# Blockchain Application in the Food Industry

**Wenlong Zhao**

Due to globalization, the supply chain of an international food company, like any other international companies can involve multiple partners across several countries. Unlike any other international company, food safety and fraud issues are often strictly regulated and vary by country because of their significant tie to people’s health. Thus, any large food company must have oversight of the entire supply chain.

Blockchain can significantly add value to a supply chain system due to its advantages such as transparency, traceability, and immutability of records. The use of blockchain can help establish trust between the consumer and the company by transparently providing product information and address the consumer’s concerns. It improves efficiency because the company can easily trace the information at each stage and detect any potential issues. The difficulty of data modification also made it difficult for anyone in the supply chain to commit food fraud. It is estimated that a $31 billion loss due to food fraud can be saved by 2024 globally.

Thus, many food companies and distributors have collaborated with enterprise Blockchain providers to build their systems. Among the providers, IBM Food Trust is the industry leader and has helped many companies such as Nestle, Carrefour, Wal-Mart and Dole.

Although the future seems very promising, besides IBM Food Trust, there aren’t many commercial-ready platforms. Most companies are still experimenting. The industry appears to be in a "wait-and-see" mode and “mainstream adoption” is still 5 to 10 years ahead, according to some food industry experts. Here are some key issues the industry needs to solve.

Currently, all the blockchain systems still require people to upload the information, thus, there are always human errors. If the information is entered incorrectly, it stays there forever. Therefore, not many incentives for suppliers to spend time to ensure they are logging all the information correctly.

The transaction of (or integration with) the existing supply chain system can be costly and time-consuming, considering all the infrastructure upgrades and human learning curve. Also, to many traditional food supply companies, this could mean a significant culture change.

In conclusion, Blockchain technology still faces some main challenges during its commercialization process. The potential is limitless, but it still requires the technology developers, supply chain participators, and regulators to work together to make it more economically viable to be accepted by the food industry.

# Reference:

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3. IBM Food Trust Expands Blockchain Network to Foster a Safer, More Transparent and Efficient Global Food System <https://newsroom.ibm.com/2018-10-08-IBM-Food-Trust-Expands-Blockchain-Network-to-Foster-a-Safer-More-Transparent-and-Efficient-Global-Food-System-1>
4. How blockchain is revolutionising food supply chains <https://blockheadtechnologies.com/how-blockchain-is-revolutionising-food-supply-chains/>
5. Applications of blockchain technology in the food industry <https://www.newfoodmagazine.com/article/110116/blockchain/>

**Counterparty Credit Risk (CCR)** is the risk that the counterparty to a transaction could default before the final settlement of the transaction's cash flows.  An economic loss would occur if the transactions or portfolio of transactions with the counterparty has a positive economic value at the time of default. Unlike a firm's exposure to credit risk through a loan, where the exposure to credit risk is unilateral and only the lending bank faces the risk of loss, CCR creates a bilateral risk of loss: the market value of the transaction can be positive or negative to either counterparty to the transaction.  The market value is uncertain and can vary over time with the movement of underlying market factors.

A **central counterparty** (CCP) is a clearing house that interposes itself between counterparties to contracts traded in one or more financial markets, becoming the buyer to every seller and the seller to every buyer and thereby ensuring the future performance of open contracts.  A CCP becomes a counterparty to trades with market participants through novation, an open offer system, or another legally binding arrangement. For the purposes of the capital framework, a CCP is a financial institution.

A **qualifying central counterparty** (QCCP) is an entity that is licensed to operate as a CCP (including a license granted by way of confirming an exemption), and is permitted by the appropriate regulator/overseer to operate as such with respect to the products offered.  This is subject to the provision that the CCP is based and prudentially supervised in a jurisdiction where the relevant regulator/overseer has established, and publicly indicated that it applies to the CCP on an on-going basis, domestic rules and regulations that are consistent with the CPSS-IOSCO Principles for Financial Market Infrastructures.

A **clearing member** is a member of, or a direct participant in, a CCP that is entitled to enter into a transaction with the CCP, regardless of whether it enters into trades with a CCP for its own hedging, investment or speculative purposes or whether it also enters into trades as a financial intermediary between the CCP and other market participants.

A **client** is a party to a transaction with a CCP through either a clearing member acting as a financial intermediary, or a clearing member guaranteeing the performance of the client to the CCP.

**Initial margin** means a clearing member's or client's funded collateral posted to the CCP to mitigate the potential future credit exposure of the CCP to the clearing member arising from the possible future change in the value of their transactions. For the purposes of this chapter,initialmargindoesnotincludecontributionstoaCCPformutualisedloss sharing arrangements (i.e., in case a CCP uses initial margin to mutualise losses among the clearing members, it will be treated as a default fund exposure).

**Variation margin** means a clearing member's or client's funded collateral posted on a daily or intraday basis to a CCP based upon price movements of their transactions.

**Trade exposures** (in section 4.1.9) include the currentand potential future credit exposure of a clearing member or a client to a CCP arising from OTC derivatives, exchange traded derivatives transactions or securities financing transactions(SFTs), as well as initial margin.

**Default funds**, also known as clearing deposits or guaranty fund contributions (or any other names),are clearing members' funded or unfunded contributions towards, or underwriting of, a CCP's mutualised loss sharing arrangements. The description given by a CCP to its mutualised loss sharing arrangements is not determinative of its status as a default fund; rather, the substance of such arrangements will govern its status.

**Offsetting transaction** means the transaction leg between the clearing member and the CCP when the clearing member acts on behalf of a client (e.g. when a clearing member clears or novates a client's trade).

**Long Settlement Transactions**

are transactions where a counter party under takes to deliver a security, a commodity, or a foreign exchange amount against cash, other financial instruments, or commodities, or vice versa, at a settlement or delivery date that is contractually specified as more than the lower of the market standard for this particular instrument and five business days after the date on which the bank enters into the transaction.

**Securities Financing Transactions (SFTs)**

are transactions such as repurchase agreements, reverse repurchase agreements, security lending and borrowing, and margin lending transactions, where the value of the transactions depends on market valuations and the transactions are often subject to margin agreements.

**Margin Lending Transactions**

are transactions in which a bank extends credit in connection with the purchase, sale, carrying or trading of securities. Margin lending transactions do not include other loans that happen to be secured by securities collateral. Generally, in margin lending transactions, the loan amount is collateralised by securities whose value is greater than the amount of the loan.

**Netting Set**

is a group of transactions with a single counterparty that are subject to a legally enforceable bilateral netting arrangement and for which netting is recognised for regulatory capital purposes under chapters 3 and 5 or the Cross-Product Netting Rules set forth in this chapter. Each transaction that is not subject to a legally enforceable bilateral netting arrangement that is recognised for regulatory capital purposes should be interpreted as its own netting set for the purpose of these rules.

**Risk Position**

is a risk number that is assigned to a trans action under the CCR standardised method (set out in this chapter) using a regulatory algorithm.

**Hedging Set**

is a group of risk positions from the transactions within a single netting set for which only their balance is relevant for determining the exposure amount or EAD under the CCR standardised method.

**Margin Agreement**

is a contractual agreement or provisions to an agreement under which one counterparty must supply collateral to a second counterparty when an exposure of that second counterparty to the first counterparty exceeds a specified level.

**Margin Threshold**

is the largest amount of an exposure that remains outstanding until one party has the right to call for collateral.

**Margin Period of Risk**

is the time period from the last exchange of collateral covering a netting set of transactions with a defaulting counterpart until that counterpart is closed out and the resulting market risk is re-hedged.

**Effective Maturity under the Internal Model Method**

for a netting set with maturity greater than one year is the ratio of the sum of expected exposure over the life of the transactions in a netting set discounted at the risk-free rate of return divided by the sum of expected exposure over one year in a netting set discounted at the risk-free rate. This effective maturity may be adjusted to reflect rollover risk by replacing expected exposure with effective expected exposure for forecasting horizons under one year. The formula is given in paragraph 43.

**Cross-Product Netting**

refers to the inclusion of transactions of different product categories within the same netting set pursuant to the Cross-Product Netting Rules set out in this chapter.

**Current Market Value (CMV)**

refers to the net market value of the portfolio of transactions within the netting set with the counterparty. Both positive and negative market values are used in computing CMV.

**Distribution of Market Values** is the forecast of the probability distribution of net market values of transactions within a netting set for some future date (the forecasting horizon) given the realised market value of those transactions up to the present time.

**Distribution of Exposures** is the forecast of the probability distribution of market values that is generated by setting forecast instances of negative net market values equal to zero (this takes account of the fact that, when the bank owes the counterparty money, the bank does not have an exposure to the counterparty).

**Risk-Neutral Distribution** is a distribution of market values or exposures at a future time period where the distribution is calculated using market implied values such as implied volatilities.

**Actual Distribution** is a distribution of market values or exposures at a future time period where the distribution is calculated using historic or realised values such as volatilities calculated using past price or rate changes.

**Current Exposure** is the larger of zero, or the market value of a transaction or portfolio of transactions within a netting set with a counterparty that would be lost upon the default of the counterparty, assuming no recovery on the value of those transactions in bankruptcy. Current exposure is often also called Replacement Cost.

**Peak Exposure** is a high percentile (typically 95% or 99%) of the distribution of exposures at any particular future date before the maturity date of the longest transaction in the netting set. A peak exposure value is typically generated for many future dates up until the longest maturity date of transactions in the netting set.

**Expected Exposure** is the mean (average) of the distribution of exposure sat any particular future date before the longest-maturity transaction in the netting set matures. An expected exposure value is typically generated for many future dates up until the longest maturity date of transactions in the netting set.

**Effective Expected Exposure** at a specific date is the maximum expected exposure that occurs at that date or any prior date. Alternatively, it may be defined for a specific date as the greater of the expected exposure at that date, or the effective exposure at the previous date. In effect, the Effective Expected Exposure is the Expected Exposure that is constrained to be non-decreasing over time.

**Expected Positive Exposure (EPE)** is the weighted average over time of expected exposures where the weights are the proportion that an individual expected exposure represent soft he entire time interval. When calculating the minimum capital requirement, the average is taken over the first year or, if all the contracts in the netting set mature before one year, over the time period of the longest-maturity contract in the netting set.

**Effective Expected Positive Exposure (Effective EPE)** is the weighted average over time of effective expected exposure over the first year, or, if all the contract sin the netting set mature before one year, over the time period of the longest-maturity contract in the net ting set where the weights are the proportion that an individual expected exposure represents of the entire time interval.

**Credit Valuation Adjustment** is an adjustment to the mid-market valuation of the portfolio of trades with a counterparty. This adjustment reflects the market value of the credit risk due to any failure to perform on contractual agreements with a counterparty. This adjustment may reflect the market value of the credit risk of the counterparty or the market value of the credit risk of both the bank and the counterparty.

**One-Sided Credit Valuation Adjustment** is a credit valuation adjustment that reflects the market value of the credit risk of the counterparty to the firm, but does not reflect the market value of the credit risk of the bank to the counterparty.

**Debit Valuation Adjustment** is a valuation adjustment that reflects the market value of the credit risk of the bank to the counterparty (i.e., changes in the reporting bank's own credit risk), but does not reflect the market value of the credit risk of the counterparty to the bank. [Added by OSFI]

**Rollover Risk** is the amount by which expected positive exposure is understated when future transactions with a counterpart are expected to be conducted on an ongoing basis, but the additional exposure generated by those future transactions is not included in calculation of expected positive exposure.

**General Wrong-Way Risk** arises when the probability of default of counterparties is positively correlated with general market risk factors.

**Specific Wrong-Way Risk** arises when the exposure to a particular counterpart is positively correlated with the probability of default of the counterparty due to the nature of the transactions with the counterparty.

 When using an internal model, exposure amount or EAD is calculated as the product of alpha times Effective EPE, as specified below (except for counterparties that have been identified as having explicit specific wrong way risk – see paragraph 74):

EAD = α × Effective EPE (1)

 Effective EPE ("Expected Positive Exposure") is computed by estimating expected exposure (EEt) as the average exposure at future date t, where the average is taken across possible future values of relevant market risk factors, such as interest rates, foreign exchange rates, etc. The internal model estimates EE at a series of future dates t1, t2, t3,… Specifically, "Effective EE" is computed recursively as

Effective EEtk = max(Effective EEtk-1, EEtk) (2)

where the current date is denoted as t0 and Effective EEt0 equals current exposure.

 In this regard, "Effective EPE" is the average Effective EE during the first year of future exposure. If all contracts in the netting set mature before one year, EPE is the average of expected exposure until all contracts in the netting set mature. Effective EPE is computed as a weighted average of Effective EE:

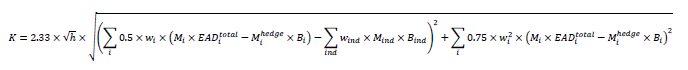
Not yet defined

where the weights Δtk = tk − tk−1 allows for the case when future exposure is calculated at dates that are not equally spaced over time.

 Alpha (α) is set equal to 1.4.[BCBS June 2006 Annex 4 par 32]

 Supervisors have the discretion to require a higher alpha based on a firm's CCR exposures. Factors that may require a higher alpha include the low granularity of counterparties; particularly high exposures to general wrong-way risk; particularly high correlation of market values across counterparties; and other institution-specific characteristics of CCR exposures.

When a bank does not have the required approvals to use paragraph 110 to calculate a CVA capital charge for its counterparties, the bank must calculate a portfolio capital charge using the following formula:



Where

h

is the one-year risk horizon (in units of a year), h = 1;

wi

is the weight applicable to counterparty 'i'. Counterparty 'i' must be mapped to one of the seven weights wi based on its external rating, as shown in the table of this paragraph below. When a counterparty does not have an external rating, the bank must, subject to supervisory approval, map the internal rating of the counterparty to one of the external ratings. If the bank does not have an approved rating system, then any unrated counterparty will receive a weight of 2.0%;

EADi total

is the exposure at default of counterparty 'i' (summed across its netting sets), including the effect of collateral as per the existing IMM or CEM rules as applicable to the calculation of counterparty risk capital charges for such counterparty by the bank. For non-IMM banks the exposure should be discounted by applying the factor (1−exp (-0.05×Mi))/(0.05×Mi). For IMM banks, no such discount should be applied as the discount factor is already included in Mi;

Bi

is the notional of purchased single name CDS hedges (summed if more than one position) referencing counterparty 'i', and used to hedge CVA risk. This notional amount should be discounted by applying the factor (1−exp(- 0.05 × Mi hedge))/(0.05 × Mi hedge);

Bind

is the full notional of one or more index CDS of purchased protection, used to hedge CVA risk. This notional amount should be discounted by applying the factor (1−exp(- 0.05×Mind))/(0.05× Mind);

wind

is the weight applicable to index hedges. The bank must map indices to one of the seven weights wi based on the average spread of index 'ind';

Mi

is the effective maturity of the transactions with counterparty 'i'.For IMM banks, Mi is to be calculated as per paragraph 43 of this chapter. For non-IMM banks, Mi is the notional weighted average maturity as referred to in the third bullet point of paragraph 120 of chapter 6. However, for this purpose, Mi should not be capped at 5 years;

Mi hedge

is the maturity of the hedge instrument with notional Bi (the quantities Mi hedge × Bi are to be summed if these are several positions);

M ind

is the maturity of the index hedge 'ind'. In case of more than one index hedge position, it is the notional weighted average maturity.

Banks that do not have approval to apply the internal models method may use the current exposure method.  The current exposure method is to be applied to OTC derivatives only; SFTs are subject to the treatments set out under the Internal Model Method of this chapter or in Chapter 5 of the CAR Guideline.

Institutions should calculate the credit equivalent amount these contracts using the **current exposure method** by adding

* + the amount for potential future credit exposure (or "add-on") of all contracts (this is calculated by multiplying the notional principal amounts by the add-on factors in the following table)
  + the replacement cost (obtained by "marking to market") of all its contracts with positive value.

The add-on applied in calculating the credit equivalent amount depends on the maturity of the contract and on the volatility of the rates and prices underlying that type of instrument. Options purchased over the counter are included with the same conversion factors as other instruments.

Regardless of whether a CCP is classified as a qualifying CCP (QCCP), a bank retains the responsibility to ensure that it maintains adequate capital for its exposures. Under Pillar 2 of Basel II, a bank should consider whether it might need to hold capital in excess of the minimum capital requirements if, for example, (i) its dealings with a CCP give rise to more risky exposures or (ii) where, given the context of that bank's dealings, it is unclear that the CCP meets the definition of a QCCP. [BCBS, July 2012, Annex 4 par 106]

Where the bank is acting as a clearing member, the bank should assess through appropriate scenario analysis and stress testing whether the level of capital held against exposures to a CCP adequately addresses the inherent risks of those transactions. This assessment will include potential future or contingent exposures resulting from future drawings on default fund commitments, and/or from a secondary commitments to take over or replace offsetting transactions from clients of another clearing member in case of this clearing member defaulting or becoming insolvent. [BCBS, July 2012, Annex 4 par 107]

A bank must monitor and report to senior management on a regular basis all of its exposures to CCPs, including exposures arising from trading through a CCP and exposures arising from CCP membership obligations such as default fund contributions. [BCBS, July 2012, Annex 4 par 108]

Where a bank is trading with a Qualifying CCP (QCCP) as defined in Section 4.1.1.1, paragraphs 125 to 141 will apply. In the case of non-qualifying CCPs, paragraphs 142 and 143 will apply. Within three months of a central counterparty ceasing to qualify as a QCCP, unless a bank's national supervisor requires otherwise, the trades with a former QCCP may continue to be capitalised as though they are with a QCCP. After that time, the bank's exposure with such a central counterparty must be capitalised according to paragraphs 142 and 143.