SYSTEMS AND PROCESSES – IS THERE A DIFFERENCE?

By David Hoyle

Abstract
At a time when we are more conscious than ever before of the interconnectedness of our actions we are still publishing international standards that ignore the advances made in system theory and process management since the 1950s. David Hoyle author of the ISO 9000 Quality Systems Handbook, shows that we are rooted in the past using standards that promote unhelpful models of systems and processes. He highlights the key differences between systems and processes and how we can gain a better understanding of the interacting variables that determine organizational outcomes and thus enable us to manage processes and systems more effectively.

Personal reflections
I have changed jobs a few times in my career and went through a termination process each time. When I now look at the ISO 9000:2005 definition for a process I see that I should have been transformed but I can assure you my form was just the same after the process as it was before. During my time as a seagoing engineer office with Cunard on the old RMS Queen Elizabeth I learnt that I was performing a function that the ship had been designed to perform through instrumentation but which had become defunct though neglects and decay. The ship had been adapted to compensate for the reduction in functionality; a characteristic often not possible with other mechanistic systems but quite common with systems that include components of the human kind. During my time as a product assurance manager in spacecraft development with British Aerospace I learnt that in physical systems the components have to work together to achieve the goal of the system, that they can’t fulfil their function outside the system; that control over interfaces was critical to project success and that all systems are effected by the environment in which they operate.

Thus, I was well aware of the properties of systems but less aware of processes. In fact I was only aware of manufacturing processes like a plating process or welding process and it was to be many years later before I became aware of management and business processes. In common with most organizations at the time, the emphasis was on following procedures, adhering to codes of practice and standards; not in managing a system of interacting processes.

What does ISO 9000 say about systems and processes?

Intent and requirements
The new edition of ISO 9001 contains some interesting statements that suggest there is a move towards recognising the true properties of systems and processes. However, the intent expressed in the introduction to the 2008 edition is not reflected in the requirements. There are no requirements for managing process interactions, no requirements for taking account of changes in the business environment, no requirements for producing desired outcomes and the explanation of a process approach looks too similar to that given for a systems approach to convey clarity. It therefore appears that ISO/TC 176 are somewhat confused about the differences between systems and processes thus making their standards a less than satisfactory source of reference.

Definitions
A system is defined in ISO 9000:2005 as a set of interrelated or interacting elements. But this definition does not accord with others from relevant literature e.g:

- A set of components that work together for the overall objective of the whole (Bertalanffy 1968).
- A set of variables that influence one another (Senge 1990).
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- A series of functions or activities within an organization that work together for the aim of the organization (Deming 1994)

A process is defined in ISO 9000:2005 as a set of interrelated or interacting activities which transforms inputs into outputs. The implication here is of a sheet of metal being transformed into a component, but the diagram of a process on the ISO web site, reproduced in Fig 1, implies something different. The inputs here are requirements and the outputs satisfied requirements thus implying that requirements change their form as they pass through the process which of course is absurd.

Once again the ISO definition does not accord with others from the literature e.g:

- A systematic series of actions directed to the achievement of a goal. (Juran 1992)
- A structured measured set of activities designed to produce a specified output for a particular customer or market (Davenport)
- A collection of activities that takes one or more kinds of inputs and creates an output that is of value to the customer (Hammer)

What is missing from the ISO definition is the recognition that processes create results and not necessarily by transforming inputs.

System model

In ISO 9001 there is a diagram that portrays a model of a process based quality management system. This is reproduced in Fig 3 but it is seriously flawed for several reasons.

- The elements within the ellipse imply processes but in fact they are simply the headings of sections 5, 6, 7 & 8 of the standard. Some of the requirements are deliberately placed in section 8 because the only section where exclusions are permitted is section 7; hence product measurement and nonconformity control, which would be part of product realization, are included in section 8 and not section 7;
- Management responsibility is not a process but a series of obligations.
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- Separating measurement, analysis and improvement implies that the output from product Realization is not measured as product measurement is addressed in section 8 of the standard not section 7;
- The continual improvement element that sits outside the ellipse implies its outside the system when it is already addressed by the measurement analysis and improvement element;
- The diagram omits other stakeholders upon which the delivery of outputs depend such as suppliers, employees and investors;
- There is no indication of the influence of the business environment mentioned in clause 0.1 of the standard.

This model is often used in quality manuals in response to the requirement in ISO 9001 clause 4.1 to determine the interaction of processes. This shows a complete misunderstanding of interactions for the diagram at best only shows a flow of product and information.

**What are we trying to do?**

We create models of our organizations in order to better understand how they work and imagine the models reflect reality but appearances can be deceiving. The models created responding to various management systems standards look as though for each group of objectives a management system is established and a person is appointed to manage it as illustrated in Fig 3. These standards are encouraging organizations to break the whole into parts then manage the parts as if by doing so they are managing the whole. This we call reductionist thinking. These types of systems appear as systems of documentation that do not reflect the dynamic behaviour within organizations so we have to question their credibility in enabling us to manage the organization effectively.

![Figure 3 Systems of documentation](image-url)
Types of systems
Instead of breaking the whole into parts, we should be trying to understand how the organization works as a whole. We call this holistic or systems thinking. Ackoff identified four types of systems:

- Physical or mechanistic systems such as a power station, aircraft or computer;
- Biological or animate systems such as animals, humans and other life forms;
- Social systems such as societies, tribes, groups of people, organizations;
- Ecological systems such as a coral reef or rain forest with all its living and non-living entities, surrounding environment and all that impacts it.

We can see that physical or mechanism systems are static, they can’t adapt to the environment without human intervention. They exist until their utility expires and is superseded by a new system.

We need to recognise that organizations are social systems not mechanistic systems but even social systems are being managed as if they were mechanistic.

Types of social systems
Gharajedaghi identified three types of social systems each being a product of their age.

*Mechanistic view*
A mechanistic system is mindless, it has no purpose of its own except to create profit for its owner. No parts must deviate and it’s a reactive system with no choice. This type of social system was prevalent in the 19c when entrepreneurs organised labour to create and operate the machines of the industrial revolution. The perception that the primary purpose of a business is to make a profit for their master emanates from this period in our history and is still prevalent today. When other types of systems enter into the market place, parts are attracted to better working conditions and exercise their only choice which is to leave.

*Biological view*
A Biological system is uniminded with a purpose of its own, dictated by an executive. Its growth is the measure of success, profit the means to achieve it and although the system has a choice the parts don’t. The parts either conform or are replaced. This is representative of the typical 20c command and control structures having a board of directors dictating purpose and direction and a work force implementing the strategies and policies of the directors. These organizations can provide security for the less ambitious parts but those more ambitious either set up their own mechanistic or biological systems, find other sympathetic biological systems or join a sociocultural system.

*Sociocultural view*
A sociocultural system is multiminded, with a choice of ends and mean. The parts share values and work by consensus. The culture is the DNA that integrates the parts into the whole. This type of social system is not yet common but is growing in popularity as our society moves away from deference with its automatic respect for authority towards consensus management and mutual responsibility.

*Which organization do you work for?*
Gharajedaghi used the metaphor of a car and a horse to illustrate the profound difference between the biological view and the sociocultural view as reflected in Fig 4. If your organization is like a car being driven at a wall by a crazy CEO, you have no choice but to hit the wall and suffer the consequences. It is far better to work for a sociocultural organization where you can influence the direction in which the business is going and the way it deals with the obstacles it encounters.
The uniminded system. If a driver decides to run a car into a wall, the car will hit the wall without any objection.

The multiminded system. If a rider decides to jump a horse over a wall, success depends upon the bond between the horse and the rider.

Figure 4  The choice between a biological system and a sociocultural system

Circles of influence
If we recognise that there are circles of influence as postulated by Senge then an ineffective system of managed processes that produces undesirable outputs will produce dissatisfied stakeholders and hence an undesirable outcome as illustrated in Fig 5.

Figure 5  The circle of influence that create unsatisfied stakeholders

By responding to the joint demands of the business environment and stakeholders, the ineffective system of managed processes can be turned around into an effective system of managed processes, a system that delivers desirable outputs and produces satisfied stakeholders and hence the desirable outcomes expressed in clause 0.2 of ISO 9001. These circles of influence are illustrated in Fig 6.

Figure 6  The circles of influence that create satisfied stakeholders
The organization as a system

A new system model

If instead of taking one part of the organization we take the whole and view it as a system of processes as shown in Fig 7 we can produce a very different and more useful model to that in Fig 2.

This model displays several important features:

- The stakeholders sit inside the system boundary because they form part of the circle of influence. By stakeholders I mean those parties that contribute to the organization’s wealth creating capacity and in return accrue certain benefits and share the risks. These parties can be categorised as customers, investors, employees, suppliers and society;  
- Organizations satisfy customers by fulfilling their demands and thus there will be a “Fulfil Demand Process”;  
- For demands to be fulfilled they have firstly to be created and therefore there will be a “Create Demand Process”;  
- Both these processes need resources and therefore there will be a “Resource Management Process” which feeds the Demand Creation and Fulfilment Processes with capable resources when needed. The resources come from the other stakeholders and are provided by suppliers, employees and investors;  
- We have now accounted for all stakeholders in our model;  
- These three processes need to be designed and managed in such a way as to enable the organization to fulfil its purpose or what we commonly refer to as mission and therefore there is a need for a “Manage Mission Process”;  
- Success depends on understanding stakeholder needs and expectations and responding to their concerns and therefore intelligence and feedback is gathered by the Manage Mission Process, promptly analysed and changes made to all processes to sustain success.

The model shows the relationship between the four key business processes. The interconnections are channels along which product or information flow. They are not intended to represent interactions as is the case with the model in Fig 2.

Business processes

If we now model one of these business processes we can reveal the relationships between the various sub-processes. For our example I will take the Mission Management process see Fig 8.
The purpose of this process is to determine what the business needs to do, how to make it happen, establish if its happening as planned and if not change it. This resolves into four distinct work-processes each being executed through four discrete groups of activities. We will use some of these later to illustrate process interactions. Most organizations will perform the activities in the model but may not have identified them as discrete processes or though of them as part of a mission management process.

**Process hierarchy**
There is a process hierarchy that breaks down the system into levels and an example in given in Fig 9

Many management system descriptions address levels 4 and 5 and fail to address levels 1, 2 and 3 in any detail with the result that there is little recognition of the work needed to manage business and work processes.

**Process models**
If we now model the activities involved in a business process we can reveal the relationships between inputs, outputs and resources as shown in Figure 10. The inputs and resources can enter at any stage.

The model shows several distinguishing features that are contrary to the ISO 9000 model:
The processes in the sequence are not the ones that are interacting but interrelated
Inputs are not transformed but used
Outputs are not transformed from inputs but created using resources

If we now examine the activities involved in managing a business process we reveal another sequence as shown in Fig 11. Now the inputs are expressed as demands that include objectives for the output and constraints on how those objectives are to be achieved. The outputs therefore become satisfied demands. There are also process objectives and measures and process monitoring for determining if those objectives are being achieved followed by process reviews that determine whether process improvement is necessary.

There are three improvement processes which respond to the questions;

- Are we doing it right? Answers will change process capability by increasing conformity
- Can we do it better? Answers will change process efficiency by increasing resources utilization
- Are we doing the right things? Answers will change process effectiveness by aligning objectives and measures with stakeholder needs

We can add these to the model as shown in Fig 12. We can apply these concepts at each level in the process hierarchy.
Modelling process interactions

If we take Peter Senge’s view of a system as a set of variables that influence one another and assume the process outputs are variables, we can illustrate a system of processes as shown in Fig 13.

![Figure 13 A system of interacting processes](image)

I should add at this juncture that wherever you find a variable, there will be a process that has produced it even if one has not yet been identified. E.g. you might not have a defined process for creating values but organizations have beliefs they stand by even though they were not formed by any conscious process.

If we now apply this concept to our organization model in Fig 7 and select the “Develop corporate culture process from the Manage Mission business process of Fig 8, we can develop some typical process interactions as shown in Fig 14.

![Figure 14 Interaction between two processes of the mission management process](image)

In this model, values are an output of the “Develop Corporate Culture” process in Fig 8 and these will influence all processes. However, in this example they influence the process measures that are an output of the “Develop Process Structure” process from Fig 8. These measures will influence behaviour which hopefully will reflect the corporate values. However, if the output from the “Measure and Review Performance” process in Fig 8 shows profits to be down, the “Develop and Deploy Strategy” process in Fig 8 may generate an instruction for cost reduction. This feeds into the “Prepare Budget process (a sub process of the Resource management process) which may influence the process measures in such a way as to cause a change in behaviour that no longer reflects the stated values. This circle of influence is illustrated in Fig 15.
Another example to illustrate process interactions within a system is that shown in Fig 16.

In this example the “Produce Product” process delivers incidence of poor quality. The culture is such that the “Develop corporate culture” process generates management punitive action. This produces a climate of fear and blame which leads to the staff hiding errors which increases the incidence of poor quality. This reinforcing loop can only get worse so the remedy is to change the corporate culture and the effect of this is shown in Fig 17.
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In this model the interaction between four processes is shown to illustrate that a positive culture can improve quality and closing a performance gap depends upon maintaining that positive culture.

**Summarising the differences between systems and processes**

There is therefore a distinct difference between systems and processes:

- A process produces results through work being done in the process whereas a system produces results through the interaction of processes.
- Processes produce outputs whereas systems create outcomes.
- Process owners manage activities to produce required outputs whereas system managers manage interactions to produce desired outcomes.

Rick Ross from the MIT Sloan School of Management identified some striking differences between system diagrams and process diagrams that assist in clarifying these concepts\(^\text{13}\). These are summarised in Table 1.

<table>
<thead>
<tr>
<th>Table 1 Comparison of system and process diagrams</th>
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<tbody>
<tr>
<td><strong>Process diagrams</strong></td>
</tr>
<tr>
<td>Show flow of activities in a straight line</td>
</tr>
<tr>
<td>The labels are verbs and tasks</td>
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<tr>
<td>The arrows indicate sequence</td>
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<tr>
<td>A change in one activity does not necessarily affect other activities</td>
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<tr>
<td>Tends to represent a static picture</td>
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**Implications for quality managers and system auditors**

**For quality managers**

Quality managers need to ditch those system models based on the diagram in ISO 9001 and learn a new skill. Their job needs to change from a focus on flow charts and linear thinking to that of systems thinking and modelling the interactions between processes, assessing probable outcomes and enabling managers to see the impact of their actions and decisions before they jeopardise success. It follows therefore that the CEO, being the organization’s leader, would be the system manager rather than the quality manager who would have a role in diagnosing root causes and coordinating improvement programmes. These programmes should aim to build more robust systems of processes that deliver outputs which produce desired outcomes for the organization’s stakeholders.

**For system auditors**

System auditors also need to become system thinkers and focus less on conformity to specific requirements and more on examining system dynamics and searching for strengths and weaknesses. Some key questions they might ask are:

What analysis has been conducted since the last audit to determine the impact of changes in the business environment on your quality management system?

- Which processes are necessary for the organization to function effectively?
- How do you know that these processes are being managed effectively?
- How are the interactions between these processes determined?
- How are the interactions between these processes managed?
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- How do you know the organization is delivering the desired outcomes?

That none of these questions are derived from the requirements of ISO 9001 should not be a barrier as all are consistent with the intent of ISO 9001.

Conclusions

Since relinquishing the position of quality manager in industry the field has been dominated by ISO 9000 and in my view this has caused us to lose sight of the goal of quality management. There is little doubt of a lack of clarity in the published standards on management systems and this has resulted in flawed approaches. These standards don’t promote the systems approach or the process approach and there is a better solution to be found by applying systems and process thinking.

Although my search of published literature revealed much about systems and processes individually, I found nothing except the Rick Ross comparison in Table 1 that compared the two. I have therefore drawn upon the authors whose work I have referenced together with my own theories on organizational analysis to identify relationships between systems and processes and reveal the distinct differences. The diagrams presented have shown how we can model systems and managed processes including the interactions between them. We clearly have to stop tinkering with tasks and flow charts and start managing systems of processes because it is the interaction between these processes that produce the system outcomes necessary for sustained success.

Quality system management is more about change management than documentation management and auditors should focus more on the system dynamics than on ticking boxes because that approach was yesterday’s solution. These solutions have given us a heap of problems today that are holding us back from applying soundly based theories developed over 50 years ago. We can change if we really want to but we have to stop believing that international management system standards lead the way because they have a long way to go to catch up.

In the preparation of this paper I wish to acknowledge John Thompson my former business partner for his ideas on process thinking and John Colebrook, a director of EOS Ltd, a New Zealand based advisory firm who has helped me greatly in my research.


Bibliography

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