A Model for estimation of Cost of Quality

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Abstract — A model has been developed for cost of quality. This model classifies activities for cost of quality into prevention activity, appraisal activity, internal failure activity, external failure activity. Aggregate cost rate are developed for each activity. The concepts and model developed are general in nature and can be applied to most of the fabrication industry.

Keywords — Cost of quality, Activity, coat estimation.

I. INTRODUCTION

In today’s competitive world many companies promote quality as central value and consider it to be a critical success factor. Customers are not willing to pay more than certain amount of money for certain product. Consequently, the achievable profit is dependent on product cost. Cost of quality is the important factor for a product cost.

Cost of quality (COQ) was first described by Armand V. Feigenbaum in a (1956) Harvard Business Review article. The concept of cost of quality is a means to quantify the total cost of quality-related efforts and deficiencies. According to Dale and Plunkett (1995), the costs incurred in the design, implementation, operation and maintenance of a quality management Feigenbaum (1956) has classified quality cost as prevention, appraisal, internal failure and external failure system.

II. LITERATURE SURVEY

J. M. Gilbert, I.M. Bell, D.R. Johnson [1] have described the adaptation of the conformability analysis technique to the assessment of functional, manufacturing and test capability of PCB level electronic circuits. They have combined process capability indices and failure modes and effects analysis (FMEA) with cost mapping to allow the quality costs associated with design and manufacture induced faults to be estimated and the effectiveness of test strategies in reducing these costs to be determined. S. B. Jaju, and R. R. Lakhe [2] have carried out a case study in luggage manufacturing industry for quality cost. Suhansa Rodchua [3] has identified important factors and measured contributing to a successful quality cost program implementation and developed an empirically based model for quality costs in the manufacturing environment. Ali Uyar [4] has investigated the extent to which Turkish manufacturing companies implement a COQ system, to evaluate how company performance has changed after COQ system implementation, and to identify the objectives behind COQ measuring and reporting

III. MODEL DEVELOPMENT

Activities for quality can be classified into prevention activity, appraisal activity, internal failure activity and external failure activity.

A. Prevention activity

Activities that keep failure from happening, and keep appraisal costs to a minimum are called as prevention activities. Examples of prevention activities are Quality Planning, Training programs, written procedures, Analysis of quality information, and Quality improvement projects.

In general, the cost of a prevention activity is given as

\[ C_{ij} = \left[ \sum_{i} M_{ij} + \sum_{i} M_{mij} + m_{ij} + \sum_{i} m_{ij} + \sum_{i} b_{ij} + C_{c} + \sum_{i} C_{cum} \right] \]

Where, \( C_{ij} \) is the total cost of machine-activity i on job j, \( M_{ij} \) the periodic rate for main machines used for activity i, \( M_{mij} \) the utility rate for main machines used for activity i, \( m_{ij} \) the periodic rate for complimentary tools and equipment for activity i, \( b_{ij} \) the building space rate for machine activity i, \( C_{c} \) the cost of consultancy for activity i, \( C_{cum} \) the cost of consumable product for activity i, \( t_{mij} \) the machine time for job j on activity i, \( t_{ij} \) the time for activity i, \( t_{im} \) the complimentary tools time for job j on activity i, \( t_{ij} \) the labour time for job j on activity i, \( t_{ij} \) the labour training time for activity i,
B. Appraisal activity

Activities are incurred to ascertain product or service whether it conforms to quality standards called as appraisal activity. Examples of appraisal activities are inspection of incoming work, supplies and materials, periodic inspection of work in process, final inspection and collecting quality data.

In general, the cost of a appraisal activity is given as

\[
C_{ij} = \left[ \left( M_{t_{ij}^a} + \sum M_{u_{ij}^{t_{ij}^{ram}}} + m_{t_{ij}^a} + \sum m_{u_{ij}^{t_{ij}^{ram}}} \right) + \right. \\
\left. + \sum L_{t_{ij}^a} + \sum b_{t_{ij}^a} + \sum C_{cum} \right] \\
+ \left[ \left( M_{t_{ij}^{ra}} + \sum M_{u_{ij}^{t_{ij}^{ram}}} + m_{t_{ij}^{ra}} + \sum m_{u_{ij}^{t_{ij}^{ram}}} \right) + \right. \\
\left. + \sum L_{t_{ij}^{ra}} + \sum b_{t_{ij}^{ra}} + \sum C_{cum} \right] \\
C_{sc} = \text{cost of scrap for activity i,} \\
C_{rs} = \text{cost of transport of labour,} \\
C_{us} = \text{cost of transport of machine and complimentary tool.}
\]

\[
C_{ij} = \left( M_{t_{ij}^a} + \sum M_{u_{ij}^{t_{ij}^{ram}}} + m_{t_{ij}^a} + \sum m_{u_{ij}^{t_{ij}^{ram}}} \right) + \sum L_{t_{ij}^a} + \sum b_{t_{ij}^a} + \sum C_{cum} + C_{sc}
\]

\[
C_{ij} = \left( M_{t_{ij}^{ra}} + \sum M_{u_{ij}^{t_{ij}^{ram}}} + m_{t_{ij}^{ra}} + \sum m_{u_{ij}^{t_{ij}^{ram}}} \right) + \sum L_{t_{ij}^{ra}} + \sum b_{t_{ij}^{ra}} + \sum C_{cum} + C_{sc}
\]

C_{a}, C_{ci} the cost of transport of labour. C_{us} is the cost of transport of machine and complimentary tool.

D. External failure activity

Activities incurred to correct non-conforming work after delivery to the customer, or to correct work that did not satisfy a customer’s specified standards are called as external failure activities. Examples of external failure are warranty, Complaint Administration, Sales return.

External failure activities are further classified into rework activity at customer site, rework at industry.

Rework activity at customer site

If the rework carried out at customer site after external failure then it is called as rework activity at customer site.

In general, the cost of rework activity at customer site is given as

\[
C_{ij} = \left( M_{t_{ij}^{ra}} + \sum M_{u_{ij}^{t_{ij}^{ram}}} + m_{t_{ij}^{ra}} + \sum m_{u_{ij}^{t_{ij}^{ram}}} \right) + \sum L_{t_{ij}^{ra}} + \sum b_{t_{ij}^{ra}} + \sum C_{cum} + C_{sc}
\]