MODELLING QUALITY IMPROVEMENT PROCESSES

Purnendu Mandal, School of Engineering & Technology, Deakin University, Geelong, Australia

Amrik S. Sohal, Department of Management, Monash University, Caulfield. Australia.

Abstract

The paper attempts to relate the operational elements of manufacturing organisations to the overall theme of quality. A common modelling framework is developed to bring together a number of issues such as technological flexibility, training and motivation, product improvement, process improvement, customer satisfaction, productivity and quality costs. The model is under validation and testing stage, and the policy options which will be evaluated are related to technological flexibility, investment, and employee development.

Introduction

Quality improvement is a widely accepted catchword today. Quality improvement is synonymous to continuous improvement and it emphasises on the ability of an organisation to improve on its quality performances each time. There is a time dimension and the efforts in quality improvement should focus in building the desired abilities in an organisation which enable the organisation to perform better in the future. In other words, an organisation should have its quality goals for the future (better every time) and must align its operations in such a way that the abilities are developed to meet the future goals. Abilities, however, are developed through structuring and restructuring of organisational elements. In fact, the study of the process of quality improvement becomes the study of how the various elements (focusing the quality aspects) are related and how they affect the quality goals and what can be done to have better effects on the quality goals.

In this paper we attempt to relate the various elements of a manufacturing organisation to the overall theme of quality. The interactions among the elements will be studied through causal mechanisms and through the study of computer simulations. The major output variables considered are product quality, customer complaints/return, employee motivation, revenue, commitment to quality, manufacturing cycle time. In selecting these measures the works of Sterman, Repenning and Kofman (1995) and Wisner and Eakins (1994) have been considered.

Quality Model

The process of improving quality can not be studied in isolation. The process is intertwined with the development in technical areas and with the human resources in an organisation. Figure 1 shows that the quality gap, a mismatch between the ideal and the actual quality perceptions, is the driving force which brings about the changes in the technical and human-resources systems. The changes in turn decrease the quality gap by improving the actual quality situation.

Figure 2 provides an overview of the interactions among the major elements of the model. The inputs and outputs of the model are identified; flows between the subsystems are also identified. The output variables have influences over the quality improvement processes and the inputs to the system.

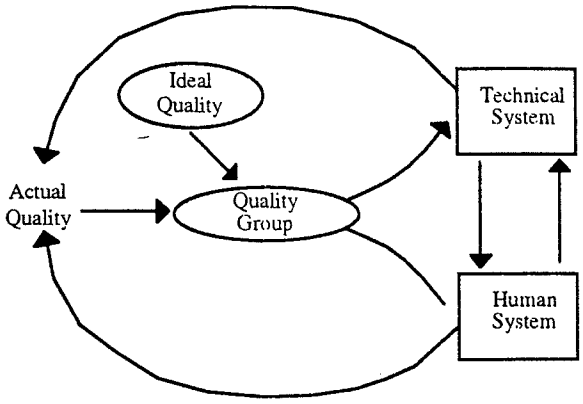

Figure 1: Dependance of Quality on Technical and Human Services

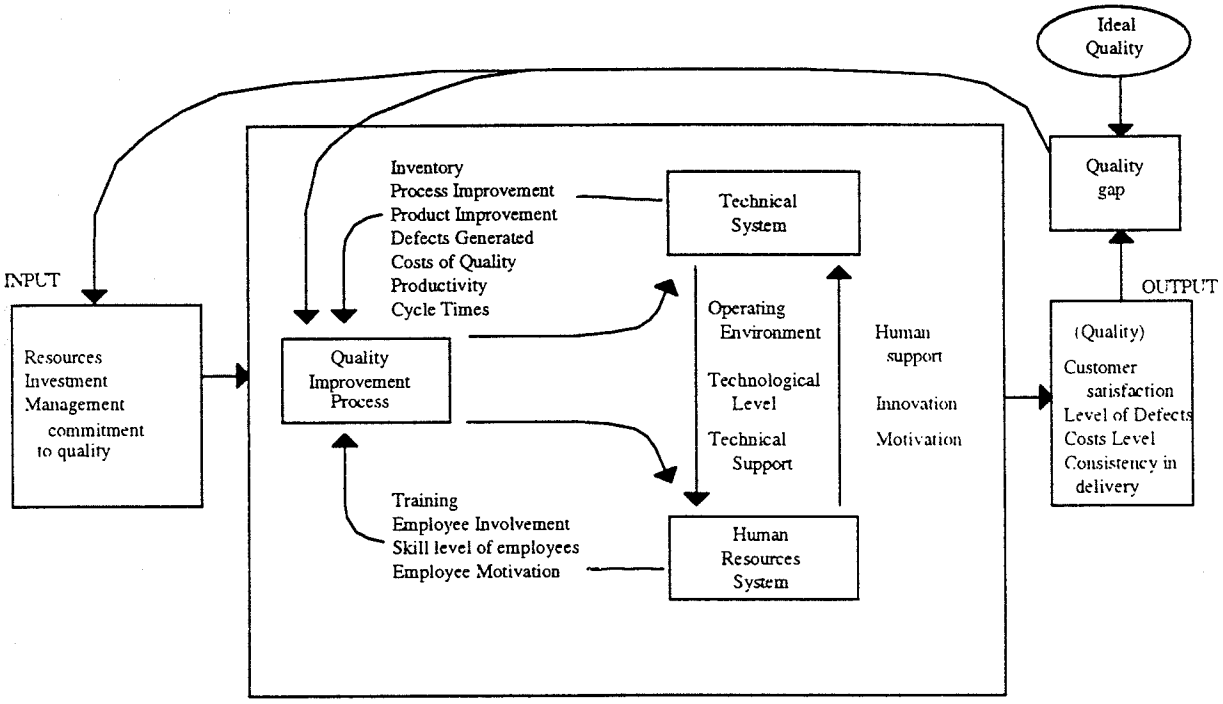

Figure 2: Overview diagram of Quality Improvement Processes System

A computer model using VENSIM package has been developed for a typical manufacturing company. The company is producing about 1000 units of a consumer product every month. The products sale at $100 a piece. The company has a capital base of $36 million out of which $21.6 million (60% of the total capital) is in capital intensive technology and hardware. The remaining $14.4 million is tied up in low capital intensive technology.

The company does not have any specific investment policy. But the previous investment pattern suggests that the company is spending roughly 60 percent of the resources in acquiring new capacity or technology, 20 percent in productivity improvement activities and the remaining 20 percent in quality improvement programmes. The management of the company is receptive to

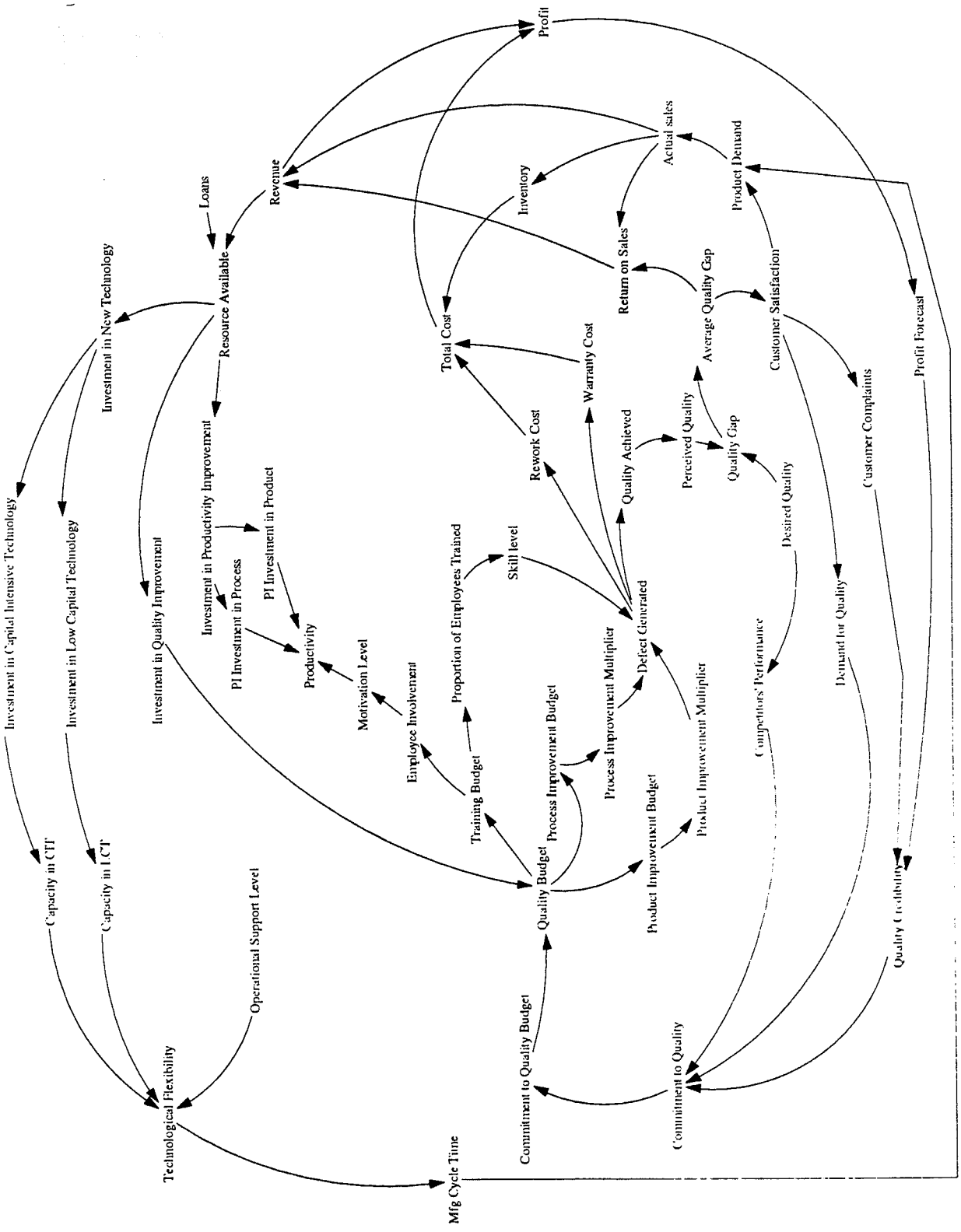

Figure 3: Overall Causal Loop Diagram of the Model

customers' complaints and to some extent the activities relating to quality improvements are formalised. The purpose of the modelling is to demonstrate the dynamic behaviour of the organisation under different policies and help management to identify the areas of primary importance.

Figure 3 is the overall causal loop diagram for the model. The relationships have been quantified and have been checked for consistency. Once finalise, the model will be used to test the policy issues regarding technological flexibility, investment and employee development.

- Technological flexibility and its impact on dynamics of quality. Technology has an impact on manufacturing cycle time and ultimately to the ability of manufacturer to supply goods in time. In the overall diagram (Figure 3) this influence has been considered; and tests will be conducted to estimate the sensitivity of technological flexibility on quality.
- Effects of investment decisions in quality improvement areas. Tests will enhance further understanding of quality behaviour for investment patters in training, process improvement, product improvement, and productivity improvement.
- Developing technical and quality skills of employees. As may be seen from Figure 2, the human resources system (through skills development) exerts a great impact on the technical system. A quantitative study is needed to evaluate the effects of technical and quality skills development processes on productivity and quality of the organisation.

References

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