Intended Function and Function Realization

Where Quality Factors Begin

Foundational Article 6

Whole-Quality Institute

Quality assessment cannot begin with a checklist.

Before we can say whether something has quality, we must first understand what the object is expected to realize.

This is why the Whole-Quality Institute begins with the quality object and its intended function.

A quality object may be large or small. It may be physical, social, organizational, biological, or informational. It may be a natural gas pipeline system, a support service, a certification process, a health state, a body system, a cell, a DNA region, or another defined object.

But not every thing, condition, process, or grouping in the world can automatically be treated as a WQI quality object.

A WQI quality object must have a sufficiently coherent boundary and a sufficiently discoverable or formulable intended function or function-realization logic. Without this, Quality Factors, Indicators, evidence, and Quality Claims may become artificial or misleading.

This is especially important when several entities are grouped together. A grouping does not become one quality object merely because its parts are placed side by side. It becomes one quality object only when the grouping has its own coherent boundary and shared function-realization logic.

For example, one human functioning state may be analyzed as a quality object because a human person has an integrated functional unity. Organs, systems, capacities,

activities, biological functions, conscious actions, and social functioning are subparts of one whole human functioning state.

By contrast, two humans together do not automatically form one WQI quality object. Each person may have a separate health or functioning quality state. The two persons become one quality object only when a higher-level shared function is declared, agreed, socially recognized, legally established, institutionally assigned, or relationally created — for example, a caregiver–recipient dyad, a household functioning system, a work team, a service-delivery relationship, or another defined social-functional system.

Therefore, intended function is not discovered by aggregation alone. It is discovered or formulated through the boundary and purpose of the quality object. Where no coherent shared function exists, WQI should not force a single quality-object claim.

But in every case where a coherent quality object can be defined, WQI asks a basic question:

What function is this object expected to realize, and what must be present, protected, supported, evidenced, or controlled for that function to be realized with quality?

From this question, the WQI structure begins.

In WQI, intended function, functional requirements, and function realization are connected but not identical.

The intended function defines what the quality object is expected to realize. Functional requirements translate that intended function into the necessary conditions, capabilities, supports, boundaries, interfaces, controls, and evidence needs that must be present for the function to be realized. Function realization describes the actual achievement of that function in real conditions.

Therefore, WQI does not move directly from an abstract function statement to measurement. It first asks whether the intended function has been translated into adequate functional requirements. If the functional requirements are incomplete, unclear, unverifiable, or disconnected from real boundaries, interfaces, failure modes, and evidence needs, the later Quality Factors, Indicators, Outcome Criteria, and Quality Claims may also become weak or misleading.

Function realization is examined through the conditions, capabilities, supports, constraints, interfaces, evidence needs, and failure-mode families that affect whether the object can realize its intended function.

These elements lead to Quality Factors.

Quality Factors lead to Indicators.

Indicators lead to Quality Outcome Criteria.

Evidence then supports or limits the Quality Claim.

This means Quality Factors are not selected randomly. They are not borrowed as generic categories. They are derived from the way the quality object realizes its function, the conditions and capabilities needed for that realization, the evidence needed to support a quality claim, and the ways the function can be prevented, distorted, weakened, interrupted, or misdirected.

Assigned Function in Human-Created Objects

Some quality objects are created by people.

Infrastructure systems, support services, organizations, standards, procedures, and certification processes are examples of human-created objects. Their intended functions are assigned through human purpose, design, need, law, policy, planning, funding, professional practice, or social expectation.

A natural gas pipeline transportation system is created to transport natural gas safely, reliably, and within defined operational, environmental, and public-safety boundaries.

A support service is created to help a person participate in daily life, work, community, relationships, or other valued roles.

A certification process is created to determine whether defined requirements have been met and whether a quality claim is supported by evidence.

In these examples, the function is not hidden in nature. It is assigned by human intention.

But this does not mean the function is always clear.

Human-created objects may still have uncertainty. Their intended functions may be incomplete, vague, conflicting, over-narrow, over-broad, or distorted by routine, funding rules, institutional habits, or compliance language.

For this reason, WQI does not simply accept a function statement at face value. It helps discover and clarify the appropriate intended function of the object.

WQI asks:

What was this object created to do?

For whom?

Under what conditions?

Within what boundaries?

Across what interfaces?

What results are expected?

What functional requirements translate the intended function into necessary conditions for realization?

What conditions and capabilities are needed for those results?

What failures would prevent or distort those results?

What evidence would show that the function has been realized sufficiently?

In human-created objects, uncertainty is often bounded because the function was assigned by people. We can review the design, purpose, requirements, operating conditions, service goals, stakeholder needs, and expected outcomes.

The task is to clarify the function well enough to derive the right Quality Factors.

For human-created objects, functional requirements are the bridge between purpose and realization. They express what must be true for the assigned intended function to be realized sufficiently, safely, reliably, beneficially, and within the declared boundary. They may include required capabilities, operating conditions, lifecycle conditions, interface conditions, evidence requirements, safety or protection conditions, and constraints that must not be violated.

The adequacy of functional requirements is therefore itself important. Requirements should be complete enough, clear enough, traceable enough, verifiable enough, and sufficiently connected to the real failure-mode families of the quality object. A weak requirement may allow an object to appear compliant while still failing to realize its intended function with quality.

Function Realization, Not Only Function Statement

WQI does not stop at a simple statement of function.

It is not enough to say that a pipeline transports gas, or that a support service helps a person, or that a health system treats illness.

WQI asks how the function is realized.

Function realization includes the object's boundaries, interfaces, lifecycle conditions, operating environment, users, beneficiaries, risks, constraints, supports, capabilities, and expected outcomes.

For example, a pipeline does not realize quality only by existing as a pipe. It realizes function through route selection, material integrity, pressure control, flow capacity, corrosion protection, monitoring, emergency response, public-safety protection, environmental protection, maintenance, lifecycle evidence, and the ability to support the intended transportation service.

A support service does not realize quality only by recording that a service was provided. It realizes function through the actual support relationship, the person's goals, dignity, safety, participation, choice, role development, setting conditions, documentation, and coordination with other systems.

In WQI, the function statement is only the beginning.

The real question is:

What must remain visible, controlled, supported, protected, and evidence-supported for this function to be realized with quality?

The answer to that question leads to Quality Factors.

WQI does not require a separate Core Standard for every individual object. Where a family of quality objects shares a sufficiently common function-realization logic, WQI may define a family-level Core and then use Context Guides for specific object types. For example, different energy infrastructure assets are not one physical asset, but they may be treated as a family-level quality-object domain because they share common infrastructure quality concerns such as intended service, boundary definition, interface control, safety, reliability, continuity, environmental protection, lifecycle evidence, and public-interest consequences. The Core defines the shared quality-state architecture. Context Guides then adapt that architecture to the specific intended function, boundaries, failure modes, Indicators, evidence, and Quality Outcome Criteria of each infrastructure type.

Quality Management Systems and Quality-State Evidence

In human-created objects, function realization may be supported by a quality management system.

A manufacturer, designer, construction provider, commissioning provider, operator, or infrastructure owner may use a quality management system to manage and control activities, responsibilities, resources, suppliers, records, verification, validation, nonconformities, corrective actions, and lifecycle processes.

Such systems may be valuable and may provide important evidence for WQI analysis. However, WQI should not be reduced to QMS.

A QMS primarily helps an organization manage and control the processes intended to create, verify, preserve, and improve quality. WQI asks a related but different question: what is the quality state of the quality object itself, and can that object realize its intended function within the declared boundary, context, and evidence claim?

Therefore, QMS evidence may support a WQI Quality Claim, but it does not replace WQI analysis. Existing or future lifecycle QMS standards may help manage realization processes, while WQI remains focused on the object's condition, capability, evidence sufficiency, uncertainty, and intended-function realization.

Function-Realization Analysis and Failure-Mode Families

WQI discovers Quality Factors by examining the whole logic of function realization.

This includes what enables the function, what supports it, what preserves it over time, what makes it observable, what evidence is needed to claim it, and what can prevent, distort, weaken, interrupt, or misdirect it.

A failure mode is not only a technical breakdown. It may be any way in which the intended function is prevented, distorted, weakened, interrupted, or misdirected.

Failure-mode families are therefore important discovery tools, especially for safety, reliability, protection, and risk-related dimensions of quality. But they are not the only source of Quality Factors.

Because quality includes safety but also exceeds safety, WQI also looks for positive and enabling dimensions of function realization: capability, suitability, continuity, usability, accessibility, adaptability, dignity, maintainability, evidence sufficiency, beneficial outcome, service effectiveness, environmental fit, and other dimensions relevant to the quality object.

In infrastructure, function-realization analysis may include required capacity, continuity of service, pressure and flow control, compatibility with connected systems, maintainability, inspection access, evidence sufficiency, public safety, environmental protection, and lifecycle resilience. Failure-mode families may include loss of

containment, corrosion, overpressure, ground movement, material defect, monitoring failure, interface failure, construction defect, operational error, environmental damage, or public-safety exposure.

In support services, function-realization analysis may include the person's goals, dignity, choice, safety, participation, role development, continuity of support, coordination, documentation, accessibility, and real-life outcome. Failure-mode families may include unsafe support, loss of dignity, role confusion, poor documentation, service duplication, service gaps, funding misalignment, exclusion from community life, weak employment support, or failure to recognize a person's actual needs and goals.

By identifying the enabling conditions, required capabilities, supports, interfaces, evidence needs, constraints, and failure-mode families, WQI identifies the dimensions of function realization that must remain visible, controllable, supportable, and evidence-supported.

These dimensions become Quality Factors.

A Quality Factor names a dimension of function realization that must remain visible, controllable, supportable, and evidence-supported.

Indicators make a Quality Factor observable, assessable, or verifiable. A single Quality Factor may require several Indicators to show its condition, behavior, capability, result, or evidence status.

Quality Outcome Criteria define the expected state, condition, behavior, capability, or result showing that the function has been realized sufficiently, safely, beneficially, and within intended boundaries and interfaces.

This is the stable WQI logic:

Intended Function → Functional Requirements and Enabling Conditions → Function Realization → Quality Factors → Indicators → Quality Outcome Criteria → Evidence → Quality Determination / Quality Claim

In this sequence, functional requirements do not replace Quality Factors. They help translate the intended function into the conditions that must be present for realization. Quality Factors then name the dimensions of that realization that must remain visible, controllable, supportable, and evidence-supported.

Discovered Function in Biologically Based Objects

Biologically based objects are different.

A cell, an organ, a DNA region, a body system, an animal health state, or a human health state was not invented by human will.

Its function is not assigned in the same way that people assign the function of a bridge, a pipeline, a service, or a standard.

Biological function is discovered through observation of life processes.

It may be genetically influenced, chemically mediated, developmentally shaped, environmentally affected, adaptive, self-regulating, and only partly observable.

A cell may divide, signal, repair, migrate, respond, reject, adapt, die, or interact with other cells.

An organ may filter, pump, digest, regulate, sense, protect, or coordinate.

A body system may support movement, circulation, immunity, cognition, reproduction, perception, or adaptation.

A human health state may include biological condition, functional ability, mental condition, social participation, recovery capacity, disability, resilience, and lived experience.

In these objects, WQI cannot assume that all intended-function aspects are fully known.

Many function-realization pathways are internal. They occur inside the object through boundaries and interfaces that are not directly visible to us.

The uncertainty is therefore different from uncertainty in human-created objects.

In human-created objects, uncertainty often comes from incomplete purpose, unclear requirements, poor design, conflicting stakeholders, or insufficient evidence.

In biologically based objects, uncertainty often comes from hidden internal mechanisms, partly observable processes, unknown interactions, and internal boundaries and interfaces that cannot be fully seen.

This makes it harder to discover all necessary and sufficient Quality Factors that determine the quality state of the object.

Different Origins of Uncertainty

WQI must therefore distinguish between two different origins of uncertainty.

For human-created objects, uncertainty often concerns how well people have defined, designed, implemented, operated, or evaluated the intended function.

The function itself is usually assigned by human purpose, even if it needs clarification.

For biologically based objects, uncertainty often concerns what the function actually is, how it is realized, and which internal mechanisms and interfaces are necessary for the quality state.

The function is not assigned by humans. It is discovered from the object's nature, behavior, development, adaptation, damage, repair, and failure.

This does not make WQI impossible for biological or health-related objects.

It means WQI must be more careful.

It must distinguish between:

known mechanisms,

partly known mechanisms,

inferred mechanisms,

observable patterns, and

unknown mechanisms.

A quality claim about a biological or health-related object must therefore be bounded by the evidence available.

Where the mechanism is known, WQI may use biological, chemical, genetic, neurological, physiological, behavioral, or social terms.

Where the mechanism is unknown or only partly known, WQI may use semantic descriptors such as recognition, selection, compatibility, rejection, direction, adaptation, resistance, recovery, or similar terms.

In some cases, metaphorical model-language may also be useful, such as "cellular will." But such language should not be treated as literal consciousness. It should be understood as a provisional way to describe a directional pattern of function realization when the underlying mechanism is not fully known.

Human Health as a Special Case

Human health is especially complex because the human being is both biological and conscious.

A human body has biological function realization: cells, organs, tissues, body systems, genetics, chemistry, immunity, neurology, movement, perception, repair, and aging.

But a human person also has conscious, social, and personal function realization: will, choice, meaning, dignity, relationships, work, family, culture, self-direction, participation, and responsibility.

For this reason, human health quality cannot be reduced only to biological condition.

It may include medical health state, functional ability, social participation, support needs, environmental fit, work capacity, recovery, and the person's ability to live meaningfully within real conditions.

Human health therefore requires careful boundary definition.

Sometimes the quality object may be the medical health state after an injury.

Sometimes it may be the social health state related to disability.

Sometimes it may be a specific body system.

Sometimes it may be a rehabilitation process.

Sometimes it may be a person's functional condition in relation to work or daily life.

Each quality object requires its own function-realization analysis.

WQI should not collapse all these objects into one number or one generic category.

A single human functioning state may be treated as a quality object because the person has an integrated whole-functioning boundary. Internal biological systems, body functions, conscious capacities, daily activities, social participation, and adaptive responses may be analyzed as subparts of one human functioning state.

However, two or more persons do not automatically form one health or functioning quality object. Their health states may be related, but relation alone is not enough. A multi-person quality object requires a declared shared function, such as a caregiver–recipient relationship, a household functioning system, a clinical care relationship, a work team, or another defined social-functional system.

Without such a shared function, WQI should analyze each person's health or functioning state separately and should not create an artificial combined Quality Claim.

Discovering and Formulating Function

To discover and formulate intended function or function realization, WQI may use a sequence of questions.

First, define the quality object.

What is the object being assessed?

Where does it begin and end?

What is inside the boundary?

What is outside the boundary?

What interfaces connect it to other objects, systems, environments, or people?

Is the proposed object a coherent quality object, or only an aggregation of separate objects?

If several entities are grouped together, what shared function, relationship, agreement, legal role, institutional purpose, or system boundary makes them one quality object?

If no such shared function exists, should WQI treat them as separate quality objects instead of forcing one combined Quality Claim?

Second, identify the nature of the object.

Is the object human-created?

Is it biological?

Is it social?

Is it technical?

Is it a service?

Is it a mixed object?

Third, identify the source of function.

Was the function assigned by human purpose, design, policy, law, or service need?

Or is the function discovered from biological behavior, natural processes, adaptation, development, or observed life activity?

Fourth, describe function realization.

What must the object actually do or support?

How is this function realized over time?

What boundaries and interfaces are involved?

What conditions are necessary?

What capabilities are required?

What supports must be present?

What constraints must be respected?

What results are expected?

What management systems, lifecycle controls, verification processes, or validation processes may support this function realization, and what evidence do they provide about the quality state of the object?

Fifth, identify enabling conditions, evidence needs, and failure-mode families.

What enables the function?

What supports or preserves the function over time?

What must be monitored, protected, controlled, supported, verified, or evidenced?

What evidence is needed to support a bounded Quality Claim?

How can the function fail?

How can it be weakened?

How can it be distorted?

How can it be misdirected?

How can it be interrupted?

How can it appear successful while actually failing?

Sixth, derive Quality Factors.

What dimensions of function realization must remain visible, controllable, supportable, and evidence-supported?

Which dimensions relate to safety?

Which dimensions relate to capability, suitability, continuity, benefit, usability, dignity, effectiveness, adaptability, maintainability, or other quality aspects beyond safety?

Seventh, derive Indicators and Quality Outcome Criteria.

What Indicators can make each Quality Factor observable, assessable, or verifiable?

Does one Quality Factor require several Indicators to show its condition, behavior, capability, result, or evidence status?

What evidence is needed?

What state, capability, behavior, or result would show that function realization is sufficient?

What uncertainty remains?

Why This Matters

If intended function is poorly defined, the entire quality structure becomes weak.

If functional requirements are incomplete, unclear, unverifiable, or disconnected from the real object boundary and failure modes, the intended function may not be assessed correctly even when measurement appears orderly.

The wrong function leads to the wrong Quality Factors.

The wrong Quality Factors lead to weak Indicators.

Weak Indicators lead to poor Quality Outcome Criteria.

Poor Quality Outcome Criteria lead to unsupported or misleading Quality Claims.

This is why WQI begins before measurement.

It begins with the object, its function, its boundaries, its interfaces, its enabling conditions, its evidence needs, and its possible failure modes.

Only then can quality become visible.

Conclusion

Intended function and function realization are the starting point of whole-quality thinking.

For human-created objects, intended function is assigned by human purpose and clarified through design, service goals, requirements, stakeholder needs, conditions, boundaries, interfaces, enabling capabilities, evidence needs, failure analysis, and the adequacy of functional requirements that translate purpose into realizable conditions.

In human-created objects, quality management systems may help control lifecycle processes, but WQI remains focused on the resulting quality state of the object and the sufficiency of evidence supporting intended-function realization.

WQI may also define family-level Cores where related quality objects share a common function-realization logic, while Context Guides adapt that shared architecture to specific object types.

For biologically based objects, function realization is discovered through observation of life processes, internal boundaries, hidden interfaces, known and unknown mechanisms, adaptation, damage, repair, and recovery.

Both kinds of objects can be studied through WQI.

But not every grouping or condition should automatically be treated as a WQI quality object. A quality object must have a coherent boundary and a sufficiently discoverable or formulable function-realization logic. Aggregation alone does not create a quality object. Where no shared function exists, WQI should not force a single quality claim.

The nature of uncertainty is different across object types.

In infrastructure and support services, uncertainty often concerns how well people have defined and controlled the intended function.

In biology and human health, uncertainty often concerns function-realization mechanisms that are internal, partly observable, or unknown.

WQI responds to both situations by using the same stable method:

Intended Function → Functional Requirements and Enabling Conditions → Function Realization → Quality Factors → Indicators → Quality Outcome Criteria → Evidence → Quality Determination / Quality Claim

This method allows quality to be examined across different kinds of objects without pretending that all objects are the same.

It keeps the structure stable while allowing the meaning of function, failure, evidence, and uncertainty to change according to the nature of the quality object.

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