Course Final

Case Study 12.2: Quality Costs

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TECH 50000 Quality Standards
Spring 2011
Saturday, April 14, 2012

Table of Contents

1. Introduction 2
   - 1.1 Definition and Scope of the Problem 2
   - 1.2 Purpose of the Study 4
   - 1.3 Summary of the Finding 5
2. Results and Discussions 5
   - 2.1 SWOT Analysis of the Experiment/Research Results 6
   - 2.2 My Findings 7
   - 2.3 My Contributions to the Body Knowledge Based on What I Have Learned 8
3. Conclusions and Recommendations 8
4. References 9

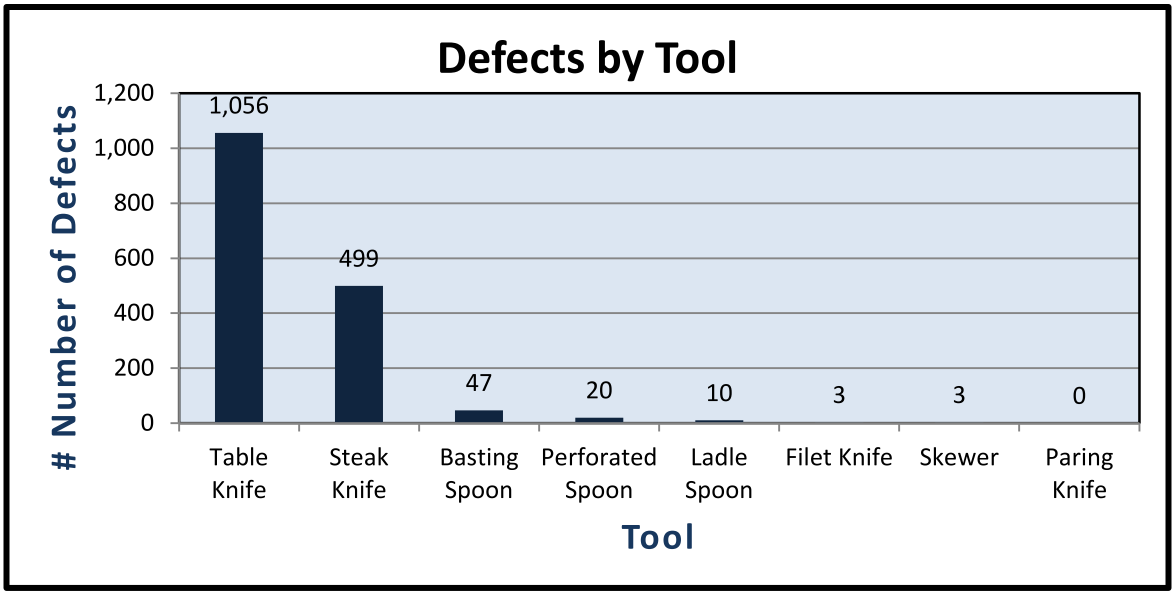
1. Introduction

The purpose of this paper is to evaluate Case Study 12.2 Quality Costs concerning Max's B-B-Q, Inc. using what I have learned throughout this course pertaining to statistical thinking, statistical approaches, and overall quality business performance in general.

1.1 Definition and Scope of the Problem

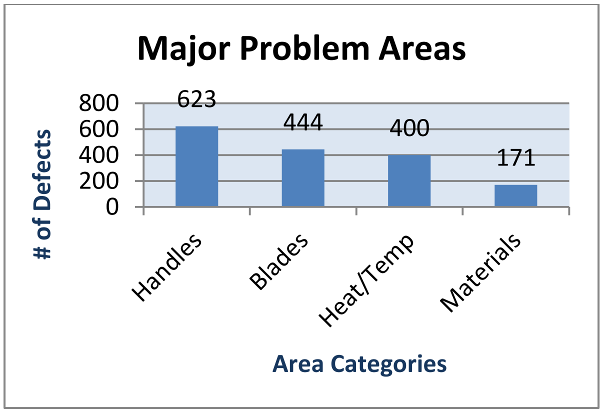
Max's B-B-Q, Inc. manufactures more than 1,000,000 top-of-the-line barbecue utensil tools each yearly quarter. During each quarter, approximately 240,000 utensil tools of those manufactured are inspected for various defects. Those that have defects are either returned to the line for rework or scrapped. The information provided in Figure C12.2.2 is based on Max's first-quarter inspection results which are divided by the amount of defects per utensil tool and details all those that were either reworked or scraped by including the number of tools inspected and rejected. These numbers in particular concentrate on measuring the vital few variables rather than the trivial many. And, as our textbook states on page 405, "Fewer is better." (Evans & Lindsay, 2008)

Using the original data obtained from Figure C12.2.2 and researching the definitions for most defects, I was able to construct an Excel spreadsheet and various Pareto charts showing even more detailed information *(See AmyHissomFinal.xlsx)*. The definitions of each defect used are excluded from this paper due to space limitations. However, my references include Internet resources where I found most of the definitions, and my interview with Joshua Didion of Didion's Mechanical and the Didion Separator Co who also helped me with the definitions. The first Pareto chart, shown below, which is based on the original data, indicates that the utensil tools having the most defects are table knives, followed by steak knives, and then basting spoons; the majority occurring in table and steak knives.



Taking into consideration the definitions of defects, four more graphs and Pareto charts were constructed by combining "LIKE" defects with a total number of one or more into specific defect categories. Doing this enabled me to determine which areas (defect categories) are the most problematic. Those areas include handles, blades, heat/temperature, and materials *(See AmyHissomFinal.xlsx)*. By taking those areas into consideration, the following graph and Pareto chart illustrate how many of the total 1,638 rejects fall within each category of defects; directing attention towards handles, followed by blades, and then heat/temp. These first three areas alone total 89.56 percent of all rejected utensil tools.

MPA	# of Defects	% of Defects	Cumulative %
Handles	623	38.03%	38.03%
Blades	444	27.11%	65.14%
Heat/Temp	400	24.42%	89.56%
Materials	171	10.44%	100.00%
TOTAL	**1,638**	100.00%	



Based on this information it is obvious that most of the defects listed are from manufacturing issues, therefore, Max needs to reconsider his operational focus of rework and scrapping and direct concentration towards keeping track of quality costs. Given the present situation, types of quality costs that Max will incur include prevention costs such as quality training, statistical process control, quality data gathering, analysis, and reporting, equipment maintenance; appraisal costs such as testing and inspection of incoming materials, in-process goods, and final products; internal costs such as cost of scrap, rework labor, re-inspection and re-testing of reworked products, downtime caused by quality problems, and analysis of the cause of defects in manufacturing; and external costs such as handling complaints, warranty repairs or replacements, product recalls, product liability, and lost sales arising from a reputation for poor quality by dissatisfied customers. Since the most effective way to manage quality costs is to avoid having defects in the first place, Max should invest in prevention costs such as statistical process control techniques that involve all workers in all department. (Quality Costs, 2011)

1.2 Purpose of the Study

The purpose of this study is to measure routine tool wear on the company's stamping machine; in particular, tool wear patterns for the tools used to create knife blades. It is critical that the tool be pulled for maintenance only when necessary to reduce manufacturing costs and simplify machine scheduling. When a tool wears out earlier than expected, the tool room may not have time to work on the tool immediately. While waiting on the tool to be reground, the press and its operators will be idle. Therefore, it is important for scheduling, costing, and quality purposes that the average number of strokes, or run tool length, be determined. Based on the information given, the total cost to regrind is as follows:

2 Hours of press downtime to remove and reinsert the tool at $300 an hour =	600
5 Hours of tool maintenance time at $65 an hour =	325
5 Hours of downtime while press is not being used at $300 an hour =	1,500

Total cost to regrind =	**$2,425**

The cost of an unplanned pull (tool regrind) is:

15 Hours average wait time at $300 an hour =	**$4,500**

The average number of strokes for each tool is 45,000. The plant manager wants tools pulled early in their wear-out phase at 40,000 strokes to avoid the chance of a costly unexpected pull. However, a prediction routine for tool wear must be developed first to estimate the chance of an unplanned pull before 40,000 strokes.

1.3 Summary of the Finding

The information provided by the tool maintenance department tells us that:

μ = 45,000 Strokes, σ = 2,500 Strokes, 1 Punch = 25 Regrinds, Continuous Distribution = Normal Curve

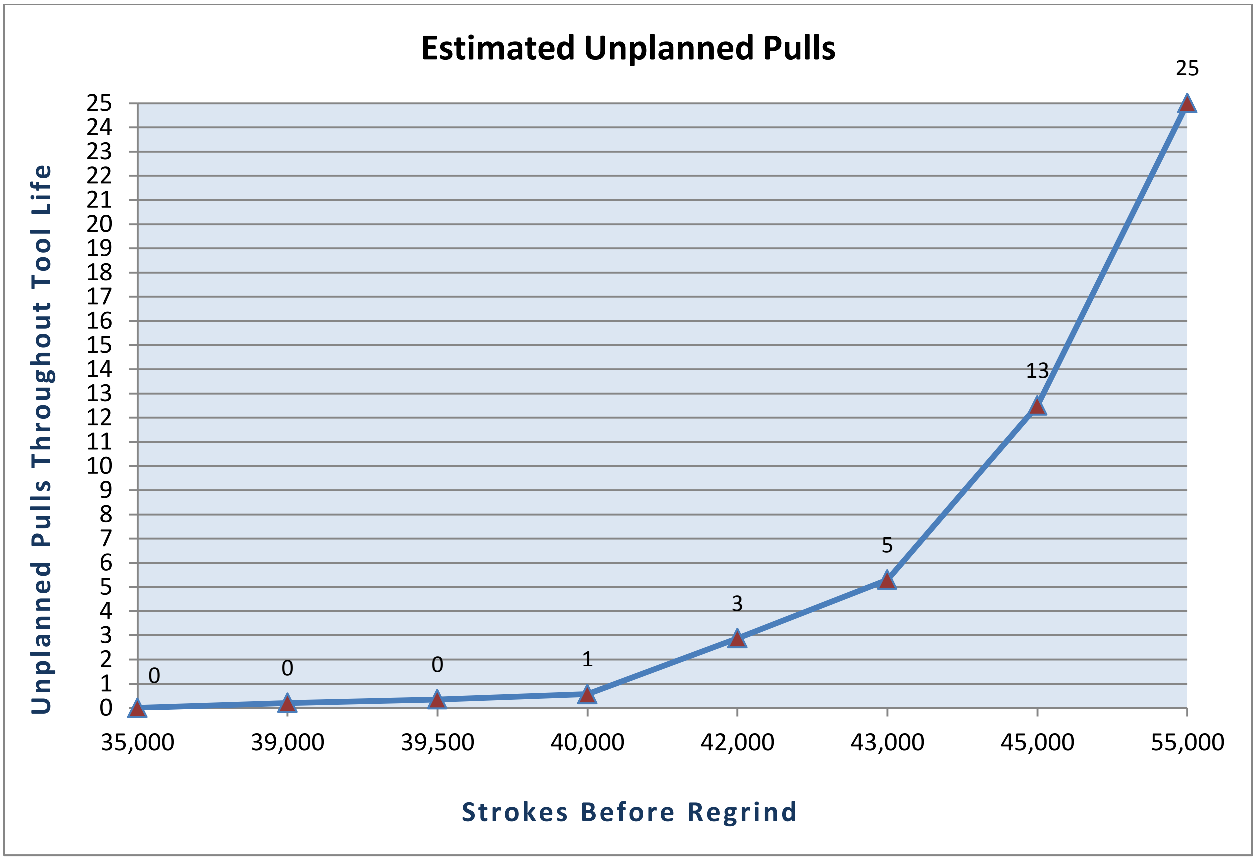
Therefore, the probability equation for the normal distribution is used to estimate the chance of an unplanned pull before 40,000 strokes. So, if X = 40,000, then the following solution shows us that there is a 2.275% chance that an unplanned pull will occur before 40,000 strokes.

$$\mathbf{Z = \frac{X - \mu}{\sigma} = \frac{40,000 - 45,000}{2,500} = -2.0}$$

$$\mathbf{P(x < 40,000) = 0.02275 = 2.275\%}$$

2. Results and Discussions

As it stands, the plant manager wants zero unplanned tool pulls, the sales manager needs pricing cost reductions, and the production scheduler would like to have a tool-regrind schedule that results in minimal inventory. Given the need to balance maximizing tool use and minimizing inventory, production disruption, and cost, the right number of strokes must be determined to run the tool before pulling for a regrind. To do this, I created a graph *(See AmyHissomFinal.xlsx)* that shows the number of unplanned pulls versus the number of strokes by choosing eight data points for intervals from 35,000 strokes to 55,000 strokes. For each stroke interval I used the probability equation for the normal distribution to calculate the chances of an unplanned pull before each. Based on this graph, the chance of an unplanned pull is 0% at 35,000 strokes where the chance of an unplanned pull over the life of the tool is 0. The chance of an unplanned pull is 100% at 55,000 strokes where there is an expected unplanned pull over the life of the tool before each regrind (25). The following chart shows that the chance of an unplanned pull increases dramatically the closer we get to 55,000 strokes.



2.1 SWOT Analysis of the Experiment/Research Results

Strengths of this research include the ability to narrow down the categories of defects into specific areas to find those that are causing the most problems and finding the right number of strokes for tools to complete before planned pulls, which in turn, will not only reduce maintenance costs due to unplanned pulls, but also those costs associated with defects caused by faulty machinery. The major weakness in this research is that one person is completing it.

Researching cause and effect of occurring problems should be an ongoing process that involves everyone. Opportunities include ongoing production analysis for continued improvements to prevent problems with tool maintenance; the reduction and elimination of errors, defects, delays, scrap, and causes of downtime; and the improvement of product costing through constant tracking and collection of data. Threats include disagreement among the plant manager, sales manager, and production scheduler concerning the number of strokes before regrind and discontinuing improvement methods once a number of strokes is agreed upon, which is turn can put Max back where he started. Just because the agreed upon number of strokes works now, doesn't mean it will continue to work. Losing site of ongoing improvements can increase the cost of quality, causing dissatisfied customers, and the loss of Max's top-of-the-line image.

2.2 My Findings

By creating the graph showing the number of unplanned pulls versus the number of strokes and completing the given spreadsheet, I was able to construct a cost analysis to determine a preventive maintenance plan *(See AmyHissomFinal.xlsx)*. The cost analysis shows that the total cost of planned pulls (25) over the life of each tool is $60,625. This cost was determined by multiplying the cost of one planned pull by 25. If my calculations are right, the cost of one unplanned pull is $6,925, determined by adding the cost of one planned pull to the additional cost of an unplanned pull. The chance of unplanned pulls for each stroke interval mentioned earlier was determined by using the probability equation for the normal distribution. The number of unplanned pulls for each interval was calculated by multiplying the chance of unplanned pulls by the number of planned pulls (25). The total additional cost due to unplanned pulls over the life of the tool was calculated by multiplying the number of unplanned pulls by the total cost of one unplanned pull. Production over life of the tool was calculated by multiplying the number of strokes before pull by the number of planned pulls (25). And finally, the cost per piece was calculated by dividing the total planned and unplanned costs by the amount of production over the life of the tool.

2.3 My Contributions to the Body Knowledge Based on What I Have Learned

Based on what I have learned throughout this course, my contributions to the body knowledge of this paper not only includes a much better understanding of quality and performance excellence in terms of deciphering the questions for this case, but also the ability to create all the spreadsheets, graphs, and charts along with their calculations. My calculations may not be right on the mark, but without this class I wouldn't have even began to understand what I was reading, let alone the questions that this study entailed. I think my main contribution is the ability to think more statistically.

3. Conclusions and Recommendations

My conclusion of this study is that 39,500 is the best number of strokes to pull each tool for regrind. At this interval point production is maximized, unplanned pull costs are minimized, and the cost per piece is the lowest at $0.061392. My recommendations for Max is to create a cross-functional team that includes members from each department to implement statistical methods that measure all areas and processes within the company for ongoing research and continuous improvements.

4. References

Heat Treatment Of Steel Terminology. (2007, September 11). Retrieved April 26, 2011, from Metallurgical Consultants: http://www.materialsengineer.com/E-Heat_Treatment_of_Steel.htm

Burr (edge). (2011, April 26). Retrieved April 29, 2011, from Wikipedia, the Free Encyclopedia: http://en.wikipedia.org/w/index.php?title=Burr_(edge)&oldid=426041104

Honing (metalworking). (2011, March 17). Retrieved April 25, 2011, from Wikipedia, The Free Encyclopedia: http://en.wikipedia.org/w/index.php?title=Honing_(metalworking)&oldid=419259044

Kitchen knife. (2011, April 7). Retrieved April 26, 2011, from Wikipedia, The Free Encyclopedia: http://en.wikipedia.org/w/index.php?title=Kitchen_knife&oldid=422882400

Knife. (2011, April 29). Retrieved May 1, 2011, from Wikipedia, The Free Encyclopedia: http://en.wikipedia.org/w/index.php?title=Knife&oldid=426611759

Quality Costs. (2011). Retrieved April 27, 2011, from Accounting For Management: http://www.accountingformanagement.com/quality_costs.htm

Didion, J. (2011, April 29). Engineer/Estimator. *http://www.didionseparator.com*. (A. Hissom, Interviewer) Bellevue, Ohio, United States.

Evans, J. R., & Lindsay, W. M. (2008). *Managing for Quality and Performance Excellence* (Seventh ed.). Mason, Ohio: Thompson South-Western.

Fisher, J. (2011). *Knife Anatomy*. Retrieved April 26, 2011, from Jay Fisher - World Class Knifemaker: http://www.jayfisher.com/Knife_Anatomy_Parts_Names_Definitions.htm#Knife_Anatomy_1

Fisher, J. (2011). *Knife Anatomy Definitions*. Retrieved April 26, 2011, from Jay Fisher - World Class Knifemaker: http://www.jayfisher.com/Knife_Anatomy_Parts_Names_Definitions.htm#Knife_Anatomy_Definitions