

R571

SIGNIFICANT DIFFERENCES IN QUALITY

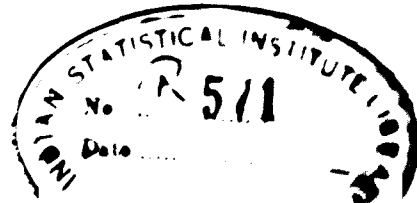
One of the two fundamental objectives¹ in judging quality is to render judgment as to whether or not the quality in question differs significantly from its standard. Hence it is but natural that in our quality report much should be said about significant differences in quality. So much is said in fact that it has been deemed desirable to introduce the shorthand notation:

- ✓✓ = significantly above standard quality level
- ✓ = not significantly different from standard quality level
- x = significantly below standard quality level.

Broadly speaking, judgments in respect to quality are of practical value in that they suggest definite action that should be taken in the control of quality of manufactured product. But for the action to be definitely indicated, the meaning of such signs must be neither vague nor ambiguous. Therefore this meaning is of vital importance. The question now to be considered is: What is the meaning of such signs?

A reader of such a report not acquainted with the many problems of quality control might assume that if quality differed significantly from standard something ought to be done about it. However, he might be inclined to ask: Why worry if the quality is above standard? From the latter viewpoint, the occasion for action would be that where the quality is significantly below standard. But such a conclusion obviously rests upon the assumption that "above standard" means "better than standard" and "below standard" means "worse than standard", as determined by some one's interest in the quality. On the other hand, a technical engineer who is trying to control the wantableness of his product will be interested in maintaining standard levels for certain physical characteristics in which above and below standard is simply equivalent to greater than or less than some chosen magnitude. Thus the length of a lead pencil might be greater than or less than a previously chosen standard length without meaning to the user that it was correspondingly better than or worse than the standard in terms of the wantableness of the pencil. Hence the meaning of such signs depends upon the viewpoint adopted.

1. Cf. Q. M. 9.



Now, if we approach the consideration of differences from standard from the viewpoint of action, it is reasonable to presume that when a statement is made that the quality is significantly different from standard, such a statement should indicate definitely the kind of action that appears desirable. However, in order to make definite the kind of action needed, it is necessary to consider "by whom" the action is to be taken, and "on what" the action is to be taken. It is also necessary to know the nature of significant difference (or, in other words, how it is measured) for, after all, it is only when we know how to experience or measure a quality that we really know definitely what we are talking about. Furthermore, it is necessary to know whether or not the cause of significant difference is such as may likely be found and eliminated through research and whether or not it is economically feasible to remove the cause without modifying the whole manufacturing process.

Enough has been said to indicate that definiteness in the mind of the one reading the report necessitates, among other things, an understanding of the meaning to be attached to the terms "significant", "quality", and "standard", because it is obvious that the meaning of statements about significant differences will depend upon the meanings of these three terms. It is from this angle that we shall briefly outline in this memorandum the nature of the factors which must be considered in making and interpreting statements about significant differences.

In the last analysis, the consumer is interested in the wantableness of the quality of a thing. Presumably such wantableness should not differ significantly from some pre-assigned standard level. This constitutes a goal for the action of the producer. However, it is one thing to know the goal and another to know whether or not it is likely the goal can be reached economically. The point which I wish to make is simply this: The first thing for the producer to decide is whether or not it is possible to modify through action the existence of a significant difference to the consumer. Having decided whether or not it is possible, it is then necessary to decide whether or not it is possible under existing conditions and if so, whether or not it is economically feasible. From the viewpoint of the producer, therefore, it is necessary for him to classify any difference under one of four headings: a. It is likely possible through more careful control of the present production process to remove the cause of the significant difference. b. It is not likely possible to remove the cause of the significant difference through control of the present production process. c. It is likely both possible and economically feasible to

remove the cause of the significant difference. d. Even though possible, it is not likely to be economically feasible to remove the cause of the significant difference.

For example, in the production of any kind of product, it may be for one reason or another desirable from the consumer's viewpoint that all pieces be made so nearly alike that he cannot detect any differences. It may, however, in the present state of engineering knowledge, be impossible for the producer to make them alike in this way. Or, even though possible, it may not be economical in the sense that it would cost more than the consumer would be willing to pay.

In the second place, it is desirable to note that, if action is to be taken by the producer, it is necessary to know "on what" this action is to be taken. From this viewpoint, there are two important classifications: a) The action may be on one or more things already made and constituting a lot, or b) The action may be directed to the discovery and possible removal of some assignable cause of variation in the process. For example, the action in respect to a lot may be one of rejection, modification, or the like, whereas the action in respect to the process is always one of trying to prevent the occurrence of unnecessary future trouble of one kind or another.

A third important basis of classifying action is upon the grounds of the one who is to perform the action. For example, if there is a difference which is significant from the viewpoint of the consumer but at the same time one which must be left to chance so long as the present process of production is used, it is a case to be considered in general by research or development engineers. If the difference is significant in the sense that it indicates the presence of an assignable cause which it is reasonable to believe may be removed through design, such a difference calls for the action of the design engineer. Again the difference may be one which is indicative of an economically findable cause of variation in the manufacturing process or in the control of the raw materials and hence calls for action on the part of either manufacturing or purchasing engineers.

The fourth viewpoint from which we must approach the consideration of significant differences in quality is the meaning of quality. For example, the quality of particular interest may be a single quality characteristic of Types I, II, or III. It may, however, refer to an overall or resultant quality of a thing, customarily spoken of as a rate. On the other hand, the quality implied may be

the quality of a lot in which case we must know in what way the quality of the lot is to be measured in terms of the qualities of the pieces constituting the lot, - whether, for example, it is a frequency distribution, some statistic of such a distribution, or some more complicated measure. Likewise, the significant difference may be from a quality level for the "product". Before any statement in respect to significant difference is meaningful in the sense that it may be interpreted in an operational way, it is necessary that the implied meaning of quality be known. This is of particular importance from the viewpoint of the one taking action. For example, the engineer is interested for the most part in the physically measurable quality characteristics of a thing. He has to deal with each one of these separately. He cannot do anything about the over-all quality of a thing until he knows the way in which this over-all quality depends upon the physical properties that he can put his hands on.

There is, however, a fifth viewpoint from which we must consider significant differences. We must determine the meaning to be attached in a given case to "standard". For example, quite often we use "standard" as a modifier of the level of quality and refer to the standard level of quality. In doing so, however, we must take into account the fact that inherently any standard of this character is fixed in terms not only of specification but also of custom and precedents established by the quality of material already produced. Furthermore the standard must take into account the limitations imposed by authority and natural law both of which are constantly subject to change.

Assuming that the above statements are true in respect to the need for considering to whom and for what the difference is significant, as well as the different kinds of significance, then let us ask ourselves again the question: What do the signs introduced in the first paragraph mean? Do they mean something perfectly definite to the one writing the report? Do they mean the same thing to the one reading the report? Are they free from unnecessary vagueness and ambiguity? I am afraid that a negative answer to these questions must be given in many instances at least. Furthermore, I am afraid that a positive answer cannot be given until we as judges of quality have considered and applied the theory of meaning to such statements. This necessitates a study of the meaning of the term "standard" for each of the several kinds of quality mentioned above and also necessitates a consideration of the meaning of the kinds of

significance. Here then we come right down to earth as to one of the practical reasons for establishing an adequate quality jurisprudence. This is one of the things that must be done if the quality report is to have a perfectly definite meaning as a basis for definite action.

It is from this angle that we shall approach the problem of judging quality in the succeeding memoranda.

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