ULTRA-WRITE, INC.

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ABSTRACT

This case study is designed for upper-level undergraduate students in a basic operations management course. Prerequisites would include statistics and computer science. The purpose of the case is to give students an opportunity to design a quality control process, using both acceptance sampling for purchased goods and process control charts for manufactured goods in a make-or-buy problem. They must also deal with the cost aspects of the two systems. Although the item the case is centered around is a trivial one, it provides an example that is very easy for students to visualize, and their understanding of the situation presented here can be useful for the quality control of more important items.

INTRODUCTION

Ultra-Write is an old, prestigious New York company that produces high-quality (and high-priced) writing implements. They were founded in 1886 as a maker of fountain pens and later expanded their line to include mechanical pencils. They now produce an extensive line of writing implements made out of expensive hardwoods, as well as the more traditional metals. Ultra-Write prides itself on producing their products almost entirely in-house. Of course, they purchase pencil leads and ink cartridges from outside vendors, but they produce the casings, the mechanical parts, and even the erasers themselves.

Since the firm's beginnings in the nineteenth century, expansion and modernization have come slowly and gradually. Originally all pens were made by individual skilled craftsmen. Jobs were mechanized only when it could be clearly shown that the same quality could be produced at a significantly lower cost. Now the metal casings, all mechanical parts, and the erasers are made by machine. Much of the woodworking is also automatic. However, the final assembly of parts is still done manually (e.g., inserting the lead, ink, and erasers, screwing on the tips, and putting on the upper cap).

To protect the quality of their products Ultra-Write was willing to spend a considerable amount on quality control. Workers doing manual work were expected to do a certain amount of self-inspection and testing, much as the earlier craftsmen had. In addition, though, a quality control department was established in the 1940's to formalize the standards for the workers and to keep watch over the activities that were machine-controlled. While there was 100% inspection of the finished goods before shipping, the quality control department worked to catch defects earlier in the process where they would be much easier and cheaper to correct. With the significant labor and material costs of the writing implements, it was very expensive to have to scrap an item or to send it back to be reworked. To avoid disruption of the production line, the quality control department maintained their own repair shop for reworking items.

Although the company felt that it was necessary to inspect finished goods 100%, in the 1960's they were finally convinced that they could do a good job of inspection at much less cost by using sampling methods on their machine-controlled operations. Also, they found that only certain crucial operations had to be inspected at all. Overall, they were amazed at what they could save while maintaining their desired quality.

THE ERASER CRISIS

Over the last few weeks, Mark Mallinger, plant manager, had been receiving increasing complaints from his assembly division regarding the quality of the rubber erasers. These were produced on a fairly old, custom-built machine. All of the company's mechanical pencils used an eraser designed to be 5 mm. in diameter with a .1 mm. tolerance in either direction. These erasers fit into a small metal sleeve, which was then inserted into the lower shaft of the pencil. When the eraser was too small, it didn't fit snugly into the shaft and would slide down into the lead compartment. When it was too big, it would not fit into the shaft at all. In either case, it wasn't known until the eraser had been inserted into the sleeve and the sleeve into the shaft whether the eraser was correct or not. When the eraser was defective, the eraser and sleeve were both scrapped. Then these very labor-intensive assembly operations had to be repeated with another eraser and sleeve. Occasionally, the shaft was also damaged by forcing an oversized eraser into it. The company estimated that these costs averaged about $ .30 per defective eraser. Because of the increasing volume of eraser complaints, Mark called a meeting of his eraser supervisor, Steve Cauley, his assembly supervisor, Esther Hamilton, and his quality control manager, Doug Cloud.

Mark: Esther, I know you've been having problems lately with erasers. What can you tell us about it?

Esther: Well, it just seems like we're not getting the same quality we've been used to. More and more we've been scrapping erasers and spending time redoing the assembly. In the past, defects seemed to be pretty random, but now it always seems to be the erasers, and the workers are getting frustrated.

Mark: Doug, what steps do your people take regarding the erasers?

Doug: Every hour we take a random sample of 10 erasers from the machine and measure their diameter. If they seem to be out of line, we order an immediate shut-down of the machine until it can be readjusted. We haven't had to do that for quite a while, though, because I believe the workers take the time to adjust it themselves at the start of each day. I've brought along the raw data from the last week's eraser samples (Exhibit 1). You can see for yourself the kind of quality we've been getting.

Mark: Thanks, Doug. Would it help any to take samples more often or to take larger samples?

Doug: I really don't think so; we have lots of little parts to inspect as it is. I figure it costs us $ .10 to measure each eraser. Besides, the statistics books say that 10 is a large enough sample for our purposes.

Mark: Steve, what kind of volume are we talking about here?

Steve: We use one of these erasers in every model of mechanical pencil we make. That comes to about 1200 erasers per day.

Mark: What about getting a new machine?

Steve: I tried to get one about a year ago, but the finance people said it was out of the question. They said that this machine is so specialized that it would be exorbitant to have one built, and you can't just walk into a store and buy one.

Mark: So isn't there anything we can do?

Doug: Steve won't like this, but since I heard rumblings about the erasers I've done some checking around with rubber companies. I found a company, Adler Rubber, that is interested in supplying us with erasers. Old man Adler says that they will send us our entire supply for $ .15 apiece and will guarantee that there will be no more than 2% of the erasers outside of the tolerances.

Mark: That's a little higher than the $ .12 it costs us per eraser, but maybe the quality would be worth it. What if we find that we're getting more than 2% defects?

Doug: They would come in lots of 5,000, good for a little under a week. We would inspect a certain number from each lot and then decide whether to accept it or to send it back. If we sent it back, they would then go through the lot and inspect each eraser. If they found that there really were fewer than 2% defective, they would charge us for the inspection and the shipping, about $150 per batch overall. However, we would set up our inspection so that there would be only about a 5% chance of that happening when we sent a batch back. Also, to protect our assembly department, we would make sure that if a lot was really bad and had 6% defects, for example, we would catch it 90% of the time.

Mark: How much would such an inspection system cost?

Doug: That's something I haven't worked out yet.

Mark: Well, I'd like to know just what the difference would be in our total purchase costs, our inspection costs, and the costs to Esther's department. I'll get my analysts to work on it right away. In the meantime, I'd like a report from each of you on your thoughts on the matter, how it would affect your department if we made the switch, and so forth. Also, any other ideas you or your people have on this problem would be welcome. Thank you for coming.

POINTS FOR ANALYSIS

1. From the sample data in Exhibit 1 construct the relevant process control charts to determine the company's present performance.

2. Calculate the costs of the current system, including production costs, inspection costs, and costs of defective erasers.

3. For the proposed system of purchasing from Adler Rubber determine the sample size and cutoff point for defects necessary in a single sampling plan in order to meet the desired probabilities for accepting a good batch and rejecting a bad batch. (Conduct a trial and error process until the operating characteristic curve comes close to the two specified points.)

4. For the alternative of purchasing from Adler Rubber calculate the costs of purchase, inspection, defective erasers, and the potential cost of sending back a good batch of erasers.

5. Choose between the alternatives of continuing to produce the erasers and purchasing them from Adler Rubber based on costs and any nonquantitative criteria that you feel are important.

6. Do you have any other recommendations for Ultra-Write in their efforts to improve quality?

(For the complete case study, including data and teaching notes, please contact the author.)