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EVALUATION OF COST OF QUALITY USING ACTIVITY BASED COSTING: A CASE STUDY

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ABSTRACT

This paper was aimed at developing a Quality Costing System for manufacturing industry, and to show that such a system could provide a basis for analysing quality costs and developing and evaluating the quality improvement process. Current quality cost measurement systems were limited by their inability to trace quality costs to their source; quality was manageable only if it could be measured; quality cost did not easily fit into the traditional cost accounting structure; traditional accounting systems were unlikely to change radically to accommodate proper quality costing. Activity Based Costing tools with the theory of quality costing to provide a system that can deliver valuable information is implemented as an effective CoQ (Cost of Quality) analysing tool. The CoQ of the agricultural machine manufacturing industry situated in Kerala, was evaluated using ABC terminology.

Keywords-Activity based costing, Cost of Quality, PAF, Productivity, Poor quality

I. INTRODUCTION

Many companies promote quality as the central customer value and consider it to be a critical success factor for achieving competitiveness. Any serious attempt to improve quality must take into account the costs associated with achieving quality since the objective of continuous improvement programs is not only to meet customer requirements, but also to do it at the lowest cost. This can only happen by reducing the costs needed to achieve quality, and the reduction of these costs is only possible if they are identified and measured. Therefore, measuring and reporting the cost of quality (CoQ) should be considered an important issue for managers.

CoQ analysis links improvement actions with associated costs and customer expectations, and this is seen as the coupling of reduced costs and increased benefits for quality improvement. Therefore, a realistic estimate of CoQ and improvement benefits, which is the tradeoff between the level of conformance and non-conformance costs, should be considered an essential element of any quality initiative, and thus, a crucial issue for any manager.

The purpose of quality cost techniques is to provide a tool to management for facilitating a quality program and quality improvement activities. Quality cost reports can be used to point out the strengths and weaknesses of a quality system. Improvement teams can use them to describe the monetary benefits and ramifications of proposed changes. In practice, quality costs can define the activities of a quality program and quality improvement efforts in a language that management can understand and quantify. Any reduction in quality costs will have a direct impact on gross profit margins and can be counted on immediately as pre-tax profit.

Nowadays, a clear understanding of the economics of quality and the use of a quality cost system in the management of quality and of quality improvement efforts may make the difference between maintaining current levels of profitability and outperforming the competition.

II. LITERATURE REVIEW

Poor quality of products and processes has direct impact on the finance of the company in both the company's top line (revenues) and its bottom line (profits). During development, i.e., the design and manufacturing phase , poor quality causes late delivery, added test time, added development time to correct problems found, and additional people being added to try to overcome the problems encountered. This adds significantly to development costs, reducing the bottom line. Once poor quality products are delivered to customers, word of that poor quality quickly spreads, and results in reduced sales, from some who will return products they are not satisfied with, and from others who will never buy a poor quality product in the first place.[2] This reduces ongoing revenues, often significantly, thus impacting both the top and bottom lines. With poor quality product in the field, customer support issues will quickly grow, and this will in turn require additional engineering support people to be assigned. These added support and engineering costs would add to development costs, often for prolonged periods of time, further reducing the bottom line[3]. Poor quality products also imply a poor quality company, affecting the reputation of the company. For avoiding the poor quality issues the company have to focus on cos of quality analysis. The cost of quality model is specified in Fig 1.

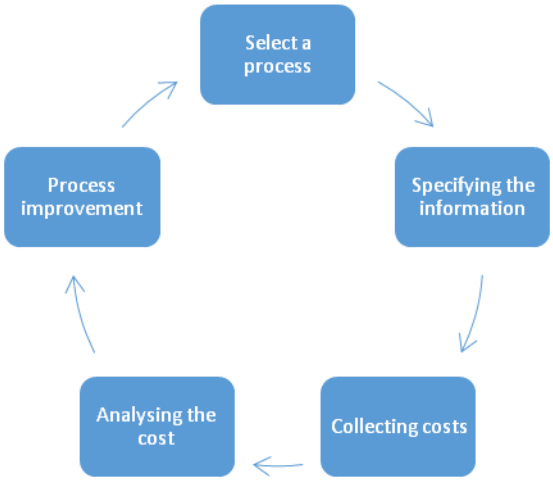

Figure 1 Quality cost model

III. CASE STUDY

An agricultural machine manufacturing company situated in south india, were seeking for solution for the low productivity issues (Fig 2). From our study it was found that the major issue of low productivity was analyzed and represented in the form of a Fish-bone diagram(Fig 3).The major issue of the lower productivity was found to be the quality related cost.In order to analyzing the problems related to quality, we decided to compute the Cost of quality in the company, By optimizing the CoQ, the company can find the way to resolve the quality related problems.

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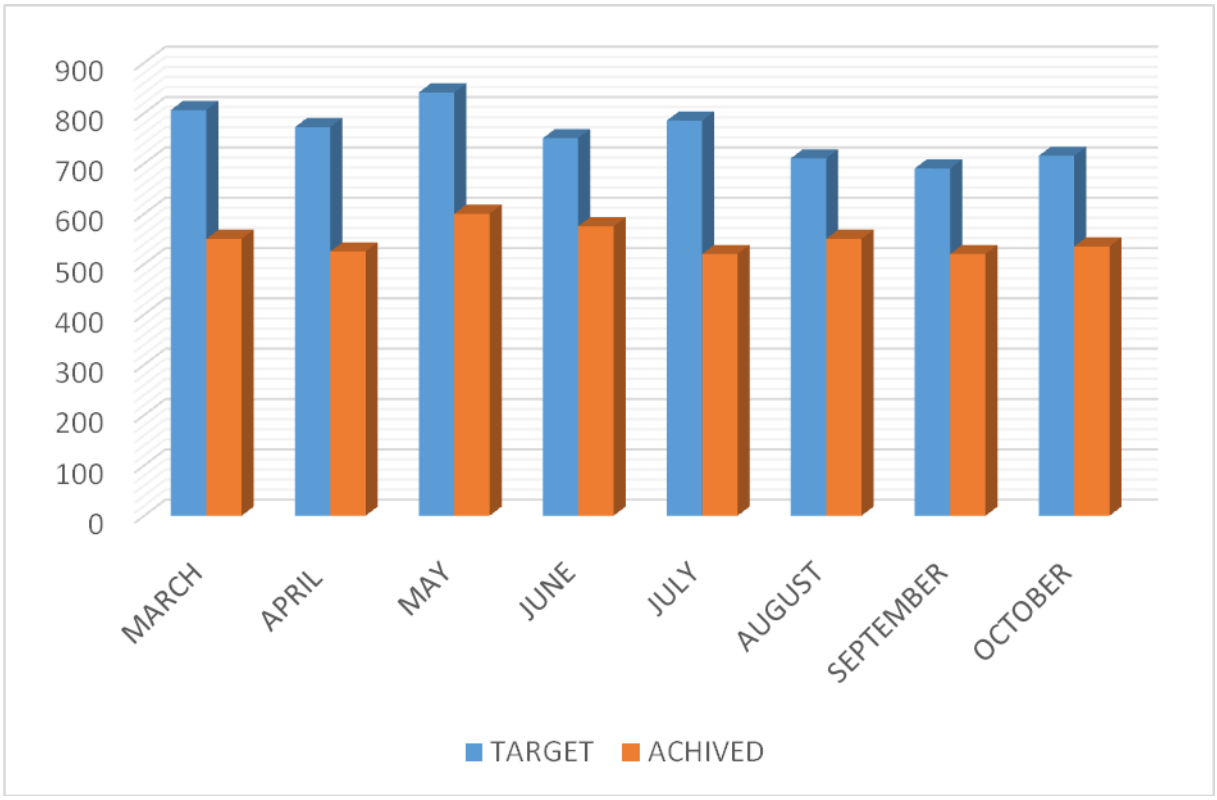

Figure 2 : Production Target vs. Production for year 2015

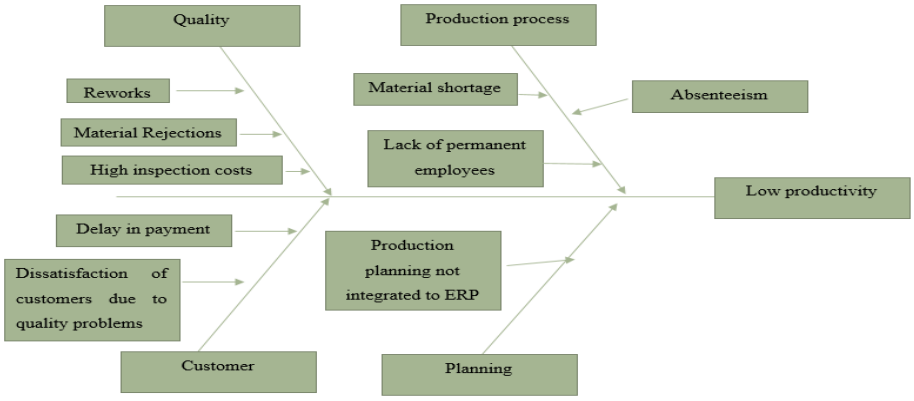

Figure 3: Fish-bone Diagram

IV. DATA COLLECTION AND ANALYSIS

Data collected for a period of ten months from March 2015 to March 2016 against two customer requirements as cost object was taken for this cost of quality analysis. Labour cost, Machine cost and facility costs are the resource costs. Labour hours and machine hours are the resource drivers for labour cost and machine cost respectively. These data are collected from the manufacturing time cards and standard man hour (SMH) calculations after time study of each operation is done by the Industrial Engineering department. Machine hour is collected from the machine job cards and machine cost worked from the procurement cost of machine, its guaranteed life time and operation and the depreciation factors from accounts. Other costs such as facility costs, tool costs, consumable costs etc. are directly taken from the records. Detailed flow charting of the process,

listing out of all activities in the process, tracing resources costs to activities using resource drivers and tracing activity costs to cost objects using activity drivers were done. Machine hours, number of reworks, number of tests carried out, units taken for packaging, number of loaded batches, maintenance hours etc are the activity drivers used for activity cost assignment to cost objects.Table 1 represents the results of activities identified, resources required, resource drivers and Table 2 represents tracing the labour costs of each activity . Table 3Machine costs for corresponding activitiesand Table 4 represents the results of tracing the activity costs to cost objects using activity drivers.

Table 1 List of activities

Sl. No.	**Activities**	**Required Resources**	**PCM Category**	**VA/ NVA**	**Activity Drivers**
1	Material Handling	People,Trolly	Essential	NVA	No.of moves
2	Inspection	People, Testors, Tools	CoC	NVA	No. of Tests
3	Planning & Scheduling	People	Essential	VA	No.of Batches
4	Assembling	People, Machines, Tools, Consumables	Essential	VA	Machine Hours
5	Maintenance	People,Materials, Tools	COC	VA	Labour hour
6	Re Work	People, Machines, Tools , Materials	CONC	VA	No.of Rework
7	Packaging	People, Materials, Tools	Essential	VA	Units Packaged
8	Replacement	People, Tools, Materials	CONC	NVA	No.of replacement

Table 2 Labour cost calculation for activities

Activities	Planning & Scheduling	Material Handling	Assembling process
Labour hours per month	237.5	250	7650
Labour cost	53437.5	56250	1721250

Activity costs are then classified to Essential, Cost of Conformance and Cost of Non Conformance based on the Process Cost model of Cost of Quality and further analyzed to Valueadded and Non-Value added as per customer perspectives. Essential costs are cost of those activities which are inevitable to run the process but not relevant to COQ.

Table 3 Machine cost for activities

Sl. No.	Activities	Activity code	Engine Asembly			Transmission Assembly			Total machine Hours	Total machine cost
			Hours/Day	No.of. Days	Total per month	Hours/Day	No.of. Days	Total per month		
	Material Handling	MH 001	0	0	0	0	0	0	0	0
	Inspection	INS001	1.5	25	37.5	1.7	25	42.5	80	4304
	Planning & Scheduling	PS 001	0	0	0	0	0	0	0	0
	Assembling	AS001	3.8	25	95	3.9	25	97.5	192.5	10356.5
	Maintenance	MN001	0.7	25	17.5	0.6	25	15	32.5	1748.5
	Re Work	RWK 001	1.3	25	32.5	1.5	25	37.5	70	3766
	Packaging	PK001	0	0	0	0	0	0	0	0
	Replacement	RP001	0	0	0	0	0	0	0	0

Planning and scheduling, Material handling cost and Machine cost are essential Non-Value added costs. Even though they are not adding any values they cannot be eliminated. Machining and packaging are essential value added costs. Inspection and maintenance are cost of conformance, out of which inspection is Non-value added and Maintenance Value added.Rework, Warranty repairs and Replacements are cost of non-conform Rework, Warranty repairs and Replacements are cost of non-conformance which are non-value added costs. Further analysis made on these costs to identify the root cause.

Table 4 Activity cost assignment

Sl. No.	Activities	Activity Level	Labour Cost (Rs.)	Machine Cost (Rs.)	Other Cost (Rs.)	Total Cost (Rs.)
1	Material Handling	Batch	41362	0	25562	66924
2	Inspection	Unit	92735	6200	23200	122135
3	Planning & Scheduling	Batch	39294	0	350	39644
4	Assembling	Unit	3550000	2256	3500	3555756
5	Maintenance	Facility	15000	1252	15000	31252
6	Re Work	Unit	95265	1050	5685	102000
7	Packaging	Unit	45250	1653	3250	50153
8	Replacement	Unit	7250	0	15525	57403

Table 4 represents the result of this analysis. Using Statistical tools, activities incurring highest cost are identified for further analysis. Fig 4 shows the result of this analysis. Total product cost, total non-value added and Value added cost, total Cost of Quality and its percentage to total product cost and the cost improvement

areas were identified in this analysis. Costs traced are grouped to COQ related and COQ –unrelated costs to cost objects. In the COQ related costs, further analysis made to identify the Cost of Conformance and Cost of Non Conformance.

Total Activity cost = Labour cost + machine cost + other cost

= 3973880Rs.

Total product cost= Total activity cost + Direct material cost

= 3973880 + 30657388= 34631268 Rs.

Percentage of direct material cost to product cost = direct material cost /Total product cost

= 88.5%

Percentage of total activity cost to product cost = Total activity cost /Total product cost

= 11.5%

Unit product cost= Total product cost/Production quantity = 34631268/350

= 98946.48Rs.

Table 5 Total CoQ cost analysis.

Activity	Cost (Rs.)	%	COC/CONC	VA/NVA
Inspection	122135	39.04	COC	NVA
Re Work	102000	32.60	CONC	NVA
Replacement	57403	18.35	CONC	NVA
Maintenance	31252	9.99	COC	VA
Total CoQ	312790 Rs.			

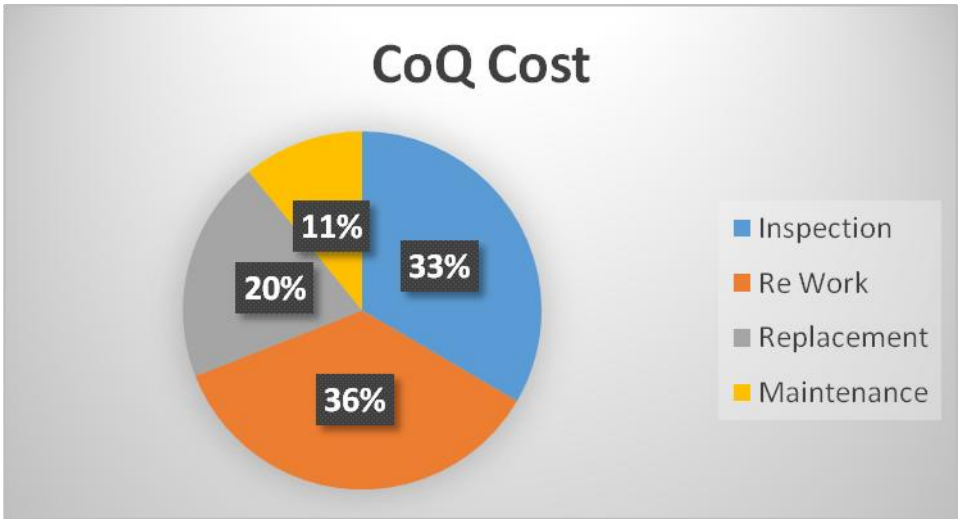

Figure 4 CoQ elements.

V. RESULTS AND FINDINGS

From the analysis the following inferences can be made;

- The cost of the inspection, re- work and warranty repairs arefound as the major contributors of Cost of Quality. Inspection cost is the activity bearing highest COQ with a contribution of 39% of the total COQ; Reworkcost is next highest.
- Idle capacity costs are also identified in this analysis, which gives an insight to the authorities to deploy the unused resources.
- This integrated model enables resources and other associated costs to be more accurately attributed to the products and the customers and identifies where high (and low) costs are being incurred. The reason for the same can also be traced out.

The analysis shows that CO Q can be more effectively calculated in the ABM system than the traditional PAF model, since it tracks all the resource costs to the activities including the costs of indirect labour and indirect machine which are not appropriately assessed in the PAF model.

VI. CONCLUSION

Many research papers on CoQ propose quality cost models, methods and techniques, and provide abundant information on the topic. The literature review of the practical use of CoQ suggests that even though quality is considered to be an important issue, the CoQ approach is not fully appreciated by organizations and only a minority of them use a formal quality costing method. Nevertheless, companies usually do have quality systems and continuous improvement programs, but approach quality improvement and cost containment in many other ways. Thus, although not using CoQ as a method to drive quality costs down, they achieve the required result with different techniques.

In this paper an attempt is made in this study to analyse the drawbacks of traditional methods of Cost of Quality, advantages of Activity Based Costing methods over the traditional method and also the strengths of Activity Based Cost of Quality system model. It is explicit that ABC oriented COQ system is an alternative to overcome the limitations of traditional mode, such as inappropriate resource allocation, difficulty in tracing COQ to its cost objects. Further a detailed case study on implementation of COQ with ABC model has been conducted. This study points out the requirement of an integrated data capturing system.

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