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MEASUREMENT OF QUALITY COSTS AND QUALITY METRICS IN EXCEL FOODS PVT. LTD. - AN EMPIRICAL STUDY

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ABSTRACT

Food processing industries provides the vital linkage between industry and agriculture and is of enormous significance for India's development. Excel Foods Pvt. Ltd. being one of the leading runners in the food industry provides a range of food products such as fruit juices, fruit pulps and concentrates. These products are tested under high quality measures and are processed under expert supervision. Excel Foods Pvt. Ltd is an ambassador for the quality of the product.

They lead in food industry due to their dedication, their team of experts; world class facilities; most advanced infrastructure and self-designed quality protocol. The advancement of the company is contributed to a multi-tier quality control and test approach. From supply of Raw material to extract the pulp, they monitor systems installed to keep a keen eye on every moment.

Quality costs are the costs associated with preventing, detecting and remediating product issues related to quality. Quality costs do not involve simply upgrading the perceived value of a product to a higher standard. Instead, quality involves creating and delivering a product that meets the expectations of a customer.

The present study evaluates the quality circles prevailing in the world are considered for the purpose of compared Test Significances. past five-year data is being analyzed and significant conclusions are drawn for the betterment of the organizational quality Metrics.

Keywords: Quality Circles, Cost of Quality, Quality Metrics.

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1. INTRODUCTION

Excel Foods Pvt. Ltd is a manufacturer / exporter of a range of Aseptic and Canned Premium Quality Tropical Fruits Purees with its production unit located at Hubli in North West Karnataka, India. Starting out in 1987 as a toll processor we have now matured into a production partner for prominent global customers who demand high quality, flawless purees for premium applications. It is a fruit and vegetable processing unit located at Plot no. 47, KIADB, Tarihal, and Hubli. The Company is a family run & family managed producer with a special emphasis on producing high quality fruit Purees. Their specialty is High Ratio, Deep Orange-Colored Western Alphonso Mango Puree. They also say that they are fortunate to be strategically located in the agro-food chain of the fruits that they process, where they can make a difference to lives and livelihoods of several small growers.

Figure 1 Logo

Food processing industries provides the vital linkage between industry and agriculture and is of enormous significance for India's development. Excel Foods Pvt. Ltd. being one of the leading runners in the food industry provides a range of food products such as fruit juices, fruit pulps and concentrates. These products are tested under high quality measures and are processed under expert supervision. Excel Foods Pvt. Ltd is an ambassador for the quality of the product.

They lead in food industry due to their dedication, their team of experts; world class facilities; most advanced infrastructure and self-designed quality protocol. The advancement of the company is contributed to a multi-tier quality control and test approach. From supply of Raw material to extract the pulp, they monitor systems installed to keep a keen eye on every moment.

The company believes in serving the genuineness and so they actively participate in maintaining the original taste of the pulp by not adding other flavors and colors to it. The company has various quality and safety certifications of foods such as FSSC 22000, US FDA, GMP, kosher and they are also member of SEDEX.

Quality costs are the costs associated with preventing, detecting and remediating product issues related to quality. Quality costs do not involve simply upgrading the perceived value of a product to a higher standard. Instead, quality involves creating and delivering a product that meets the expectations of a customer.

Eg: marketing research, design quality progress reviews, product design qualification test, field test, product or service quality audits, setup inspections and tests etc. This chapter deals with highlights of the study to know about the costs incurred in maintaining quality or cost of quality in Excel Foods Pvt. Ltd.

2. OBJECTIVES OF THE STUDY

To understand the current costing methods in Excel Foods Pvt. Ltd.

To understand the various factors affecting on cost of quality in Excel Foods Pvt. Ltd.

To know and help the organization in reducing unnecessary cost to improve quality

To increase the company's quality circles.

To take the company's quality level towards Six Sigma.

3. RESEARCH METHODOLOGY

3.1. T-test for two populations means (method of paired comparisons) Object

1. To investigate the significance of the difference between two population means, μ1 and μ
2. No assumption is made about the population variances.

3.2. Limitations

1. The observations for the two samples must be obtained in pairs. Apart from population differences, the observations in each pair should be carried out under identical, or almost identical, conditions.
2. The test is accurate if the populations are normally distributed. If not normal, the test may be regarded as approximate.

3.3. Method

The differences di is formed for each pair of observations. If there are n such pairs of observations.

3.4. Tools Used For Analysis

Data analysis is being done thorough SPSS.

Tables are used to analyze the data and charts are used for representation of the outcome for easy understanding.

4. LITERATURE REVIEW

Most CoQ models depend on the P-A-F arrangement (Plunkett and Dale,1987; Machowski and Dale, 1998; Sandoval-Chávez and Beruvides, 1997). It was Armand Feigenbaum, who in 1943 originally concocted a quality costing investigation when he and his group built up a dollar-based detailing framework (Harrington, 2002). Joseph Juran (1951) started the idea of value costing, the financial matters of value and the graphical type of the CoQ model. furthermore, Armand Feigenbaum (1956) later proposed the now broadly acknowledged quality cost arrangement of counteraction, evaluation and disappointment (inward and outer) costs. Avoidance costs are related with activities taken to guarantee that a cycle gives quality items and administrations, examination costs are related with estimating the degree of value accomplished by the cycle, and disappointment costs are caused to address quality in items and administrations previously (inner) or after (outside) conveyance to the client.

Juran later featured the customary tradeoff that contrasts anticipation in addition to examination costs with disappointment costs (Juran, 1962). The fundamental speculations of the P-A-F model are that interest in counteraction and evaluation exercises will diminish disappointment costs, and that further interest in avoidance exercises will lessen examination costs (Porter and Rayner,1992; Plunkett and Dale, 1987). The goal of a CoQ framework is to

locate the degree of value that limits absolute expense of value. Feigenbaum's and Juran's P-A-F plot has been received by the American Society for Quality Control (ASQC, 1970), and the British Standard Institute (BS6143, 1990), and is utilized by the vast majority of the organizations which utilize quality costing (Porter and Rayner, 1992).

The previously mentioned traditional perspective on quality cost conduct in the P-A-F model holds that an ideal financial quality exists at the level at which the expense of making sure about higher caliber would surpass the advantages of the improved quality (BS 4778, 1987). This idea is, in any case, regularly tested, and it is contended that there is no financial degree of value, that the spending on anticipation could be constantly defended and that ideal quality level actually rises to zero deformities (for instance, Fox 1989; Plunkett and Dale 1988a; Price, 1984; Schneiderman 1986). These and different various references (for instance, Porter and Rayner, 1992; Cole, 1992, Shank and Govindarajan,

1994) examine the two clashing perspectives on the monetary degree of value costs that are appeared in Burgess bolsters the old style see in certain time compelled conditions, though under a boundless time skyline the cutting edge see wins. Also, Fine (1986), Dawes (1989), Marcellus and Dada (1991) and Love (1995) recommend that the conventional compromise model might be a precise, static portrayal of value cost financial aspects, however that in unique, multiperiod settings, disappointment expenses can keep on declining after some time with no relating increment in counteraction and evaluation costs. Ittner (1996) gives experimental proof to help this conduct. Regardless of the proceeding with conversation on monetary quality levels, the essential standards of the P-A-F arrangement are still commonly perceived and acknowledged.

The cost classes of Crosby's model (Crosby, 1979) are like the P-A-F plot. Crosby considers quality to be "conformance to necessities", and hence, characterizes the expense of value as the aggregate of cost of conformance and cost of non-conformance (Crosby, 1979). The cost of conformance is the cost associated with verifying that things are done well the first run through, which incorporates genuine counteraction and evaluation costs, and the cost of non-conformance is the cash squandered when work neglects to adjust to client prerequisites, generally determined by measuring the expense of revising, the significance of chance and immaterial expenses has been as of late underscored.

Immaterial expenses are costs that can be just assessed, for example, benefits not procured in view of lost clients and decrease in income inferable from non-conformance. Sandoval-Chavez and Beruvides (1998) fuse opportunity misfortunes into conventional P-A-F quality costs. As per them, opportunity misfortunes might be separated into three segments: underutilization of introduced limit, lacking material taking care of and helpless conveyance of administration. They express all out CoQ as income lost and benefit not acquired. Mojarras and Ansari (1987) likewise advocate that the P-A-F model be extended to oblige additional measurements that are distinguished as the expense of wasteful asset usage and quality plan cost. Vehicle (1992) incorporates opportunity cost and reports proof of its fruitful use in a quality program. Quality expenses are characterized in three classifications: the expense of conformance, the expense of non-conformance and the expense of lost chance. Different creators address the expense of lost costumers got from item disappointments that arrive at the market (Tatikonda and Tatikonda, 1996; Heagy, 1991). Juran's model (Juran et al., 1951) additionally perceives the significance of intangibles. His CoQ plot incorporates two quantifiable cost classifications: substantial processing plant costs and unmistakable deals expenses, and he proposes the consideration of immaterial inside advantages.

Albright and Roth (1992) have proposed Taguchi's quality misfortune work as a method for assessing quality costs that are covered up by bookkeeping frameworks. Kim and Liao (1994) have broadened the value of this idea by creating different types of value misfortune works and

have demonstrated how unique misfortune capacities can be utilized for estimating shrouded quality expenses for any variety of the real incentive from the objective estimation of assigned attributes of an item.

Table 1 P-F-A Model

Company	*Industry*	*CoQ calculation*	*Base for CoQ calculation*	*Reported gains*	*Reference*
P-A-F model					
United Technologies/ Essex Group, USA	telecommuni-cations	**CoQ = P+A+F**	% of total manufacturing cost % of cost of goods produced	• CoQ reduced from **23.3% to 17.2%** in 5 years. • gain in productivity of 26%	Fruin, 1986
AT&T Bell Laboratories	telecommuni-cations	**CoQ = P+A+IF+EF**	% of project budget		Thompson and Nakamura, 1987
Hydro Coatings, UK	industrial coatings manufacturing	**CoQ = P+A+IF+EF**	% of annual sales turnover % of raw material usage	• CoQ reduced from **4.1% to 2.5%** in 4 years. • investment in quality paid back in the first year.	Purgslove and Dale, 1995; Purgslove and Dale, 1996
Philips Power Semiconductor Business Group, UK	electronics	**CoQ = P + A + CONC**	% of factory turnover	• CoQ reduced from **35.8% to 18.1%** in 4 years • workforce reduced by 25% in 18 months • output increased by 25% in 18 months	Payne, 1992
York International, UK	air conditioning and refrigeration	**CoQ = P+A+IF+EF**	% to cost of sales	• CoQ reduced from **13.5% to 3.7%** in 8 years • the cost of factory failures reduced by 96%	Knock, 1992
British Aerospace Dynamics, UK	aerospace	**CoQ = P+A+F**	% of total manufacturing cost	• objective to reduce CoQ by one third in one year	Hesford and Dale, 1991
ITT Europe, Belgium	information technology	**CoQ = P+A+F**	% of sales	• Savings from CoQ improvement program totaled over $ 150 million in 5 years	Groocock, 1980
Allis-Chalmers Corporation, US	machinery manufacturing	**CoQ = P+A+IF+EF**	% of product sales	• CoQ reduced from **4.5% to 1.5%** in 3 years	Kohl, 1976

Table 2 Crosby's Model

Company	*Industry*	*CoQ calculation*	*Base for CoQ calculation*	*Reported gains*	*Reference*
Banc One Corporation, USA	financial services	**CoQ = P+A+IF+EF**	% of operating expense	• net income enhanced **by $20 million annually** • substantial improvements in service levels and operating costs	Atkinson et al. 1991, Campanella, 1999
Cascade Engineering, USA	automotive supplies	**CoQ = P+A+IF+EF**	% of sales		Atkinson et al. 1991
electronic manufacturer	electronics	**CoQ = P+A+IF+EF**	% of sales		Denzer, 1978
Crosby's model					
Solid State Circuits		**CoQ = COC + CONC**	% of the revenue	• CoQ reduced from **37% to 17%**	Denton and Kowalski, 1988
BDM International	software	**CoQ = COC + CONC**	in $ per line of code	CoQ reduced by 50% in 8 years	Slaughter et al.,1998
Opportunity and alternative cost models					
US Marketing Group of Xerox, USA	service business	**CoQ = P + A + IF + EF + ExR + OC**	% of sales revenue	• CoQ **reduced by $54 million** in first year.	Carr, 1992
Rank Xerox, UK	office equipment	**CoQ = P + A + IF + EF + ExR + OC**	% of total manufacturing cost	• CoQ reduced from **6% to 1%** in 5 years • defects rate reduced by over 75%	Huckett, 1985
Reprographic Manufacturing Operations Unit of Xerox, USA	office equipment	**CoQ = P + A + IF + EF + ExR + OC**	% of the standard cost of production	• CoQ reduced **by 50%**	Morse et al. 1987
pharmaceutical company	pharmaceutical	**CoQ = Operating Cost + CONC + Alternative Cost**		• CoQ reduced **by 11%**	Malchi and McGurk, 2001

5. DATA ANALYSIS

Table 3 Data Analysis

Particulars	2015	2016	2017	2018
A) Prevention Costs				
Employee Quality Training	55,03,220.92	62,47,514.64	67,64,546.52	65,01,493.01
Quality Circles	24,18,081.48	26,43,179.27	25,56,679.00	23,74,458.32
Cost of Prevention Maintenance	30,85,138.44	34,60,161.95	37,81,754.35	38,44,361.09
Quality Planning	8,33,821.20	7,20,867.07	6,92,433.90	5,65,347.22
Audits of effective Quality System	23,76,390.42	20,66,485.61	21,30,565.83	22,04,854.15
Supervision of Prevention activities	9,58,894.38	15,85,907.56	13,84,867.79	8,48,020.83
Total	1,51,75,546.84	1,67,24,116.1	1,73,10,847.39	1,63,38,534.63
B) Appraisal Costs				
Material Testing & Inspection (Raw Material) (In-Process Goods) (Finished Goods)	55,86,602.04	5670820.98	5592735.31	4805451.36
Vendor Surveillance	8,33,821.20	865040.49	532641.46	282673.61
Material Handling Costs	6,25,365.90	576693.66	639169.75	848020.83
Laboratory testing	8,33,821.20	1441734.15	1544660.23	1130694.44
Pre-despatch Inspection	3,33,528.48	5,76,693.66	852226.33	734951.38
Total	82,13,138.82	9130982.93	9161433.08	7801791.62
C) Internal Failure Costs				
Scrap	12,50,731.80	14,41,734.15	13,31,603.65	11,30,694.44
Cost of Spoilage	18,34,406.64	19,22,312.20	18,64,245.10	18,65,645.82
Downtime	12,50,731.80	14,89,791.95	19,17,509.25	16,96,041.66
Equipment failure	8,33,821.20		7,45,698.04	
Machinery Inspection after each run	3.75,219.54	13,93,676.34	2,66,320.73	12,43,763.88
Total	55,44,910.98	62,47,514.64	61,25,376.77	59,36,145.80
D) External Failure Costs				
Liability from defective products	8,33,821.20	9,61,156.10	9,58,754.62	8,48,020.83
Investigation of Customer Quality	41,69,106.00	45,65,491.47	48,63,016.51	50,88,124.97
3rd party maintenance	15,00,878	14,41,734	14,91,396.	10,51,545
Environment Costs	10,42,276.50	16,82,023.17	12,94,318.74	12,43,763.88
Total	75,46,081.86	86,50,404.88	86,07,485.95	82,31,455.51
Total Quality Costs	3,64,79,677.5	4,07,53,018.55	4,12,05,413.19	3,83,07,927.56

Table 4 Statistics 1

N	Valid	116	116	116	116	116	116
	Missing	0	0	0	0	0	0
Mean		31.5000	3.4657	7.9190	28.3181	26.7285	5.7980
Median		31.5000[a]	3.5700[a]	7.8609[a]	28.9764[a]	26.2436[a]	5.7329[a]
Mode		24.00[b]	2.80[b]	6.10[b]	22.00[b]	20.10[b]	4.60[b]

Std. Deviation		4.76095	.40043	1.23758	3.55002	5.20641	.84429
Skewness		.000	-.136	.387	-.226	.801	.076
Std. Error of Skewness		.564	.564	.564	.564	.564	.564
Kurtosis		-1.200	-.606	-.584	-.741	.804	-1.393
Std. Error of Kurtosis		1.091	1.091	1.091	1.091	1.091	1.091
Sum		504.00	55.45	126.70	453.09	427.66	92.77
Percentiles	5	24.3000[c]	2.8300[c]	6.1925[c]	22.4484[c]	20.3447[c]	4.6325[c]
	10	25.1000	2.9057	6.4250	23.5082	20.9784	4.7240
	25	27.5000	3.0913	6.8798	25.5288	21.7720	4.9899
	50	31.5000	3.5700	7.8609	28.9764	26.2436	5.7329
	75	35.5000	3.7596	8.8145	30.6093	29.9478	6.5712
	90	37.9000	3.8435	9.7776	32.2646	31.5569	6.7454

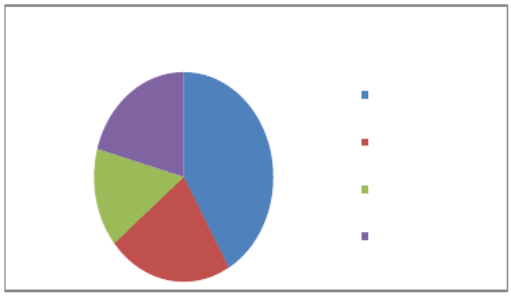
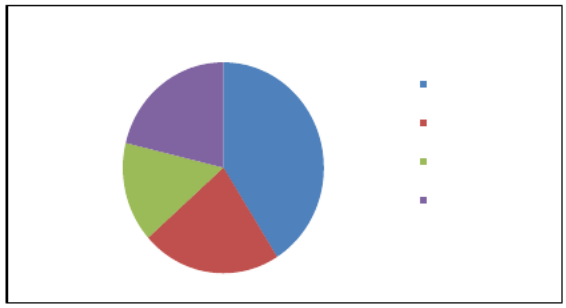
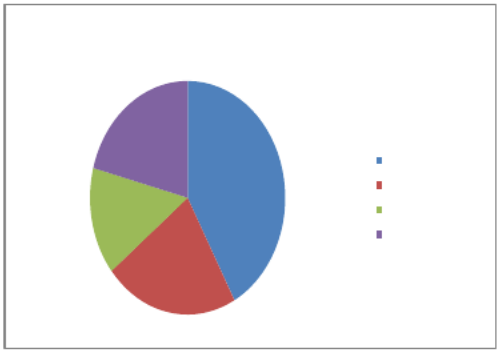
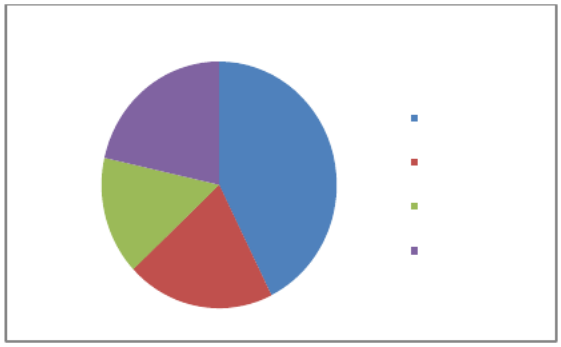

Table 5 Statistics 2

Parameters		_transformed	_transformed
N	Valid	116	116
	Missing	0	0
Mean		56.5190	62.9595
Median		56.6111[a]	61.6391[a]
Mode		39.00[b]	48.08[b]
Std. Deviation		10.37276	9.17558
Skewness		-.300	.134
Std. Error of Skewness		.564	.564
Kurtosis		-1.068	-.861
Std. Error of Kurtosis		1.091	1.091
Sum		904.30	1007.35
Percentiles	5	39.6353[c]	48.4795[c]

	10	41.3059	49.9706
	25	48.1168	56.9730
	50	56.6111	61.6391
	75	64.6129	70.5682
	90	69.8809	74.7877

6. MAJOR FINDINGS & SUGGESTIONS

Table 6 Findingd

year	Quality costs	percentage
2015	3,64,79,677.50	8.750%
2016	4,07,53,018.55	8.480%
2017	4,12,05,413.19	7.736%
2018	3,83,07,927.56	6.776%

- With the above table it is understood that the quality cost in the year 2015 is high because of Company's initial days of the production.
- Due to maintaining high quality and less defectiveness policy, had help the organization in increasing sales but the same way cost of quality also increased due to increase in sales volume.
- In the year 2018 company adopted defect prevention techniques model which help the organization in reducing quality cost.
- There is drastic change in year 2018 with the quality cost of 6.776 % because the company concentrated more in prevention of defects while manufacturing and company concentrated in getting the quality raw materials from suppliers.
- The application of cost of quality in Excel Foods Pvt Ltd. has reduced the cost of quality to have greater control over Production line.
- Alternative Hypothesis is Accepted Which means Different Cost Prevailing in the Organization
- has significant difference Between Spending on Quality and Sales.

6.1. Suggestions

- As the company has the better goodwill in the market it will help them to enter a new market, use the latest technologies, systematic departmental marketing patterns and many more.
- Supplier evaluation process and procedure and supplier capability assessment records must be checked well in advance to avoid rejections which incur extra costs.
- It should be made sure that the identification and reduction in cost of quality in the organization as a goal and drive it across organization i.e. all departments like human resource, finance, manufacturing etc. through employee motivation.
- The company should try to reduce the closing stock of finished goods lying in the
- Cold storage warehouse, maintaining accurate inventory control methods.
- Reduce over- processing of Raw materials will help the organization in of minimizing defects.

7. CONCLUSION

The study of cost of quality must be employed by every organization to identify high cost areas, to compare and analyze prevention, appraisal, and failure costs, to determine whether quality cost is properly distributed, to establish goals for budgets and identify profit opportunities for the organization. All the failures have a cause, causes are preventable. The failures detected at the beginning of the operation are less costly. Prevention costs should take priority because it is less costly to prevent a defect than to correct them. The prevention costs and appraisal costs must be significantly reduced. This, in turn, decreases the total cost of quality. The cost of quality action team must concentrate on finding the root cause of the problem and develop a corrective action and employ permanent solutions to reduce cost of quality, thereby increase the profitability of the organization. The study is aimed to provide a defined framework to measure cost of quality to be readily used by the small and medium scale manufacturing industries.

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