

## Title / Acronym of Digital Enabler

Quality Clearing House / QCH.

## Value/Functionality

QCH enables a decentralized workflow for quality management in supply chain scenarios. Deployed as a *smart contract* on the Hyperledger Fabric blockchain platform, it provides a common system of record for a manufacturing ecosystem where actors need to continuously assess the quality of raw material, parts and final products and match the results against contractual standards that may change frequently. Thanks to distributed ledger technology, QCH records are secure and trustworthy: they are timestamped, immutable and non-repudiable. Data storage and business logic are replicated on all the nodes of the system, which are operated equally by all participants, so that no single “owner” of the system exists who may introduce bias in the process

## How it can be accessed and used by third-parties

For experimentation in the scope of the QU4LITY project, the QCH smart contract is deployed on a Hyperledger Fabric instance which is operated by ENG and is accessible – to authorized users only – from the public Internet. A Java-based client library, packaged as a JAR file, is also provided as part of the enabler’s distribution. The library exposes to client applications an in-process API, which is actually a higher-level abstraction of the smart contract’s API. All platform-specific details, including those related to security (user identification, authentication and authorization), are hidden from the application.

## Contact Point for more information

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## Possible Use in an Open Call Experiment

The supply chain processes supported by QCH follow a simple pattern, the workflow of which is described below. To exemplify the pattern and for the sake of simplicity, we have identified distinct “actors” playing the three roles embodied in the system (Quality Master, Provider, Quality Assessor); however, in real-world supply chain processes it is likely that multiple organizations will play the Provider role, and/or that one single organization will play the remaining ones.

### Records

All records have their own unique identifier, which is used internally for cross-reference, and are owned by the party that creates them.

- Quality Assessment Data Model (QADM): a structured digital document that defines the standard of quality that applies to a given material, part or product, as stipulated by a commercial agreement (which is out of this scope). The standard is expressed in terms of a list of measurements, each consisting of a qualitative definition<sup>1</sup> and a quantitative range. One QADM document may exist for the entire duration of a contract, or new versions may be created that override previous ones in order to follow along the evolution of quality requirements.
- Shipping Unit Manifest (SUM): a digital record that identifies a shipped batch of materials, parts or products as subject to a given quality agreement. It consists of a pointer to an existing QADM and of a list of IDs, each associated to a physical item in the batch.
- Quality Assessment (QA): a digital record that reports the quality measurements taken on a received batch of materials, parts or products, along the guidelines of their agreed standard. It consists of pointers to an existing QADM and SUM, plus the actual values of all the measurements taken. Depending on the quality agreement in place, measurements may be reported per-batch (average values) or per-item.

### Roles

- Quality Master: typically, it's the manufacturing company that manages the supply chain. It creates the QADM document(s).
- Provider: it's always a provider of the supply chain (seller of goods). It creates SUM records.
- Quality Assessor: it is responsible of measuring the quality parameters on physical items with respect to the standard. It may be the same entity as the Quality Master or a different one – i.e., a third party in charge of independent assessment. In the latter case, it should be trusted by all the involved parties. The Quality Assessor creates QA reports.

### Actors in the example

- Factory A: plays the role of Quality Master.
- Factory B: plays the role of Producer.
- Company C: plays the role of Quality Assessor.

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<sup>1</sup> The vocabulary used to identify measurements must be in common between all parties involved: the meaning of each measurement declaration, which includes not only the “what” but also the “how” and possibly the “when”, must be unambiguous for everyone. To this goal, a formal ontology may be defined.

### **Example workflow**

1. When a commercial agreement is first defined, Factory A defines the quality standard and creates a new QADM, which is published on the QCH. Factory A also sets up and configures its quality assessment process and tools in collaboration with Company C, which provides the metrology equipment that is deployed on Factory A's premises.
2. Factory B prepares a batch of goods under the aforementioned agreement. The physical items in the batch are tagged with individual IDs. When the batch is shipped, Factory B publishes a new SUM record on the QHC that points to the reference QADM and lists all the IDs contained in the shipment.
3. Factory A receives the shipment. As the individual items herein contained are unloaded, they are sent to a quality assessment facility where the equipment provided by Company C is in use. The metrology tool reads the tag, identifies the item and executes the appropriate measurements.
4. When the shipment has been entirely processed, a QA report is generated by the metrology tool and published on the QCH on behalf of Company C<sup>2</sup>.
5. The process can now iterate any number of times, starting from point #2.

When payment to Factory B is due, Factory A will apply any penalties and discounts defined in the agreement for missed quality targets documented in the QCH.

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<sup>2</sup> The tool digitally signs the QA record with a private key that matches a public key that is known to belong to Company C.