ADEQUATE INSPECTION FOR DEFECTIVE PRODUCTS IN PHOTOGRAPHY SECTOR AND DETERMINING INSPECTOR RELIABILITY BY USING JURAN - MELSHEIMER PLAN

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Abstract: General inspector errors may consist of accepting defective units of product or rejecting good units of product. It can be said that the human element in the inspection process is the inspector himself, who contributes to inspection errors. Besides some other errors like use of wrong spesifications, wrong measuring instrument, improper filling of documents etc., in some cases the effects of inspector errors are so extensive that there is need for measuring the extent of errors with a plan for measuring inspectors' accuracy and control the effectiveness of inspectors. Under this plan the check inspector re-examines the inspected product both the accepted and rejected units. Although the check inspector also makes errors, these have only a secondary effect on the inspector's accuracy. In this paper, determining inspector reliability by using the Juran - Melsheimer plan is explained with the help of a problem from the photography sector.

Keywords: *Inspection, Inspection Errors, Inspector Errors, Measures of Inspector Accuracy*

1. Introduction

The Turkish photography sector's existence depends mostly on imports. Lately, photography equipment importers and manufacturers are announcing that they have prolonged the warranty period for their products from 1 year to 3 years. There are also some importers who say they are willing to replace a defective product with a new one. These kinds of companies, who claim that they will definitely-if not at first try, at least with a second try- satisfy their consumer with a fully-functioning product, are in a way also implying that not everything is being fully done in their companies about processes and acceptance control. In today's world, where technology advances speedily, and where most products are being used professionally, it can easily be said that even if a product does not complete its technological life cycle within 3 years, it will get old. However, there are various and numerous products used professionally like slide machines, flashes, studio flash kits that require repairing or replacement not within 3 years but at first use. These complications give rise to a never-ending cycle of, "embarrassed merchants because of their defective product versus unhappy consumers who are not able to use the equipment effectively, or at all." The relationship between companies and customers does not become a lasting one. Apart from importers, the same problem also applies to the production process for the few manufacturers in the same sector.

Some precautions must be taken in order for the defected products to be somehow held back within the process, before they "escape" the production phase. Possible ways to re-include defected products to the system by repairing them should be sought. The probability that defected and sound products get mixed up always constitutes a risk. Defected semi-products or products, should be prevented from reaching the next phase during production and distribution stages.

In the photography sector -apart from Istanbul, where a first and second-hand market is well-established- production and repairing facilities are far from applying the above-mentioned strategies. This causes local production to perish before it has even had a chance to flourish. The widespread assumption about locally produced equipment offered to the sector's professionals is, "Yes, local products are cheaper but they will surely show some malfunction within one year, and when they do you are on your own. If a local product costs 1 monetary unit, an imported products costs 4 times as much. Yet, the imported product functions properly without causing any problems for at least 5 years." These kinds of consumer claims are mostly rightful with respect to the consumers' past experiences. Considering both the companies' and the consumers' insight on their own future in this sector, it is necessary to take some precautions; companies must establish some service standards and consumers must behave more consciously in order to make use of the rights they have.

2. Determining Inspector Reliability by Using Juran – Melsheimer Plan with an Example from Photography Business

The Juran-Melsheimer Plan is used to determine the inspectors' reliability. Once the effectiveness rate of the company is measured, it is multiplied with the inspector's reliability coefficient and hereby the new rate for the company is found.

Considering that,

d = number of defects reported by the inspector,

k = number of products that are actually sound but rejected by the inspector,

(d – k) = the real number of defects detected by the inspector,

b = number of defected products overlooked by the inspector,

(d – k + b) = the actual number of defects in the product,

The Correctly Defined Rate of Defects is expressed with the following formula:

[(d – k) / (d – k + b)]

In professional photograph shootings correct exposure metering is the first step for properly exposed ready to develop photographs. Since slide films are used to obtain the desired image quality and color distinction, correct exposure metering becomes especially important. Reversal colour films have a more narrow tolerance value compared to standard films. When professional slide films are used, the fact that the image distinction by exposure is narrowed down to +/- 0.5 exposure tolerance value makes correct exposure metering even more important.

Let us assume that 135 professional manual exposure meters of brand "A" that can read 3 and 5 degrees and have a spot metering system for both incident and reflective metering, are being inspected to control if they yield any results within the tolerated levels. Let us say that light measurements are being done from a stable distance for white, black, and medium gray toned areas reflecting from human complexion. Then, let us say the same readings are in turn being done for incident metering.

If,

d = 135 defected products,

k = 15 sound products,

b = 30 malfunctioning products

in the distinction made by the inspector, then the real number of defected light meters will be

(d – k) = (135 – 15) = 120

The Correctly Defined Lightmeter Rate will be equal to:

[(135 – 15) / (135 - 15 + 30)] = (120 / 150) = 0.80

meaning 80%. The b= 30 malfunctioning products in the example, is the number of defected products which the first inspector overlooked, and which came up in the second inspection performed by another inspector supervising the first one.

In real life the inspector is continuously busy with the inspection of goods. As a result, the d, k, and b values obtained from the inspections accumulate in the company's records while days, weeks and months go by.

For example:

Products; Total Numbers Inspected; d; b; k,

Projection Timer; 2.500; 25; 0; 0,

Kelvinmeter; 125; 8; 0; 3,

Hand Held Lightmeter; 375; 13; 0; 3,

Compact Camera; 12.500; 25; 0; 10,

Dark Room Thermometer; 4.000; 45; 0; 5,

Total Number of Products Inspected; 19.500; 116; 0; 21,

The rate of reliability can be reached by using the total value:

[d / (d + b)] = [116 / (116 + 21)] = 0.8467 = % 84.67

The products listed in the example above may refer to the same product being inspected on different dates or they can be different products as well. Since the important point here is to determine the inspector's reliability, the rates for d, b, and k may be taken as a total even if the products are different. However, the question that needs attention is revealed by how much time is spent for different products. The time spent for each task may be taken as a measurement for the enlargement.

Products and Enlargement (Weight) Factors

Projection Timer; % 45,

Kelvinmeter; % 5,

Hand Held Lightmeter; % 15,

Compact Camera; % 5,

Darkroom Thermometer; % 30,

Total; % 100,

The rate of reliability can be reached by using the total value:

[(di - ki) / (di – ki + bi)]

The rate of inspector's reliability found with this formula can be applied to the example above and the following values can be calculated for various products:

[d / (d + b)] = [25 / (25 + 0)] = 1.00 = % 100,

[d / (d + b)] = [8 / (8 + 3)] = 0.7273 = % 72.73,

[d / (d + b)] = [13 / (13 + 3)] = 0.8125 = % 81.25,

[d / (d + b)] = [25 / (25 + 10)] = 0.7143 = % 71.43,

[d / (d + b)] = [45 / (45 + 5)] = 0.90 = % 90.

If the inspected products were equivalent in nature, we would have expected our inspector's reliability rate to be the same as the one calculated previously. However once we have included the enlargement factors, the new rate of reliability for the inspector is calculated as:

{[100 (0.45)] + [72.73 (0.05)] + [81.25 (0.15)] + [71.43 (0.05)] + [90 (0.30)]}

= 45 + 3.64 + 12.19 + 3.57 + 27 = % 91.40

Another complication which arises with respect to this matter is when there is a large number of defected goods in a pile which the inspector may have observed or overlooked. For example, let us assume that there are 2500 units in a pile, and that all of them are defected. In case the inspector has observed all of the defected goods and if we choose to calculate his/her rate of reliability using the formula for more than one product, given that:

d = 116,

d new = 2500,

d total = 116 + 2500 = 2616 defected products

b = 21,

b new = 2500,

b total = 21 + 2500 = 2521

then,

[(d - k) / (d - k + b)] = [2616 + (2616 + 2521)] = 0.5093

If the inspector had overlooked the defected pile, then the result would be:

(116 / 2616) = 0.0443 = % 4.43

The effect of only one single pile of goods should not be so drastic for the inspector's rate of reliability.

There is also the possibility that the supervisor who controls the inspector may make mistakes. For example, if we assume that the reliability rate of the particular supervisor is 80%, the number of presumably defected goods he/she is likely to detect will be [(21) . (0.80)] = 17. In this case the rate of reliability will be calculated as

(116 / 133) = 0.8722 = % 87.22

which will lead to a situation where % 87.22 > % 84.67.

When k -the number of goods rejected by the inspector although they are in fact sound- is small there is a possibility that it can also be neglected. In some cases, instead of using the rate of reliability for the inspector, his/her rate of making mistakes can also be used. Given that n is the total number of inspected goods, the rate of Rejected Sound Products can be determined with the following formula:

[k / (n - d - b + k)]

3. Conclusion

As explained above, the inspector's reliability and the rate of properly inspected goods actually express the same thing. It is possible to use the inspector's rate of correct detection as an element of extra payment per unit system. Clearly coincidence will play an important role in the supervising of the inspector's performance. In practice, the number of supervisors used for controlling the inspector varies according to the nature of the job. Different ratios like 1 supervisor for 4 inspectors, 2 for 20, 35 to 100 supervisors for one inspector, or 50 for one are used regularly. Clearly, the inspector should be held responsible for his/her duty. However an inspector making wrong decisions due to incorrect instructions, or one who has to perform his/her duty using a measuring device that has not been properly calibrated should not be held responsible for erroneous results. It can be decided whether 100% inspection is necessary or not. If the purpose of the inspection is defined as 'detecting defected products that do not comply with specific quality standards', then this will also mean that it cannot be used to increase the standards of the products that do comply with the design quality. If the latter is also going to be the purpose of the inspection, then the whole matter must be dealt with initiating from product design.

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