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Statistics And Quality Control

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STATISTICS, now-a-days, has been defined as the theory of decision making in the face of uncertainty. The statistical quality control deal with various types of acceptance sampling systems and procedures. These are simple but powerful techniques widely used in industries in many countries of the world to improve product quality and reduce costs. The most effective use of these techniques depends upon how these are being understood by the production and management personnel. In order to formulate and execute any policy, the leading planners and researchers, mill managers, production superintendents, engineers and quality-control supervisors have to keep key-performance indicators by plotting available figures. These running records are not only on quality measurements of various production processes but also on some other measures. These are production rates, inspections, specifications, downtime, absentism injuries, late shipments, etc.

Variations: The factor which is very common to all these measurements is the variability. In every production sector quality record is generally maintained, but it varies every time with new figures which may be even poorer than the expected ones and create a difficult problem of decision-making for the managers. This is the time when the managers have to think whether the actual situation is deteriorated or the result is still within normally expected variation; and whether any perspective action is required or not.

Specification: production and inspection: Before the production of a mill or industry starts, a decision is necessary as to what is to be made. Next comes the actual manufacturing of the product. Finally, it must be determined whether the product is what was expected. It is wise to think of all the matters related to quality of products in terms of three key-functions: specification, production and inspection.

Statistical quality control enables the tools help the management in making decisions related to these three functions. The most effective use of it requires the cooperation among those responsible for these three different functions or decisions at higher levels. If the personnel in these three sectors do not understand each other's problems it would be really difficult to avoid poor quality of products and unreasonably specified tolerance. That is why the techniques of the statistical quality control should be understood at the management level which encompasses all these three functions.

Patterns of variation: It is sometimes, very difficult to the managers of our country to accept the existence of variability. They do not try to understand that without any control measure in the production the resulting qualities or products will still vary. This will be true only when no real difference is occurred which is impossible, as the individual measurement processes introduce differences. Even the repeated measurements on the same material are not likely to be exactly the same.

Another important factor in this regard is the ability to discriminate between random and assignable variability. This is where the concepts of the most powerful of all statistical quality-control tools—'the basic control charts'—must be thoroughly understood. The 'control chart' simply evaluates whether the data are, or are not in a 'state of statistical control.' If they are; the fluctuations are due to random variability and if they are not, assignable variations are there.

Assignable variations: It is the cause of assignable variability by elimination of which greater product uniformity, diminishing wastage and reduced costs can be attained. If this variation is identified once, it can be traced to specific sources, such as, differences in materials, operating conditions, sampling techniques, working screws, inspection or testing etc.

Random variations: It is also important to identify the portion of variation due to random fluctuations. Generally

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whenever we plot a series of numbers from a process (in sequence), that will behave in a fluctuating pattern. Statistical methods will tell us when this pattern is normal and the variation is just due to chance causes. Under this circumstances, the process should be left alone. Frequent unnecessary action will only bring increased variability and therefore be avoided.

Frightening: The managers who deal with this variability, first have to understand the concept of variability clearly. This is where training in statistical quality-control is helpful. Generally statistics, to many of our production managers, appears unduly complex. They think that it is a highly mathematical affair and sometimes become frightened of it. But, truly speaking, 'degrees of freedom' 'probability level,' 'standard deviation' 'co-efficient of variation,' 'three-sigma control limits,' 'confidence interval' are not an every-day vocabulary in mills and industries. Although statistical quality-control techniques are based on rigorous mathematics but most of actual applications are little more than simple arithmetic.

This is where the production supervisors or managers of the developed countries have a significant advantage over their counterparts in the underdeveloped (or developing) countries. Almost all these management personnel have been exposed to the use of statistical methods as a part of their training in the quality-control discipline. Therefore, it is safe to say that the management personnel of the production sectors of our country will understand better and be able to take better decision, if they are made familiar at first with the principles of statistical quality control techniques which will lead them to obtain maximum output at the minimum level of cost.

How to improve: If the management in a mill or industry take any decision without the help of statistical quality-control, they may commit two types of errors. First, suppose, a decision is made to take corrective measure but unfortunately the variation is just the result of chance causes. Secondly, when a decision is made not to take any corrective measure, the 'deviation from target' is due to assignable causes. So, it is very difficult to avoid these two types of errors without statistical quality-control measure.

Statistical methods can also be used for determining the natural capabilities of production processes. This, in turn, permits us to take better decisions on tolerance and specifications and even allows to compare alternate operating systems.

There are other numerous examples of the application of statistical technique which is an aid to decision-making in every management sector. We should have the capability to separate and quantify the sources of variations through analysis of variance (ANOVA). Getting the result from ANOVA that how much variation is associated with sampling, with testing or with the process itself, is essential for decision making as where to concentrate for sampling and or testing to identify a significant change in quality.

From now, we need more managers who will think statistically. Our industrial training programmes should be developed in such a way, so that the basic concepts of statistical quality-control are there for the management at all levels. We must remember that a process produces not only products, but also data. The analysis of these data and the decisions made out of it will have a great impact on the future success of our mills and industries.