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Perspective

Quality Management System: Emerging Scenario

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What's in a name? That which we call a rose, by any other name would smell as sweet:
Shakespeare, Romeo and Juliet (1600)

Abstract

Quality management systems may bear the name 'system' but what properties would they need to exhibit to qualify as a system and what kind of systems are they? In this paper I attempt to answer these questions using the latest edition of ISO 9001 and the views of systems scientists and set out to find a match, revealing gaps and inconsistencies along the way.

What is a system?

The word system is used in an increasing variety of ways to express ideas in different contexts. In the Oxford English Dictionary and the Merriam-Webster Dictionary it appears there are two basic uses of the word system (a) a connected group of objects forming a complex whole and (b) an orderly way of doing something and it is this distinction that creates communication problems because when the term system is used, it may not be clear whether it is being used in sense (a) or sense (b).

When using the word system in sense (a) the emphasis is on systematically applying codified methods of work to produce the desired results, but when using it in sense (b) the emphasis is on the systemic way entities interact to produce results. e.g. a gardener uses a systemic weed killer to kill every part of the plant because all its parts are interconnected and he proceeds to apply the weed killer systematically to all the weeds in the garden.

It was from the study of complexity in the natural world that contemporary systems theory developed in the 1950s and since then the body of knowledge has grown significantly. Unfortunately there is no common definition of the word system as each writer on the subject tends to define the term in their own way. However a comprehensive definition of a system when used in sense (a) comes from a book published in association with The Open University(Carter, Martin, Mayblin , & Munday, 1983)

System - A recognisable whole which consists of a set of interdependent parts. More specifically:

a) A system is an assembly of components connected together in an organised way.
b) The components are affected by being in the system and the behaviour of the system is changed if they leave.
c) This assembly of components does something.
d) This assembly as a whole has been identified by someone who is interested in it (e.g. the agent, the client or the problem owner)

Systemic vs Systematic

Systematic means doing things in an orderly way, following a method, whereas systemic is not at all about the way things are done but about the interconnectedness amongst entities and the effect that has on the whole.

The definition in ISO 9000:2000(see text box) remains extant in 2015 but provides no further insight into the nature of systemsunlike the above and as a result permits the term

system in ISO 9001 to be used in bothsense (a) and sense (b). Feigenbaum defined a quality system as "*the network of administrative and technical procedures required to produce and deliver a product of specified quality standards*" (Feigenbaum, 1961) which appears to be using the word system

ISO Definition of a system

A set of interrelated or interacting elements (ISO 9000, 2000)

in the sense of being systematic rather than systemic as defined by Carter et al.

The nature of systems

As stated above, the ISO 9000 definition of the term system provides little insight into the nature of systems. In ISO 9000:2000 the systems approach was included among the quality management principles on which ISO 9001 is based but in a bewildering development for the 2015 revision, this principle has been withdrawn when it should have been revised.

Systems possess different properties depending on their type but all systems will have a boundary and a purpose or function, comprise elements, interconnections and structure and have emergence whereby the whole is greater than the sum of its parts. We will now explain each of these properties and determine how they are exhibited in a QMS.

Boundary

Meadows observes that *systems rarely have real boundaries, there is no real boundary between the exhaust of an automobile and one's nose. There are only boundaries of word, thought, perception, and social agreement— artificial, mental-model boundaries (Meadows, 2008)*. A boundary is a convenience. A boundary can be defined as separating a system from its environment (Stacey, 2010). A system is a whole therefore when we draw the boundary we encircle a whole and not a bunch of unconnected parts and if we move the boundary we create a different system. Where to draw the boundary around a system depends on the purpose of the discussion (Meadows, 2008) and in terms of a QMS we have a dilemma, whether the purpose of discussion is to capture the set of interconnected elements that *"consistently provide products and services that meet customer and applicable legal requirements and enhance customer satisfaction"* as per the requirements or whether the purpose of discussion is to capture the set of interconnected elements that *establish the quality policy, the quality objectives, and the processes for achieving those objectives* as per the definition.

However, ISO 9001:2015 indirectly requires the QMS to include everything that *"affects the ability of the organization to ensure the conformity of its products and services and the enhancement of customer satisfaction"* implying environmental, health, safety or financial issues that can affect product or service quality should be included. But once again we have a dilemma because there is a statement in clause 0.4 that the standard *does not include requirements specific to other management systems, such as those for environmental management, occupational health and safety management, or financial management.* This could therefore be interpreted as ruling out of scope environmental, health, safety or financial issues that can affect product or service quality.

System purpose or function

Systems do not necessarily have a purpose, i.e. a reason for existence but they do have a function i.e. what they do. The best way to deduce the system's purpose is to watch for a while to see how the system behaves (Meadows, 2008). A car braking system exists to enable a driver to stop the car, and the function of the respiratory system is to enable our bodies to take in oxygen. In both these cases the systems are purposive rather than purposeful as neither is equipped with the ability to act independently. Both the car braking system and the respiratory system require a brain to activate them.

Purposive and Purposeful

The term purposeful refers to the capacity of a system to determine its own purpose (purpose with choice), whereas the term purposive refers to the capacity of a system to pursue a pre-set goal without the ability to change it (purpose without choice) (Carter, Martin, Mayblin , & Munday, 1983)

A quality management system (QMS) has been identified by ISO as a system of particular interest but ISO 9001:2015 fails to tell us unequivocally what the purpose of it is. We can deduce from the introduction to ISO 9001:2015 that its purpose could be:

- To enable an organization to consistently provide products and services that meet customer and applicable legal requirements and enhance customer satisfaction, implying it's

purposive and therefore a tool of management;
- To consistently provide products and services etc.,implying it's a purposeful goal seeking system.

But when we reach clause 1 we are led in a different direction to deduce that the purpose of a QMS is:

- To demonstrate an organization is able to consistently provide products and services that meet customer and applicable legal requirements and enhance customer satisfaction, implying it's a model of the organization from a particular perspective;

This range of possibilities leads users to different conclusions and will significantly affect the approach they take.

Explanations of a QMS in ISO guidance documents contradict the definitions in ISO 9000 (see text box) implying the system is an orderly way of doing something and not a set of interrelated or interacting elements.

When we examine the ISO 9000 definition of a QMS we find that it is "*part of a management system with regard to quality"* and this is where we encounter another inconsistency. Where the comma is inserted in the definition of a management system (see text box) is crucial to the meaning conveyed because it could be referring to a system of objects that establish concepts (i.e. the policies, objectives and processes) or a system of objects that establish concepts and applies those concepts to achieve objectives.

There is no explanation given in ISO 9000 as to what the elements might be so we must assume the policies, objectives and processes are established by people and that people are therefore part of this system. In an earlier standard that wasn't withdrawn until 2000, a quality system was defined as "*the organizational structure, responsibilities, procedures, processes and resources for implementing quality management*" (ISO 8402, 1986) thus making it clear that people and other resources were part of a system.

Elements

Elements are what makes a system what it is. Vary the element and it changes the nature of the system giving it different properties therefore the elements are the variables. Check land refers to them as agents or actors thus emphasising the role of people in the system. These variables may be tangible or intangible. Meadows refers to school pride and academic prowess as two intangible elements of a university. She also identifies the tangible elements of a football team as including the players, coach, field and ball and the elements of our digestive system as including teeth, enzymes, stomach, and intestines (Meadows, 2008). This provides some insight into the nature of system elements.

Definitions of a QMS i n ISO Guidance documents

A quality management system is the way your organization directs and controls those activities which are related either directly or indirectly to meeting customer requirements (ISO 9000 Small Business Handbook, 2010)

Neither ISO 9000:2015 nor ISO 9001:2015 explicitly identify the elements of a typical QMSexcept for stating that the QMS includes certain documents, but nothing else. ISO 9000:2015, tells us the QMS comprises activities and ISO 9001:2015 implies it includes processes but activities are what elements do and processes are formed from actionof the elements.

There is a note to the definition of a management system given abovethat states that the management system elements "*establish the organization's structure, roles and responsibilities, planning, operation, policies practices, rules,*

Management system

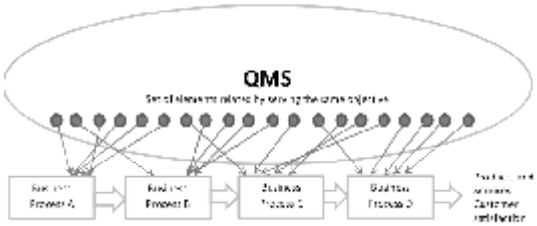
Set of interrelated or interacting elements of an organization to establish policies and objectives, and processes to achieve those objectives(ISO 9000, 2015)

beliefs, objectives and processes to achieve those objectives"(note the comma has been omitted*).*A pragmatic view is that the system must exist if it's capable of establishing such things and that the only elements that do such things would be people. Also the pragmatist would assume the tangible elements include people, products, services, tools, equipment, energy, facilities etc., and the intangible elements include trust, fear, customer loyalty, reputation, core competences etc., because they affect the outcomes but neither the definitions nor the requirements are explicit.

Interconnectedness

The elements within a system are interconnected in a relationship that holds them together. Many of the interconnections in systems operate through the flow of information. The example Meadows uses is of a football team where the elements are interconnected through the rules of the game, the strategy of the coach, the communication between the players and the laws of physics that govern the motion of the ball and the players (Meadows, 2008). ISO 9001:2015 does define a QMS as including interacting processes, internal and external communication and of course information and its flow thus alluding to the interconnections within a QMS but even in the supporting guidance(ISO/TC 176/SC 2/N1274, 2015) there is little more than a simplistic flow diagram to portray the interconnectedness within a QMS. With this as their guide it's doubtful that users will explore the interconnections even to the depth shown by Meadows.

The requirement to integrate the QMS requirements into the organization's business processes in clause 5.1.1 introduces doubt as to whether the QMS is a system at all. The requirement implies that the quality elements are not interconnected in a relationship that holds them together but that the QMS is formed within another system by connecting quality elements with non-quality elements to form a system that produces outputs of the required quality as illustrated in Figure 1. This provides further evidence that the definition of a QMS is not reflected in the way the requirements are presented.



Structure

The structure of a system as the way its elements are interconnected (Meadows, 2008). The flow of information within a system is known as feedback (Sherwood, 2002). Internal and external feedback not only enables self-correction (also referred to as **homeostasis**)but it can also reinforce a situation which may lead to either growth or decline in a variable over time e.g. a successful marketing strategy brings in more orders than the organization can cope with or secrecy within management builds distrust and leads to strike action by the workforce. Senge referred to these as balancing and reinforcing processes (Senge, 1990). The ability of a system to survive within a variable environment is called **resilience** and leads to objectives being challenged and changed.

Through the application of the process approach and PDCA, ISO 9001:2015 does define a QMS as including interacting processes that embody feedback loops from the checks and reviews. It will also possess the ability to ensure system integrity is maintained when changes are made implying recognition of the interconnectedness within a system thereby exhibiting the property of homeostasis. The new version of ISO 9001 requires the organization to determine and address external issues affecting its performance thereby addressing the issue of resilience. It is less prescriptive than its predecessors requiring certain actions and their consequences to be considered rather than mandating the mand therefore the stability of the system caused by the behaviour of variables is expected to be treated as a risk or an opportunity. In the section on performance evaluation the results of analysis are required to be used for system improvement but it's a mechanistic approach. In the supporting guidance on the process approach the only interacting elements shown are processes where the interactions are illustrated as transactions between processes.

Emergence

The property of emergence is the unexpected and unanticipated results that arise from interactions within a system. It's expressed by the axiom “the whole is greater than the sum of its parts”. When oxygen and hydrogen are combined in the correct proportions water is produced and with water comes wetness, a property not found in any of the components just as sound is not found in any of the components of a radio. It is implicit in ISO 9001:2015 that 'enhanced customer satisfaction' is an emergent property of a QMS as it is not found in any of the component parts nor is it an output of any process but maybe the outcome or consequence of possessing an output from the system. But enhanced customer satisfaction can only emerge from a purposeful system, one that possesses resilience so it can respond to a changing external environment.

Types of systems

There are different types of systems and different ways of classifying them. Ackoff divided systems in to two basic categories abstract systems (systems of concepts) and concrete (systems of objects) and then divided concrete systems into four basic types and classified them on the basis of

whether the parts and the whole were purposeful or purposive. These were deterministic systems, animated systems, social systems and ecological systems(Ackoff, 1998).

Checkland suggested that the absolute minimum number of systems classes needed to describe the whole of reality is four: natural, designed physical, designed abstract, and human activity systems (Checkland, 1981) . Jackson defined a human activity system as a model of a notional system containing the activities people need to undertake in order to pursue a particular purpose(Jackson, 2003).

As a QMS is a human construct it is neither an animated system nor an ecological system or a natural system and as a QMS is not wholly composed of people it's not a social system which leaves the possibility that a QMS could be a designed abstract system, a designed physical system or a human activity system.

The QMS as a designed abstract system

The notion of quality systems emerged after WWII when the industrial practices were still largely based on scientific management as defined by Frederick Winslow Taylor. Taylor found that when the methods of work were left to the individual it led to multiple ways of doing things and a wide variation in results. He believed that if a task was clearly defined and if those performing it can be trained and properly motivated, that productivity would be greatly improved (Taylor, 1911). This is doing things systematically not systemically. It was therefore inevitable that prescribing methods of work and inspection of work was central to prescriptions for managing quality that emerged in the late 1950s up to the mid-1990s.

An abstract system is one all of whose elements are concepts (Ackoff, 1971)so if users of ISO 9001 perceive a QMS to be a system of documentation (concepts), there is nothing in the introduction to the 2015 version that alludes to change in the meaning of the term management system. In fact statements that the organization shall implement a QMS and suggestions that organizations should adopt a QMS together with explanations in guidance documents that a QMS is “a way of” directing and controlling an organization all help to perpetuate the notion of a designed abstract system.

However, in a document recently released is the following statement “*It is stressed that ISO 9001 requires (and always has required) a “Documented quality management system*”, *and not a “system of documents*”. This could imply that a system is to be found by observing the interaction amongst elements of the organization following which it is to be documented, meaning a systemic approach as is addressed below. But it could also imply that it's the policies and procedures that are to be documented meaning a systematic approach. It may have always been the intention of ISO 9001 that a QMS was a documented system but there remains some doubt as to whether the system being referred to here is an orderly way of doing something or is a set of interrelated or interacting elements.

The QMS as a designed physical system

A designed physical system is a deterministic system, a system where neither the parts nor the whole are purposeful. Physical systems acquire their purpose from their designers. Systems in this class include automobiles, central heating system, computer systems, transportation systems etc. The only evidence in ISO 9001 that a QMS could be a designed physical system is found in Annex A.4 where it suggests one of the key purposes of a QMS is to act as a preventive tool. There is a tendency for users of ISO 9001 to think of the QMS as the software applications used in processing information such as the IT systems used in sales, purchasing, inventory control and production all of which help to perpetuate the notion of a QMS being a designed physical system.

The QMS as a human activity system

There are as many different types of Human Activity System as there are types of organisation. For example a fast-food restaurant is a human activity system but it is intended to operate like a machine. Employees are frequently trained to interact with customers according to a detailed code of instructions and are monitored in their performance. They don't have a choice and therefore function within a purposive system (purpose without choice). On the other hand if we draw our system boundary around the whole organization including its fast-food restaurants, we extend the human activity system to encompass the brain of the organization and see that it's a purposeful system comprising purposive parts. In organizations competing at the forefront of technology where they have to exploit opportunities to survive, the brain (top management) sets direction and the parts (professional staff) decide how to reach the goals as happens in the telecommunications business. Even in this business there will be staff who are,for safety, security or commercial reasons, given no freedom to choose a course of action. The boundary of the QMS could be drawn around the operational units (the machine like components) of the organization but the

explanation given in ISO 9000:2015 implies this is not the QMS at all and that the "*QMS comprises activities by which the organization identifies its objectives and determines the processes and resources required to achieve desired results"* which makes it appear that the QMS is the strategic planning process of the organization.

The QMS as a model of reality

An organization is a complex entity and when we look at it we see buildings, workshops, offices, people, machines, activity, documents etc. These are the tangible elements but there are many things we don't see, such as the spread of disease, the effect of a dispute between colleagues, a reprimand from a manager or the consequences of a particular action or decision. Therefore when "establishing" a QMS we have to be selective, we pick out the things that we believe are relevant to our system of interest and use ISO 9001 to confirm we have picked out the right things. The system is therefore not reality but a representation of the reality we perceive. What we include in our model is strongly influenced by how we "see" things, i.e. our paradigm which embodies core assumptions that characterize and define our world view. When two people share a paradigm they will view reality in the same way and therefore understand each other's models of reality.

If we consider a system to be a representation of reality from a particular perspective, a QMS would be a model of an organization from the perspective of how it manages product and service quality.

Conclusions

In examining the requirements and vocabulary for quality management systems we find little to confirm beyond doubt what a QMS is and what its purpose and it properties are. There are indeed definitions but they remain ambiguous or insufficient and conflict with the way the requirements are expressed, therefore no matter how hard we try to understand what the QMS is to which ISO 9001 requirements refer, it's difficult to draw any other conclusion than ISO 9000, ISO 9001 and supporting guides lack coherence, consistency and clarity.

There is a requirement that leads us to believe the QMS is not a system at all because its requirements are integrated into business processes (see Fig 1). There are definitions that lead us to believe the QMS is an administrative system designed by management for directing and controlling activities. There are requirements that lead us to believe the QMS is a designed abstract system of concepts that are implemented and then there are requirements implying the QMS contains processes that produce quality products and services and enhances customer satisfaction by implementing the system of concepts as illustrated in Figure 2.

External environment

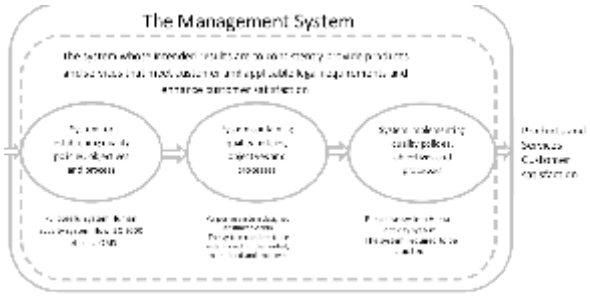


Figure 2: The system trilemma

In examining the properties of a QMS it is uncertain whether it's an abstract system or a human activity system and, if the latter, whether it is purposeful or purposive due to the differences in how a QMS is defined and what it is required to accomplish . All of this leads to the conclusion that we can't say with any certainty what its properties are having eliminated the systems approach from the quality management principles, it would appear that ISO 9001:2015 is still based on the theory of scientific management and has not embraced systems theory. However, there are changes in requirements that do address systemic concepts such as homeostasis, resilience and emergence. Having introduced risk based thinking into ISO 9001 perhaps what is missing in the supporting documentation is a guide to systems thinking especially as the focus of the standard is on systems.

The text of ISO 9001 and ISO 9000 leads the reader to different conclusions depending on the paradigm they hold. If it was clear that when establishing, implementing, maintaining and improving a QMS one was establishing, implementing, maintaining and improving 'a model of reality' there would be less confusion. Alternatively the QMS may remain a system of concepts but it should be recognized that it is the operational system which produces the products and services and not the so called QMS.

For a system to consistently provide products and services that meet customer and applicable legal requirements and enhancing customer satisfaction it must capture the set of interconnected elements that fulfil this purpose. If the boundary of the system was not to be as broad there is a danger

that it's likely to fail because it will be fundamentally anti-systemic. It will treat the whole as an aggregation of parts that can be improved independently of one another (Ackoff & Gharajedaghi, 2003).

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