring consumers who are happy to help in ramping up their consumption for that period. Typically, Trimet, the aluminium producer, has the capability to quickly increase or reduce their load by 20 MW in either direction. I.e., there is a win-win-win situation as also the grid operator is enabled to run a balanced grid.
- Other typical use cases are "Power-to-Gas" and "Power-to-Heat": If a storm front hits the coastline of Schleswig-Holstein there is an oversupply of power. Local consumers are required to consume this energy to avoid grid congestions. Here, heat pumps, boilers, electrolysers, and batteries kick in to absorb the energy – but at which price?

The NEW 4.0 scenario foresees many producers and consumers – all with their individual preferences regarding price, duration and load of production and consumption. We know already since Adam Smith that in such a decentralised situation of decision making, the market plays a crucial role as the "invisible hand" that triggers the participants' behaviour through the market price.

Consequentially, the EnergiePlattform is a marketplace that allows producers and consumer trade so-called "flexibility". Flexibility is the ability to ramp up or curb production or consumption. It might be the consumer submitting an order for more supply which triggers a producer to deliver it, or it might

be the wind farm operator who needs to find a consumer for the unexpected surplus generation of power.

As already mentioned, trading electricity is practised since over 20 years. But those classic products are already well-established (speak: commoditised). They may be intraday hours, day-ahead deliveries, or deliveries for the entire next year. With NEW 4.0, we face a new product category which requires, among others, the following product specification to be tradable:

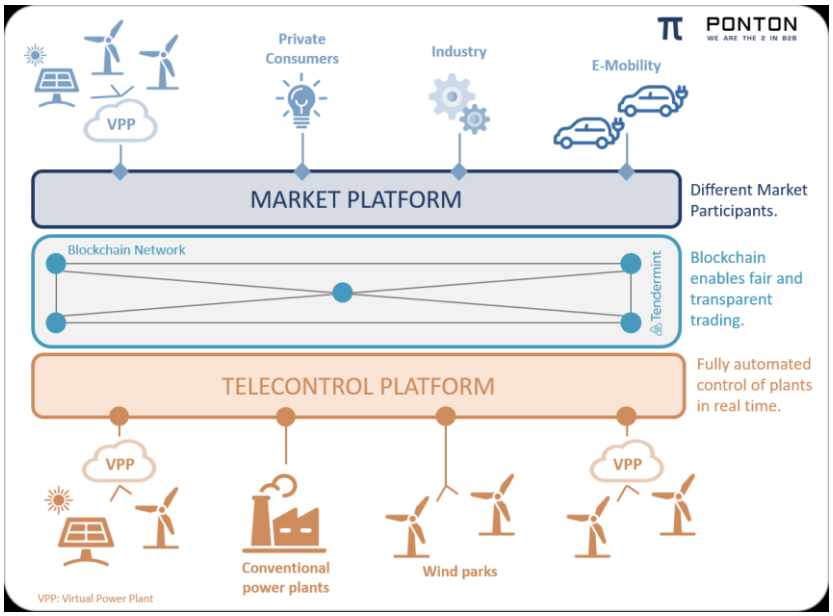
- Load – how many kW or MW will be produced or consumed?
- DeliveryStart, DeliveryEnd – defining the time window for the delivery.
- GridLocation – as the power grid is divided into a multi-layered hierarchy of grid locations, the producer's or consumer's location needs to be identified within the grid topology.
- Buy/Sell – is it the producer or the consumer who submits the order to the marketplace?
- Price – per kWh
- Source (Wind, Solar, Hydro, Biogas, Green, Gray) – producers are classified by their quality of energy. In case of consumers asking for a certain quality, only those orders can match with the same category.

When designing a market platform for flexibility, trading is only one aspect, focusing on the order and execution phase. The other is settlement: After a trade has been executed there are two streams of fulfilment:

- Financial settlement. Here, the buyer pays the total amount to the seller. This could be done bilaterally and at a later point in time, e.g., at the beginning of the next month. In case of the EnergiePlattform, settlement starts right at the point of execution: The amount is locked on the buyer's account and transferred to the seller after the transaction has taken place. This protects the seller against the buyer's default.
- Physical settlement. If you take a look at the product description, i.e., at the order data above, all parameters are already given that are needed to remote control the production and consumption assets: Following our "shared power consumption" example, ArcelorMittal offers 20 MW of power, asking zero Euro per kWh (as they save the imbalance fee through this trade), whereas Trimet ramps up their smelters exactly during the specified 10 minutes at exactly the 20 MW of additional consumption. The instruction to do so is provided by the EnergiePlattform's telecontrol system.

Many other use-cases for trading flexibility between producers and consumers have been demonstrated under the NEW 4.0 project, however, all followed the beforementioned product specification and the trading pattern described below:

- During a cold winter night, a CHP (Combined Heat and Power) plant in Flensburg needs to ramp up its heat production which leads to an increased production of power at the same time. So, the asset operator submits an order to sell power on the EnergiePlattform. At the same time, there is an operator of charging stations, facing a larger number of connected EVs during that period. As the energy offered by the CHP operator is cheaper than the local supplier's tariff for EV charging, the charging station operator executes the order and pays less. Thanks to Adam Smith, we have gained another win-win-win – also including the EV owners who can charge at a lower price.
- Another municipal electricity supplier from Schleswig-Holstein, Stadtwerke Norderstedt (SN), is able to control power consumption remotely in over 1000 households, leading to an aggregated flexibility of up to 1 MW. The remote-controlled installations are heat pumps, batteries, and even washing machines. If a producer like a wind farm or a CHP operator offers extra power at low cost, SN acts and takes the opportunity to supply low-cost power to their consumers.



- *Figure 1: EnergiePlattform – trade execution and telecontrol of production / consumption*

The EnergiePlattform is flexible enough to support all different trades of energy in the northern German region covered by NEW 4.0. It is a perfect example how untapped terrain of commoditisation can be standardised and digitalised so that new products can be traded.

Trading energy is just one example for digitalised commodities. The specific challenge hereby is to fit the trading platform into the physical telecontrol environment so that the entire value chain is fully automated. Other commoditised products require other adaptations for the platform as we will see in the following sections.

Trading of industrial goods over the Bearing X platform

It is quite easy to automate trading processes within the highly regulated energy sector as the regulator plays an important role in standardising (or inhibiting) business processes, data formats, and data communication and therefore also the commoditisation of energy products.

If we take a look at other, less regulated sectors, setting up a trading platform is rather a pioneer task: In a regulated environment, there is a high level of trust in the different stakeholders: Grid operators take care of a stable power supply, i.e., they guarantee security of supply. As such, they act as a trusted third party for producers and consumers and could serve as a marketplace operator as it is the case with platforms like ETPA[2] or GOPACS[3]. Moreover, power exchanges like EPEX Spot or EEX are trusted third parties. No one would expect them play against the rules – and should that ever happen, there is the regulator again, threatening evildoers with painful penalties. So, the energy sector is all-in-all a trusted environment.

Let us now look at a widely used industrial good which has unique requirements with regards to the design of a marketplace and business processes: Ball bearings. The standard specifications for ball bearings are defined by standard-setting bodies, such as the International Organization for Standardization (ISO). A unique bearing specification enables a fungible and marketable product so that buyers and sellers only require to agree on volume and price, assuming other terms of the trade

[2] ETPA – Energy Trading Platform Amsterdam, https://www.etpa.nl
[3] GOPACS – https://www.gopacs.eu

are already agreed upon (or they use standardised terms of a marketplace or industry association such as EFET framework contracts in the power market).

Production, trading, and delivery of all different kinds of bearings is worldwide a multi-billion business. Many manufacturers, wholesalers and smaller trading companies are involved, but the international trading of bearings is non-transparent and characterised by inefficient markets with sham offers and plagiarised products. These issues cause mistrust between market participants and make buying and selling of bearings a laborious and time-consuming effort.

In addition, traders do not sit in front of a trading screen the whole day as it is the case with financial markets. They are driven by their customers who ask for a particular product. In some cases, this product is in stock, in others the trader needs to ask others for their availability and price.

Think of the following case: A trader of ball bearings is asked by their client (e.g., a civil engineering service designing a flap bridge) if they can offer 8 bearings of type FAG-002341. Unfortunately, this is not a fast-moving product, so they need to inquire availability at ten acquainted traders. Ten separate inquiries need to be sent out, ten different offers need to be calculated, and at most one will lead to a deal. This is highly inefficient for the entire sector as the inquiries are not targeting at a deal but just to find out what the current price level is for bearings of type FAG-002341. This is even more annoying as serious inquiries cannot be distinguished from unserious ones.

The obvious solution would be to use a marketplace. And that is what Early Brands Innovation & Technology Consultants[4] have done. Together with PONTON as service provider, they launched BEARING X[5], a decentralised B2B trading platform which brings together market participants from the international bearing industry via an online trading platform, which allows participants to monitor the marketplace, track own orders and execute trades with just a few clicks.

Bearing X enables market participants to provide binding market offers, achieving leaner processes, higher transparency in the supply chain, as well as fair prices and guaranteed quality.

The market design of Bearing X also addresses one unique requirements of the participants: as they do not live in a regulated world, there is only little trust among market participants if they don't know each other. And there is also no trust in the market operator: Usually, this is a third party who manages orders and trade executions. And as such, the market operator has insight in all data that is exchanged. Each order tells a story about the bidder: Are they desperately selling or seeking a product? How is the traders' behaviour regarding prices and quantities? How has the trading behaviour changed over the past three months? A lot of information can be distilled from the market behaviour only with some basic data analytics applied.

In an untrusted world, this is a behaviour expected by the market participants so that no useful marketplace emerged in the sector of ball bearings – until Early Brands and PONTON cooperated in developing the Bearing X platform.[6]

An outstanding feature of Bearing X is the omission of a central market operator. The entire trading process takes place peer-to-peer: A node is operated for each participating company in the cloud, so that orders and trade data is directly send through this network. Furthermore, Bearing X offers individual blacklisting of market participants to exclude certain competitors from viewing the orders of other participants or to trade only with well-known counterparties. Another unique feature is that market participants can differentiate prices, enabling them to offer each market participant a different price based on their individual pricing strategy. In addition, a sophisticated filter functionality is enabling the trader to easily find the desired bearing out of the vast number of different items.

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[4] https://earlybrands.de
[5] https://bearingx.io

At PONTON, we have originally designed this marketplace infrastructure using blockchain technology. To support the fast data communication and low consensus latency, we started using the Tendermint infrastructure, which is based on a PoA consensus mechanism, called PBFT.[7] On top, we built a framework called "WRMHL" that supports authentication and identification of participants on the one side, but also anonymity with regards to orders and trades on the other.[8]

However, the trading of bearings first looked as a perfect application for blockchain technology, but then it turned out that performance requirements exceeded the capability of the blockchain approach: As a consensus protocol is required for each block to jointly assess among the validator nodes whether the transaction data is valid or not, leading to performance issues so that we decided to choose a different approach. Moreover, Blockchain technology makes a lot of sense if participants and nodes need to protect themselves against malicious behaviour of other node operators. If a system is able to cope with this situation – at least partly – then this system is called "byzantine fault tolerant". However, if the nodes are well-known to each other, if they authenticate each other, and if also each other's code is authenticated, there is no need for byzantine behaviour as it could be the case, e.g., for public blockchain environments that we find in case of, e.g., Bitcoin or Ethereum. For Bearing X though only decentralised fault tolerance is required. This requirement is met by using Kafka as a high-speed distributed messaging system.[9]

With the adjusted peer-to-peer infrastructure at hand, the next logical step was to develop a trading tool on top that allowed to submit orders or execute market orders from other participants. Figure 2 shows the trading front-end that allows to monitor orders from the sell side which can be executed by just clicking the "buy" button.

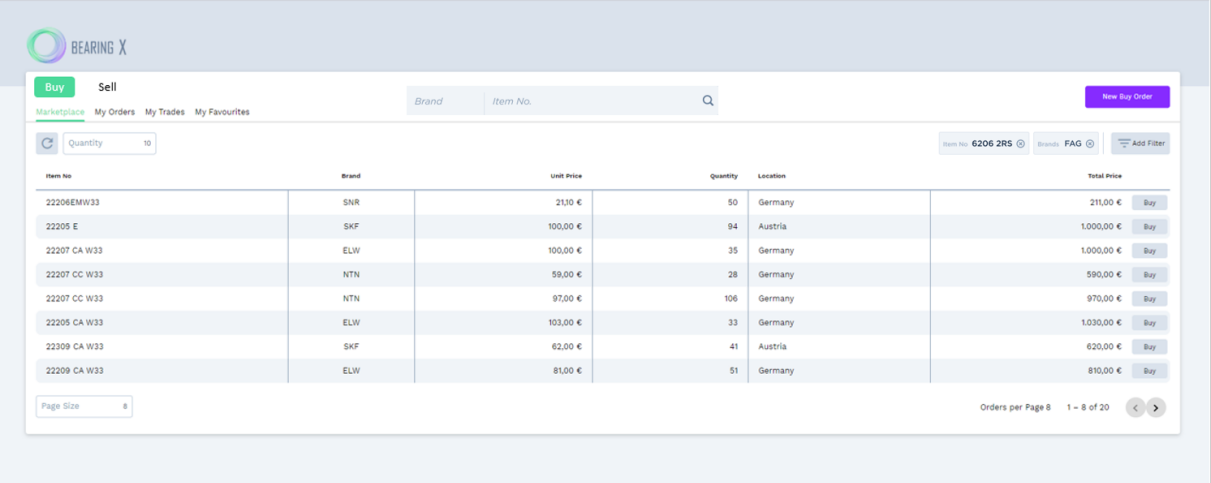

Figure 2: Bearing X trading screen

Bearing X is based on a high-performance technology stack allowing participants a speedy order generation from stock-files extracted from their ERP systems even if containing several 10.000 different items. In the future, a full integration with the ERP system is planned, so that any change in the stock or price of a good will lead to an automatic submission or update of an order.

The next figure shows the entry screen for the execution of a trade. Parameters such as Incoterms (for the delivery), the delivery location, shipment date, etc. are standardised across the Bearing X marketplace.

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[7] https://tendermint.com/core/. PoA = Proof of Authority, PBFT = Practical Byzantine Fault Tolerance.
[8] Michael Merz, "Blockchain for B2B Integration", MM Publishing, 2019. See also https://www.amazon.com/-/de/dp/3982056020 and https://www.ponton.de/products/wrmhl/
[9] https://kafka.apache.org

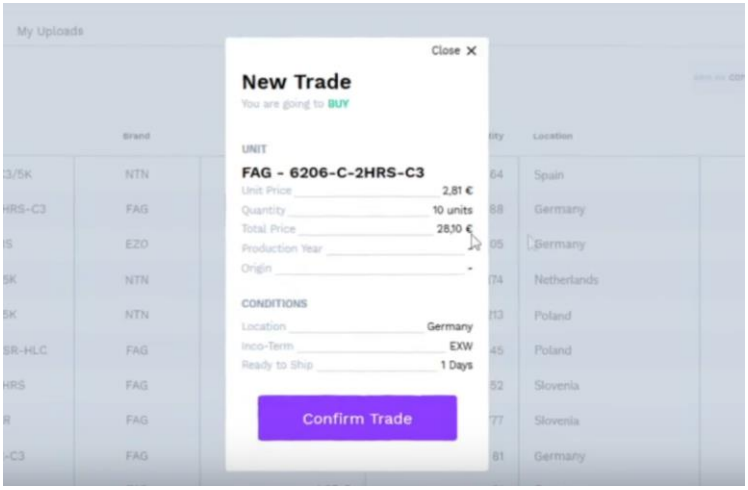

Figure 3: Execution screen based on a selected order

The Bearing X marketplace has been running in live mode already since Q1/2020. Additional traders participate step-by-step, so that market liquidity increases.

What we have learned from Bearing X is that not only standardisation is required if we want to commoditise new products. Also, the "sector culture" needs to be addressed should trading of these products be digitalised. Bearing X is a rare example of how vertical particularities and technological capabilities can meet so that we are able to enter untapped terrain.

Conclusion

The trading platforms shown above are trailblazers in their specific sectors. Each of them has its own particularities, but all of them have a few features in common:

- Commoditisation requires standardisation. Only then, flexible energy or ball bearings will really become tradeable. And there are possibly hundreds of further products and services that can be commoditised in a similar way.
- Only commoditisation allows for trading and, thus, for automation. What still causes human effort today – the information phase in a business transaction – would be avoided through standardisation if software applications use formalised policies to interact with one another. If the abovementioned civil engineering firm requires bearings of type X they can submit a buy order to the marketplace with parameters that are derived from their CAD design. In the same way, the operation system for flexible power consumption units only requires general policies to become an automated energy trading agent on flexibility markets.

At the same time, however, each platform technology needs to fit to the sector's specific requirements, i.e., each platform also needs specific process extensions. Be it the physical telecontrol of energy production or consumption devices through the NEW 4.0 platform or be it the decentralisation of Bearing X to address trust requirements.

As a partner for software innovation in the trading of commoditised goods, it is again and again a new and exciting challenge for PONTON to design a marketplace system that fits best to the particularities of the given market. As standardisation and commoditisation advances, we are looking forward to the next of these challenges.