QIF (Quality Information Framework): 2021 Definitive Guide

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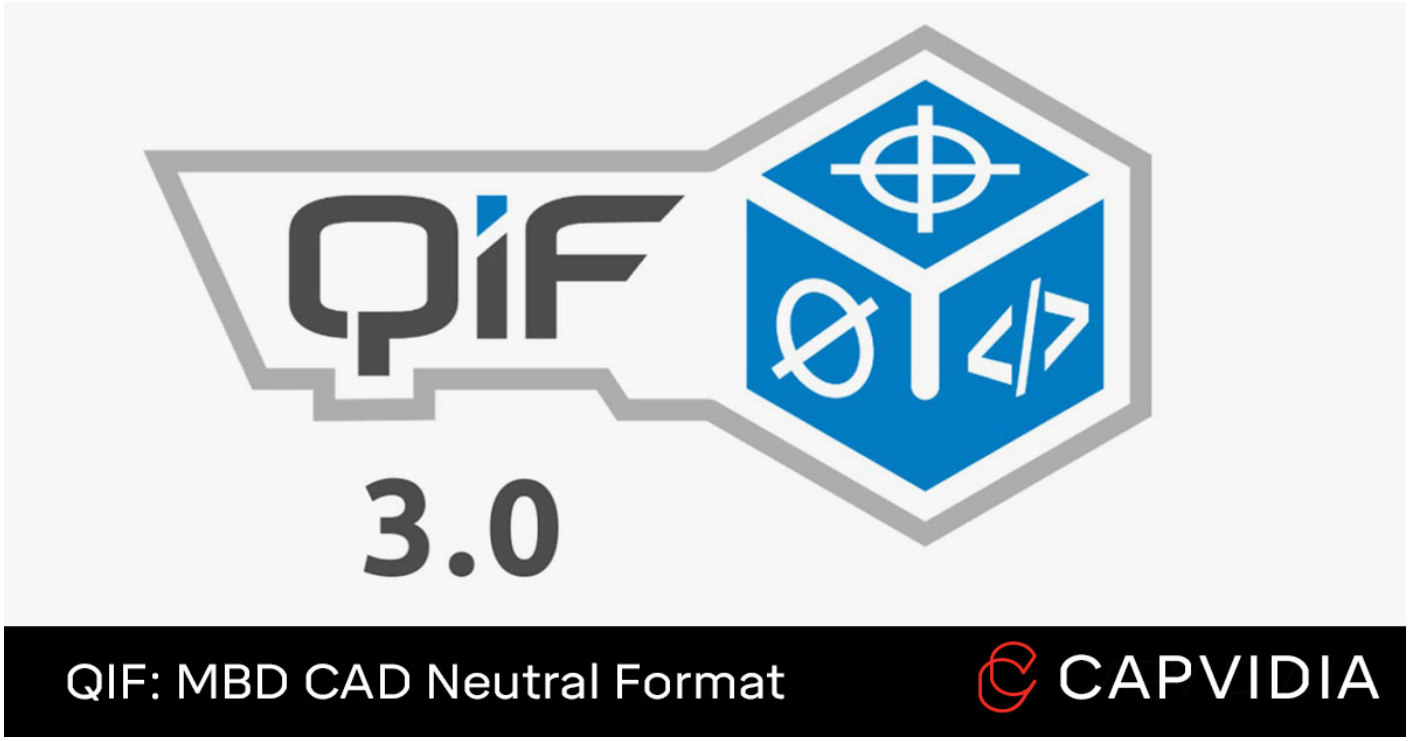

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What is QIF?

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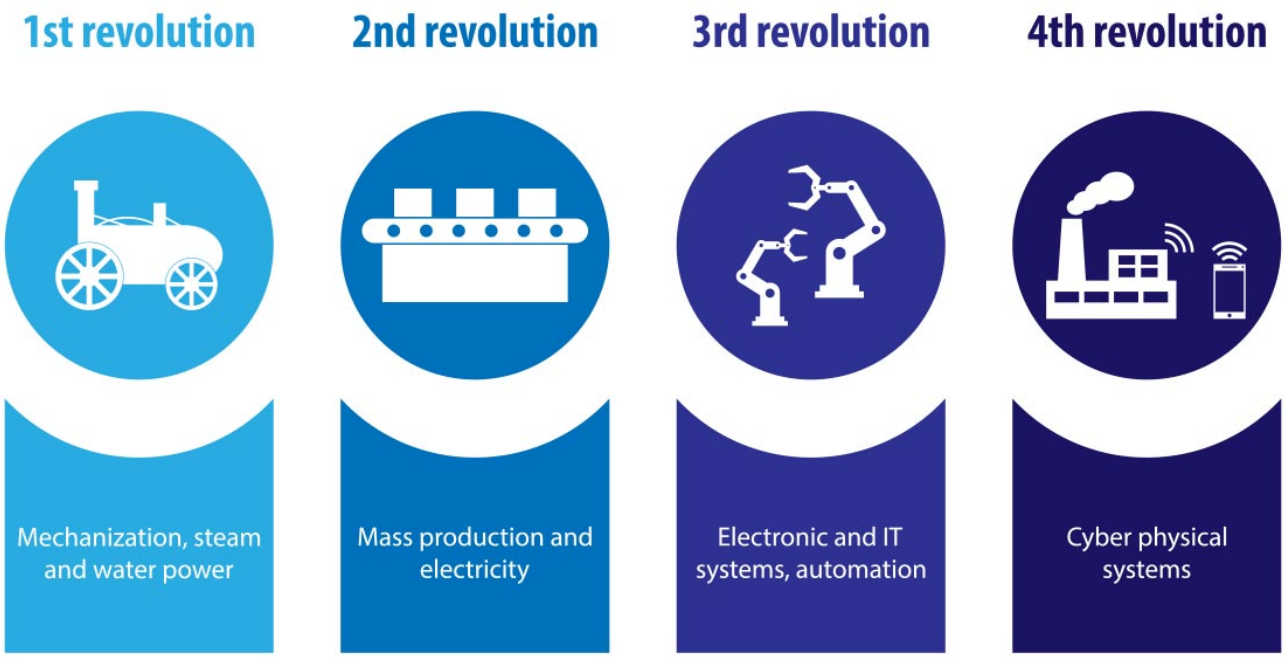
QIF (quality information framework) is an ISO standard CAD neutral file format made for downstream interoperability and traceability throughout the entire product lifecycle especially in computer-aided processes and engineering applications.

QIF is built on the XML framework for easy integration & interoperability with other systems, web/internet applications, and other formal standards-- a true unified and universal approach.

QIF overview:

- **Structured Data:** Featured-based, characteristic-centric ontology of manufacturing quality metadata.
- **Modern Approach:** XML technology-- simple implementation and build-in code validation.
- **Connected Data:** Information semantically linked to model for full information traceability to MBD.
- **Standard Data**: Approved ISO and ANSI interoperability standard.

Why is QIF important?



QIF like STEP AP242 is a 3D CAD file that contains PMI (product manufacturing information).

PMI includes all manufacturing data for building and measuring and other metadata; therefore, conveying anything in a 2D drawing into 3D annotations.

Semantically-defined PMI allows machine-readable data (GD&T, BOM, other meta-data and notes) to be consumed downstream by simulation, manufacturing, quality and other departments and their software/ machines.

By having crucial data mapped back to a single source of truth (the native CAD), it enables model-based workflows that is part of the digital manufacturing transformation.

QIF is a key conversation starter for companies beginning the MBD/MBE (model-based enterprise) process, especially for metrology-related information in PLM (produce lifecycle management) and PDM (product data management).

What are QIF key benefits?

Interoperable data

Not all data is created equal.

Different data file formats from different software are either proprietary or lacking robust data capabilities to produce true MBD. The incompatibility and inaccessibility prevent connecting data throughout the whole product lifecycle– traceability & automation in the digital thread.

Because of this, many of today's manufacturing processes depend on manual transcription and validation which impedes progress for upgrading workflows.

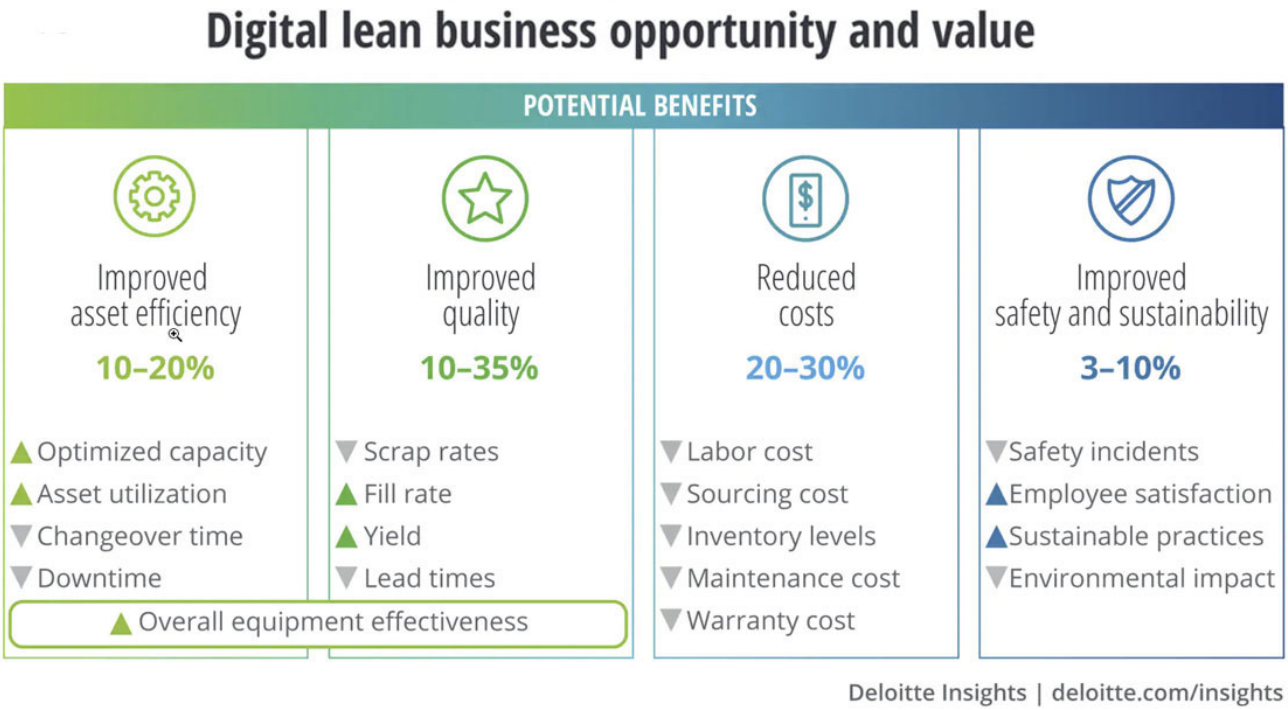
With QIF, interoperable data allows for accessibility across multiple departments and tiers, allowing for automation of manual processes such as FAI, ballooning, CMM program generation, and others to be shared.

Data management

Centralized management of data from various sources allow for efficient collection such as safeguarding valuable information, avoiding duplication, controlling access to data, and serializing result files for LOTAR (long term archiving and retrieval).

This includes tracking and locating measurement data for any specific part or characteristic.

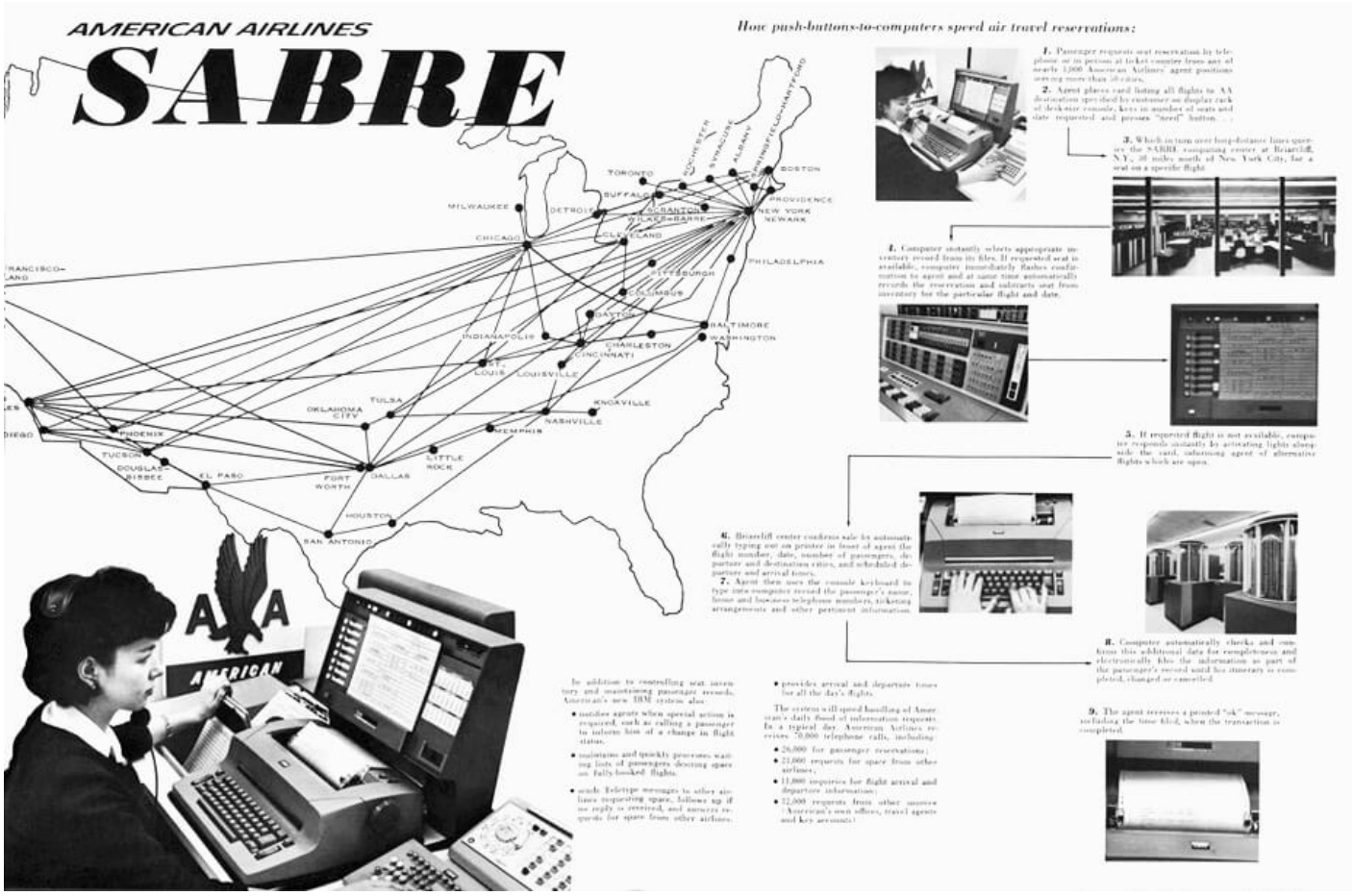
Data insights



It's no secret that the most successful companies since 2000 have been leaders in collecting, analyzing, and executing upon data insights.

Business revolutions such as Google, Facebook, and Amazon have unleashed the power of Big Data to impact their relevance and bottom line.

For the manufacturing industry, introducing Big Data as a core competency not only improves cost and time savings for immediate benefits, but has limitless potential and ROI as manufacturers embrace future use cases with automation, IoT, analytics, and AI.



A comparable case study can be made with American Airlines in the 1960s when it was one of the first airlines to automate their reservation system.

Although the goal was to initially make booking faster, the data collected from flights, cities, seasons, hours, and demand helped the company adjust ticket prices in real-time thus making more profit through efficiency.

Best yet, their reservation system became its own business when it was used as the backbone for other nationwide travel agent reservation systems, allowing American Airlines to prioritize their flights first but also gain exclusive insights on competitors while receiving licensing fees from travel agents.

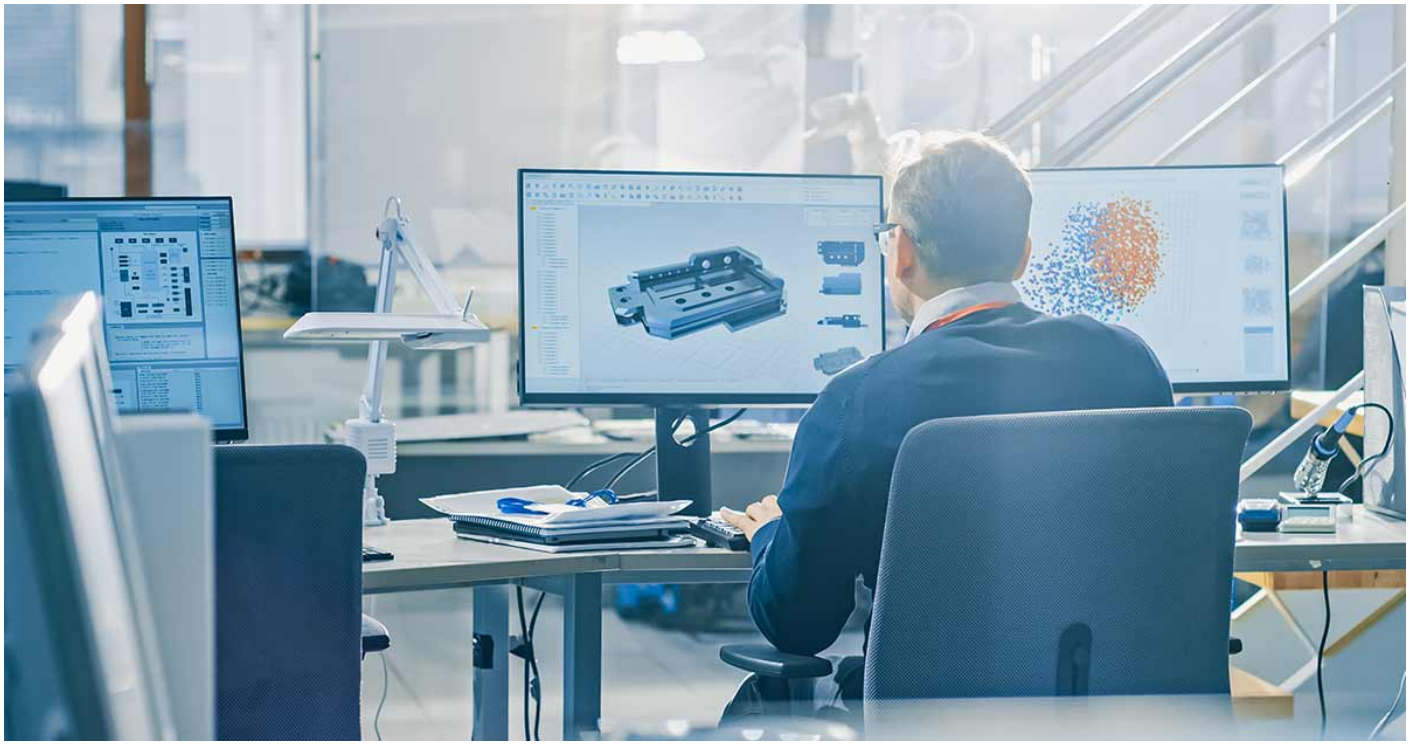
That's the power and potential of data.

Top 10 Benefits of QIF

1. **Automation:** Defined business process & software compatibility leads to the possibility of automation.
2. **Interoperability**: Enables authority CAD file to be reused on different software by different departments and companies.
3. **Single Source of Truth**: Derivative models for robust, semantic PMI, metrology features, and mappings back to any native CAD model.
4. **Big Data**: Manufacturing data is moved upstream for analytics & design improvements.
5. **Faster Time to Market**: Automation and decreased manual translation & validation begets shorter production cycles.

6. **Cost-Savings**: Up to 80% of total hours saved for annotation, control planning, and inspection processes together, meaning less resources needed for a particular task and reducing overhead.
7. **Work Efficiency**: Automation is repeatability, relying less on human involvement (and possible error) and freeing the engineer to focus on other value-add work.
8. **Process Over Personnel**: Avoiding the “human-in-the-loop” method provides documented process-driven strategy.
9. **Better Product**: Faster time to market leads to more iteration and breakthroughs in product, process, or pricing.
10. **Better Bottom Line**: Automated work processes, less bottlenecks, and faster iteration & feedback for ideation all leads to cost savings in time & money.

Use cases of QIF by stage



Design

Up to 33% of design time is spent on 2D drawings. Because QIF is a 3D CAD + PMI, all documented information is already embedded within the CAD file.

Eliminating drawings not only saves time, it also doesn’t hold back the next generation of design engineers who’ve only worked with 3D.

Manufacturing

CMM technicians translate drawings into physical models. They must have expert knowledge in GD&T, CAD, and measurement to transcribe 2D drawings into their CMM (coordinate measuring machine).

A single part can take days to several weeks. However, up to 60% of 2D drawings don’t match the 3D model. With the added burden of manual transcribing & interpreting 2D to 3D, the high-risk error greatly

increases.

QIF allows for automation from CAD design to CMM, reducing dependency on human labor and reducing up to 81% of time for CMM process.

Quality

For metrologists, QIF can be used to transmit information between supply chain partners on how and what to measure, as well as communicate the results from the measurement.

IT

For PLM/PDM owners, QIF can be used to bring your quality information into the “digital thread” for your manufacturing operation and associate all your quality information directly to your master model.

Operations

With up to 80% of total hours saved for annotation, machining, and inspection processes together, it improves processes for faster products, more efficient processes, quicker iterations, and less redundancies.

Use cases of QIF in MBD & MBE process

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CAD translation & validation:

Whether it's a CATIA, NX, Creo, or SolidWorks CAD file, it needs to be translated to a neutral format like QIF that can be passed downstream and handled off to different stakeholders & departments. Then it needs to be validated to ensure the original CAD & QIF CAD are aligned.

Ballooning & first article inspection:

Measurement control plans must be created, along with putting IDs on tolerance requirements, and finally generating inspection documents. This is all done from the MBD model.

CMM programming:

Instead of using a 2D drawing and manually transcribing GD&T and other annotations into the CMM, QIF automates this process saving time & skilled labor use.

Welding:

With weld annotations captured in the QIF PMI, semantic data can be used downstream by software specializing in welds.

Visual inspection:

Over 90% of visual quality inspection is done manually which is slow, expensive, and inconsistent. With semantic inspection requirements from the QIF model, the reality of AI-automatic visual inspections becomes a possibility.

Harvesting results:

All QIF data generated throughout the entire process is linked to the authority model. This fulfills traceability requirements and provides fertile opportunities for data mining leading to better products, processes, and more-informed people.

QIF Resources

QIF tutorial webinars

QIF 101: Understanding QIF Basics

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QIF 102: Outlining the QIF Schemas

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QIF 103: A Beginner's Guide to QIF 3.0 Implementation

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Download The Presentations (PDF)

Important links

1. QIF Standards (official website) : https://qifstandards.org/download/
2. QIF MBD Software: https://www.capvidia.com/products/mbdvidia
3. GitHub Community: https://qualityinformationframework.github.io/

Other Vocabulary Related to QIF

1. **Advanced Manufacturing Enterprise**: Companies using innovative & cutting-edge technology to deliver improved products & processes.
2. **Big Data**: Large volume of data that can be structured & analyzed for business insights.
3. **Digital Enterprise**: Company using digital technology for automation, data mining, and reducing costs.

4. **Digital Thread / Tapestry**: Connected workflow from conception to production across different departments.
5. **Digital Twin**: Digital replica of a physical thing to be tested through simulation for discovering product improvements & vulnerabilities.
6. **DMSC**: Digital Metrology Standards Consortium, manages the QIF standard.
7. **Industrial Internet of Things**: IIoT is a network of connected industrial equipment that monitor, collect, exchange, and analyze data to predict future outcomes & prevent failure.
8. **Industry 4.0**: The fourth industrial revolution with focus on wireless connectivity, connectivity, and the smart factory.
9. **MBD:** Model-based definition or digital product definition, practice of using 3D CAD with semantic PMI that is both human & machine readable.
10. **MBE**: Model-based enterprise, using the 3D CAD with semantic PMI as the sole source of authority for all activities in a product's lifecycle.

Need to Learn More About QIF and Applying It to Your Workflow?

Starting a pilot program or needing to know the right information to start MBD, contact us today and become the spark that brings your company into the digital age.