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ESTIMATING QUALITY COSTS BY COMPUTER SIMULATION

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ABSTRACT

Quality improvement continues to be a key priority in many modern-manufacturing companies. Yet it often takes place without a full evaluation of corresponding costs and benefits. A new case exercise addresses this situation with the aim of making quality managers much more aware of the consequences -particularly the detailed economic effects - of their actions.

The focus of the exercise is a set of results from a realistic production line setup. These reveal related quality costs to be far from satisfactory. With the aid of a computer simulation model (QCOST), participants strive to optimise costs for the line against a targetted output quality.

INTRODUCTION

Product quality is an important element of competitive strategy in most manufacturing companies. (Quality in this context -following the conventional view -is taken to refer to the product's "fitness for use"). But how much quality is needed at what cost?

By its nature, quality assessment is often highly subjective. This can lead to great difficulty with identification of costs. Even where costings are feasible, the calculations involved are potentially so complex as to require significant computer support -a fact conveniently overlooked by many of the texts on the subject. The effect of these constraints has been to deter all but the most dedicated of firms from pursuing a comprehensive cost assessment of their operation.

THE QCOST COMPUTER SIMULATION

QCOST allows quality costs to be estimated for a wide variety of production configurations. Particular costs covered by the program include those of quality loss, testing and inspection, scrap or rework of defective products, process adjustment, lost production and warranty.

Inputs to QCOST are handled by means of a powerful graphics editor. This enables a line to be built up simply and systematically, from its component processes. At any stage, the resultant setup can be saved to disk or viewed in schematic form, on-screen. Structural changes to the line are achieved by adding, inserting or deleting processes as necessary. Technical details on individual processes can also be easily modified by editing values held on standard templates.

The program employs large-scale Monte Carlo methods: for each line process, defined, some 3000 random numbers are generated, using standard mathematical algorithms. Each random number is taken to correspond with a product passing through the process. Cost estimates are based on the

characteristics of these would-be products and how they are dealt with on the line.

Despite the large number of computations involved, total simulation time is surprisingly manageable. For example, for the Company X (six-process) application, described below, a full cost breakdown can be obtained, on a 386-based machine, in under two minutes. Output is available in tabular form or can be graphed to show, in particular, different types of cost by process.

COMPANY X

Company X specialises in the manufacture of hydraulic hoists and has a production capacity of 200,000 tubes per year. The hoists are produced on some of the world's most advanced machinery: its 70,000 square metre factory is fully equipped with flexible manufacturing systems, robots and other computer controlled machines.

The applications described in the case concerns the processing of tubes. These first need to be cut to required lengths then rough polished. Next, pre-machined head billets are friction-welded on to them followed by slider billets. After this the tubes are sent for tuning and boring before being finished-polished.

It should be noted that, prior to QCOST, the company -in spite of all its high tech -had no awareness of a problem with its quality costs.

CONCLUSION

Visual interactive simulation modeling provides an effective tool for gaining insight into quality situations not normally amenable to analytic treatment. QCOST is an example of the type of user-friendly system now being developed to support managers in their quest for quality improvement. The related case exercise should do much to increase awareness in this vitally important area.