Role of Systems Thinking in A Traditional Quality Management Course

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INTRODUCTION

The purpose of this paper is to share some experience of using systems thinking concepts with a typical graduate level quality control and management course. Systems thinking and related tools offer an excellent vehicle for showing interconnectedness of quantitative and qualitative topics.

The major focus of the course has been to introduce students to the contemporary concepts, topics, and tools of quality management. An organization's long-term quality perspective revolves around establishing a sustainable quality mind set for excellence. The short-term needs call for the establishment of a quality system, a process management strategy, and motivating people to improve quality and productivity. It is with this aim, the course is designed around a schematic of a layered quality model as shown in Figure 1.

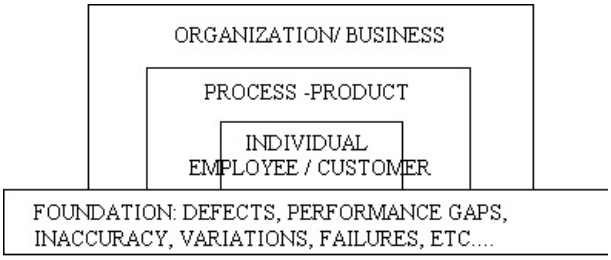

FIGURE 1: QUALITY MANAGEMENT

Next section briefly states various areas of opportunities for integrating systems thinking concepts available during the conduct of the course. The following section further describes integrated view of quality definitions with systems thinking and continuous improvement process activities.

QUALITY MANAGEMENT TOPICS AND SYSTEMS THINKING

The course begins and ends with the concepts described in the Table 1and the Figure 2, which are correlated and help to plant seed in the curious minds of the students.

Table 1: Key Quality Concepts

How to improve quality?	• Control the process • Improve the system • Create robust processes and products
How to improve the results?	• Improve the system quality • Distort the system (obtain the demanded results at the expense of other results) • Distort the results
Constraints	• Behavioral - employee and customer • Material • Capacity • Technology • Managerial • Logistical • Knowledge and Information

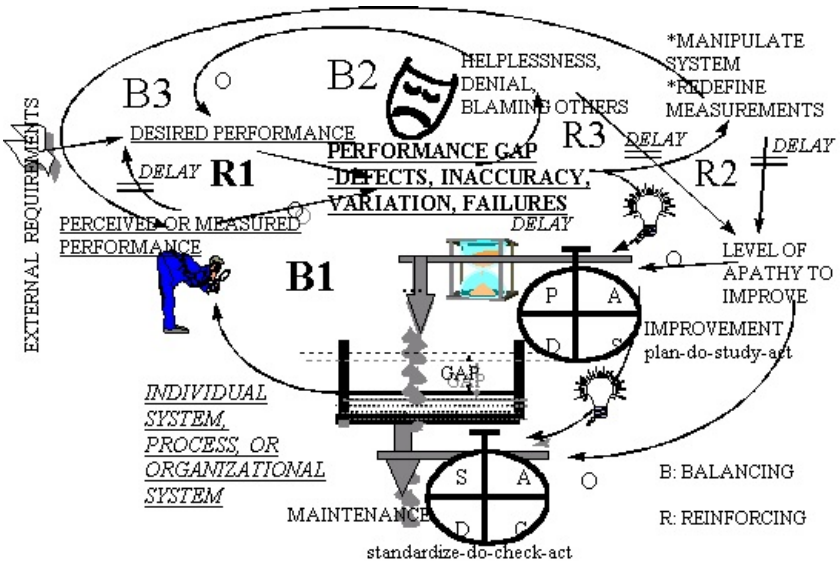

FIGURE 2: QUALITY MANAGEMENT & LEADERSHIP

Problem solving at multiple levels	• Event (symptom, single data point, etc.) • Pattern over time • Structure including mental models • Purpose

The Table 2 lists some of the areas of opportunities for introducing the systems thinking concepts.

Table 2: Quality Control & Management Topics and Systems Thinking Concepts

Topic	Ladder of Inference [Argyris, '90; Senge, et. al, '94]	Archetypes, Causal loops, & Stock and Flow [Senge, '90; High Performance Systems, '94]
Quality Definitions [Garvin, '88]	X	X
Deming's Principles[Gitlow and Gitlow, '87]	X	X
Case Studies [Leonard, '88; Jambekar, '90]	X	X
A Framework to explain dynamics of continuous improvements- common causes, special causes, problem solving statistical process control, quick fixes, inspection, and behavioral responses [Wheeler and Chambers, '92]	X	X
Flow charting and process diagramming [High Performance Systems, '94]		X
Personal Quality Improvement Project [Jambekar, '95]		X
A Team Based Improvement Project	X	X

The rest of the paper briefly reviews how quality definitions and continuous improvement concepts have been presented using with systems thinking concepts.

QUALITY DEFINITIONS

The definition of quality has been elusive and hence, must be looked at from multiple perspectives and Table 3 offers fours interrelated perspectives. The Table 3 emphasizes failure based quality definitions, and also introduces reinforcing loops which must be managed simultaneously to maintain "Constancy of Purpose" as defined by

Deming. With the help of the concepts described in the Table 1, "Limits to Success" archetype may be introduced with some relevant examples.

Table 3: Organization as a Hologram

Perspective and Factors of Influence	**Long-term Growth Process**	**Failure Assessment - Quality Dimensions**
Product or Technical • Material • Design • Fabrication • Assembly • Information • Employee capabilities • Infrastructure		• Performance • Conformance • Reliability • Durability • Features • Environment Friendliness
Customer Service • Product • Information • Service design • Customers • Execution • Employee capabilities • Infrastructure		• Reliability • Responsiveness • Assurance • Empathy • Tangibles
Organizational or Business • Employee capabilities • Organizational structure • Plants and Equipment • Methods • Supplies • Information / knowledge		• Quality reputation • Cost • Responsiveness • Flexibility • Environment Friendliness
Employee • Communication • Thinking • Actions • Vision		• Communication • Habits • Planning • Leadership

It is emphasized that each perspective offers a different set of factors used to influence its unique set of performance measures. Influencing changes focusing on just one perspective without concurrent attention to other perspectives causes people to work at cross purposes, to serve short-term self-interest at the expense of greater goods, to adapt short-term solutions at the peril of long-term performance, and to limit growth potential. System-wide effects are gradual drift toward lower overall performance, increased finger pointing by all, and general moral problems and increased cynicism. This sets a up stage for further integration of systems concepts into the course. The perspectives themselves also facilitate correlating various quality tools and concepts with one or more appropriate perspectives.

CONTINUOUS IMPROVEMENTS: DYNAMIC VIEW OF SPC AND PROBLEM SOLVING

This section briefly shows a causal loop based framework to explain the role of SPC, problem solving tools, short term responses, and behavioral issues. This framework has been varified with the explanation by Wheeler and Chambers (1992: pages 12-20). With the help of the Figure 3, the four possibilities- State of Chaos, Brink of Chaos, Threshold State, and Ideal State- for any process are delineated. Furthermore as students are introduced to various statistical and problem solving tools, they are asked to identify which part of the diagram the tools are used. This allows them to make connections between operational thinking and systems view. The systems framework also adds the concepts of process capability and its role in continuous improvements. With some modifications it become

possible to demonstrate many of the Deming's principles and rationalize his concepts of profound knowledge. Additionally, several archetypes {Senge, '90] can be isolated from this Figure to improve the communication and understanding.

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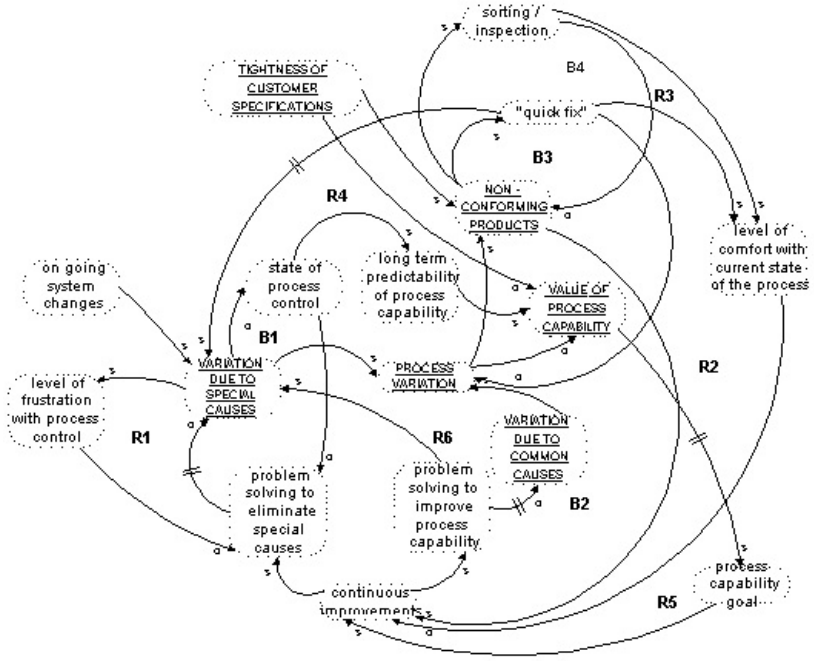

FIGURE 3: SPC, PROBLEMS SOLVING, QUICK FIX, SORTING AND BEHAVIORAL RESPONSES

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