



Quality Factors in Whole Quality

How Function Realization Becomes Understandable

Foundational Article 8 — Third Edition

Whole-Quality Institute

The preceding Foundational Articles established that Whole Quality begins with the defined Quality Object.

They explained that a defined Quality Object may have one or more Intended Functions; that an Intended Function may be associated with one or more Intended Results; and that those functions and results must be interpreted within appropriately established Boundaries and across relevant Interfaces.

Together, these concepts explain how Function Realization occurs.

A further methodological question naturally follows:

How does Function Realization become understandable for responsible Quality Determination?

Whole Quality answers this question through Quality Factors.

Quality Factors are not arbitrary categories.

They are not generic checklists.

They are not collections of commonly measured characteristics.

Nor are they selected simply because they are familiar within a particular profession, industry, or regulatory system.

Rather, Quality Factors are the principal dimensions of Function Realization that must be understood to determine the Quality State of a defined Quality Object.

The authoritative definition of Quality Factor is established in the Whole Quality Root Vocabulary Standard (WQI VOC1).

This Foundational Article does not redefine that Root Concept.

Instead, it explains its methodological role within the Whole Quality methodology.

FTA4 introduced the principle of methodological resolution.

FTA6 showed that Function Realization is naturally multidimensional and is realized through multiple Intended Results.

FTA7 established the Boundaries and Interfaces within which that Function Realization is determined.

FTA8 continues this progression by explaining how the principal dimensions of Function Realization become represented through Quality Factors.

The recurring example introduced in the previous articles continues throughout this article.

Assume that the defined Quality Object is:

Human Body Health

Its Intended Function and Intended Results have already been established.

Its applicable Boundaries and Interfaces have already been identified.

The next methodological question becomes:

Which principal dimensions of Function Realization should now be examined in order to determine the Quality State of Human Body Health?

The answers become the Quality Factors.

These Quality Factors are not invented by the methodology.

They are discovered through understanding how the defined Quality Object realizes its Intended Function within its established Boundaries and Interfaces.

This principle applies equally to infrastructure, health, support services, environmental systems, management systems, and other application domains.

The specific Quality Factors differ.

The methodology used to identify them remains the same.

Throughout this article, one principle remains fundamental:

Quality Factors do not create Function Realization. They provide the principal methodological dimensions through which Function Realization becomes understandable.

1. Why Quality Factors Matter

The authoritative definition of Quality Factor is established in the Whole Quality Root Vocabulary Standard (WQI VOC1).

This article explains why Quality Factors occupy a central methodological position within Whole Quality.

FTA6 established that a Quality Object may have one or more Intended Functions, and an Intended Function may be associated with one or more Intended Results because Function Realization is naturally multidimensional.

FTA7 established the Boundaries and Interfaces within which those Intended Results are interpreted.

The next methodological question is therefore:

Which principal dimensions of Function Realization should be examined in order to determine the Quality State of the defined Quality Object?

The answers become the Quality Factors.

Quality Factors do not replace the Intended Function.

They do not replace the Intended Results.

They do not replace Boundaries or Interfaces.

Instead, they organize the principal dimensions through which Function Realization becomes understandable.

1.1 Quality Factors Represent Principal Dimensions

Function Realization is seldom represented by one dimension alone.

A defined Quality Object commonly realizes its Intended Function through several interrelated dimensions.

Whole Quality represents these principal dimensions through Quality Factors.

Each Quality Factor represents one broad aspect of Function Realization.

Together, the Quality Factors provide a structured understanding of how the defined Quality Object realizes its Intended Function.

This understanding prepares the foundation for later identification of Quality Indicators.

1.2 Recurring Example — Human Body Health

Assume again that the defined Quality Object is:

Human Body Health

The Intended Function and Intended Results have already been established.

The applicable Boundaries and Interfaces have already been identified.

Whole Quality now asks:

Which principal dimensions of Function Realization should be examined?

Examples may include:

- cardiovascular function;
- respiratory function;
- neurological function;
- metabolic function;
- immune function;
- musculoskeletal function.

These are not yet Quality Indicators.

They are broad dimensions through which Function Realization of Human Body Health becomes understandable.

Each dimension contributes to realization of the Intended Function.

Together they provide a structured representation of the Quality Object.

1.3 Quality Factors Are Discovered

Whole Quality does not begin by selecting Quality Factors from a predefined checklist.

Nor are they chosen simply because they are familiar within a profession or required by a particular regulation.

Quality Factors are discovered through understanding:

- the defined Quality Object;
- its Intended Function;
- its Intended Results;
- its Boundaries;
- its Interfaces;
- the way Function Realization actually occurs.

Different Quality Objects therefore require different Quality Factors.

However, the methodology used to identify them remains the same.

1.4 Methodological Resolution

FTA4 introduced the principle of methodological resolution.

That principle continues here.

At a Methodological Resolution adequate for the intended Quality Determination, the principal dimensions of Function Realization become progressively distinguishable.

The Quality Object remains unchanged.

The Intended Function remains unchanged.

The methodology remains unchanged.

Whole Quality simply reveals the principal dimensions through which Function Realization becomes understandable.

These principal dimensions become the Quality Factors.

2. Deriving Quality Factors from Function Realization

Quality Factors are derived from understanding how the defined Quality Object realizes its Intended Function within established Boundaries and across relevant Interfaces. They are not independent constructs or categories selected in advance. Function Realization exists before it is organized into these methodological dimensions.

2.2 Recurring Example — Human Body Health

Assume again that the defined Quality Object is:

Human Body Health

The Intended Function is realized through multiple Intended Results, including effective circulation of blood, adequate respiration and gas exchange, neurological regulation, metabolic regulation, immune protection, movement, repair, recovery, and maintenance of internal physiological stability.

When these Intended Results are examined together, broader dimensions of Function Realization naturally become apparent.

For example:

- circulation of blood contributes to the cardiovascular dimension;
- respiration and gas exchange contribute to the respiratory dimension;
- neurological regulation contributes to the neurological dimension;
- metabolic regulation contributes to the metabolic dimension;
- immune protection contributes to the immune dimension;
- movement contributes to the musculoskeletal dimension.

These Quality Factors are not arbitrary classifications.

They represent coherent dimensions through which realization of Human Body Health becomes understandable.

2.3 The Same Methodology Across Different Domains

The same methodological principle applies regardless of the application domain.

For a natural gas pipeline transportation system, understanding Function Realization may reveal dimensions such as:

- structural integrity;
- operational capability;
- containment performance;
- operational control;
- environmental protection;
- emergency preparedness.

For a support-service arrangement, it may reveal dimensions such as:

- effectiveness of support;
- continuity of support;
- dignity and autonomy;
- communication;
- safeguarding;
- participation.

Different Quality Objects produce different Quality Factors.

The methodology used to derive them remains unchanged.

2.4 Quality Factors Represent, They Do Not Replace

Quality Factors should not be mistaken for the Intended Function itself.

Neither should they be confused with Quality Indicators or Quality Outcome Criteria.

Each Quality Factor represents one principal dimension of Function Realization.

It organizes understanding.

It does not yet provide observation.

It does not yet provide interpretation.

Those methodological roles belong to the following stages of Whole Quality.

3. Relationships Among Quality Factors

Quality Factors should not be interpreted as isolated dimensions of Function Realization.

Each Quality Factor represents one principal dimension of the defined Quality Object.

However, realization of the Intended Function commonly depends upon the interaction of several Quality Factors rather than upon any single Quality Factor considered independently.

Whole Quality therefore examines both:

- each Quality Factor individually; and
- the relationships among Quality Factors.

This distinction is essential for responsible Quality Determination.

3.1 Interdependence of Quality Factors

Function Realization is an integrated process.

Accordingly, Quality Factors are commonly interdependent.

Improvement in one Quality Factor may support another.

Weakness in one Quality Factor may reduce the realization of several others.

Some Quality Factors may compensate partially for limitations in another.

Others may introduce new constraints or vulnerabilities.

Understanding these relationships is part of understanding Function Realization itself.

3.2 Recurring Example — Human Body Health

Assume again that the defined Quality Object is:

Human Body Health

The Quality Factors may include:

- cardiovascular function;
- respiratory function;
- neurological function;
- metabolic function;
- immune function;
- musculoskeletal function.

These Quality Factors do not operate independently.

Effective circulation of blood supports oxygen delivery throughout the body.

Respiratory function supports circulation by enabling oxygen uptake and carbon dioxide removal.

Neurological regulation coordinates cardiovascular, respiratory, muscular, and many other biological functions.

Metabolic regulation provides the energy required for bodily functioning.

Immune function supports protection, repair, and recovery.

Musculoskeletal function depends upon adequate circulation, neurological regulation, metabolism, and many other interacting biological processes.

The Quality State of Human Body Health therefore cannot be understood responsibly by examining only one Quality Factor in isolation.

3.3 Relationships Depend on the Declared Quality Object

The relationships among Quality Factors differ from one Quality Object to another.

For a natural gas pipeline transportation system, structural integrity, operational capability, containment, monitoring, environmental protection, and emergency preparedness interact continuously.

For a support-service arrangement, communication, continuity of support, safeguarding, dignity, participation, and personal outcomes are also interdependent.

The specific relationships differ.

The methodological principle remains unchanged.

3.4 Methodological Resolution and Preparation for Observation

At a Methodological Resolution adequate for the intended Quality Determination, relationships among Quality Factors become more clearly distinguishable. These relationships already exist within the defined Quality Object; Whole Quality reveals them to strengthen the basis for subsequent observation through Quality Indicators.

4. From Quality Factors to Quality Indicators

Quality Factors provide a structured understanding of the principal dimensions of Function Realization. However, a Quality Factor itself is not usually observed directly.

It represents a broad dimension of the defined Quality Object.

Responsible Quality Determination therefore requires a further methodological step.

Whole Quality asks:

What should be examined to understand each Quality Factor?

The answer is identified through Quality Indicators.

4.1 Quality Factors Require Observation

Understanding a Quality Factor is not sufficient to determine its Quality State.

The methodology must identify aspects that should be examined to understand that Quality Factor.

These aspects become the Quality Indicators.

Accordingly:

- the Quality Factor represents the principal dimension of Function Realization;
- the Quality Indicator identifies what should be examined to understand that dimension.

The Quality Indicator therefore serves the Quality Factor.

It does not replace it.

4.2 Recurring Example — Human Body Health

Assume again that the defined Quality Object is:

Human Body Health

One Quality Factor may be:

Cardiovascular Function

Cardiovascular Function is a broad Quality Factor and is understood by examining relevant Quality Indicators.

Relevant Quality Indicators may include:

For example:

- heart function;
- vascular function;
- blood circulation performance;
- regulation of blood pressure;
- tissue perfusion.

Each identifies an aspect that should be examined to understand the broader Quality Factor.

Together they provide a more complete understanding of Cardiovascular Function.

No single Quality Indicator completely represents the Quality Factor.

4.3 A Quality Factor May Be Examined Through Multiple Quality Indicators

This relationship is not merely a practical convenience. It follows from the natural multidimensionality of Function Realization: a broad Quality Factor ordinarily requires several complementary Quality Indicators to examine its different quality-relevant aspects.

This progression reflects increasing methodological resolution. It reveals how Function Realization becomes understandable and observable without creating additional complexity.

4.4 Preparing for Quality Outcome Criteria

Quality Indicators identify what should be examined to understand Quality Factors, but observation alone does not establish the Quality State. FTA9 develops the Indicator architecture, and FTA10 explains how one Quality Indicator is interpreted through multiple Quality Outcome Criteria.

5. Methodological Sources and Related Work

Whole Quality is developed as a distinct cross-domain methodology. Established systems-engineering work provides relevant context for functional decomposition and for organizing the dimensions through which required system behavior is understood [1]. Quality-model literature also demonstrates that broad quality concepts can be organized into characteristics and subcharacteristics for systematic examination [2].

These sources provide methodological context; they do not define Whole Quality. The WQI contribution in this article is the derivation of Quality Factors from Function Realization rather than from a universal checklist, together with the explicit separation of Quality Factors from Quality Indicators and Quality Outcome Criteria. WQI_VOC1 remains authoritative for the controlled definitions.

References

- [1] National Aeronautics and Space Administration (NASA). NASA Systems Engineering Handbook. NASA/SP-2016-6105 Rev. 2. Washington, DC: NASA, 2016/2017.
- [2] ISO/IEC 25010:2023. Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Product quality model.

Conclusion

This Foundational Article has explained that Quality Factors represent the principal dimensions through which Function Realization becomes understandable.

Quality Factors are derived from the defined Quality Object, its Intended Function and Intended Results, and its established Boundaries and Interfaces. They are not generic categories, checklists, observations, or interpretations.

The article has also shown that Quality Factors are interdependent. Their relationships form part of Function Realization and should remain visible within responsible Quality Determination.

The next methodological stage identifies what should be examined: a Quality Factor may be examined through multiple Quality Indicators. Those Indicators may then be interpreted through one or more applicable Quality Outcome Criteria.

Throughout this progression, the defined Quality Object remains the primary reference point, and Whole Quality uses a Methodological Resolution adequate for the intended Quality Determination without creating additional complexity.

The authoritative definition of Quality Factor remains established in the Whole Quality Root Vocabulary Standard (WQI VOC1).

A Quality Object may have one or more Intended Functions, and an Intended Function may be associated with one or more Intended Results.

A Quality Factor may be examined through multiple Quality Indicators.

A Quality Indicator may be interpreted through one or more applicable Quality Outcome Criteria.

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The concepts described in this article are intended to explain the role of Quality Factors within the Whole Quality methodology and their relationship to the defined Quality Object, Intended Functions, Intended Results, Function Realization, Boundaries, Interfaces, Quality Indicators, Quality Outcome Criteria, Evidence, Quality Determination, Quality State, and Quality Claims. They do not replace applicable laws, regulations, professional standards, engineering codes, clinical guidance, organizational requirements, safety requirements, quality-management-system requirements, or other authoritative references.

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