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REPORT TO MANAGEMENT

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In response to the January 1972 Viewpoints column on process capability, ASQC Honorary Member Dr. W. Edwards Deming sent us the following "report" composed of extracts from a report to the management of a large company. In addition to its being on process capability, it covers so many other items of interest to quality controllers in general that we present it here in its entirety.

W. E. DEMING
Categorizing troubles.

This report is written at your request after study of some problems that you are having with production, high costs and variable quality, which altogether, as I understand you, have been the cause of considerable worry to you about your competitive position. Please note that I write as a statistician who sees the statistical method as a system of service to science and to industry. I am not a consultant in management. As a statistician in practice, however, I work with management on many types of problems, including statistical logic in the management of quality. Thus I learn what some management problems are and how statistical methods can help.

By quality control, I mean use of statistical methods to aid design and test of product, specifications and tests of materials, aids to production workers, measurement of the effects of common (environmental) causes, meaningful job descriptions and specifications based on the capability of the process, consumer research, sales, inventory, inventory-policy, maintenance of equipment and many other problems of management.

My opening point is that no permanent impact has ever been accomplished in quality control without understanding and continued nurture of top management. No short-cut has been discovered. In my opinion, failure of your own management to accept and act on their responsibilities in quality control is one cause of your trouble, as further paragraphs will indicate in more detail.

What you have in your company, as I see it, is not quality control, but guerrilla sniping — no organized system, no provision nor appreciation for the statistical control of quality as a system. You have been running along with a fire department that hopes to arrive in time to keep fires from spreading. Your quality control department has done its duty, as I understand, if they discover that a carload of finished product might cause trouble (even legal action) if it went out. This is important, but my advice is to build a system of quality control that will reduce the number of fires in the first place. You spend money on quality control, but ineffectively.

You have a slogan, posted everywhere. I wonder how anyone could live up to it. By every man doing his job better? How can he, when he has no way to know what his job is nor how to do it better? Exhortations and platitudes are not effective instruments of improvement in today's fierce competition, where a company must compete across national boundaries. Something more is required.

A usual stumbling block most places (except in Japan, I believe, where they had the benefit of a better start, and a willingness of top management to learn and stay interested) is management's supposition that quality control is something that you install, like a new dean or a new carpet.

Another roadblock is management's supposition that the production workers are responsible for all trouble: that there would be no problems in production if only production workers would do their jobs in the way that they know to be right. Man's natural reaction to trouble of any kind in the production line is to blame the operators. Instead, in my experience, most problems in production have their origin in common (environmental) causes, which only management can reduce or remove. For best economy, the production worker is held responsible to maintain statistical control of his own work. To ask him to turn out no defectives may be costly and the wrong approach. The QC Circle movement in Japan gives to production workers the chance to

move on certain types of common causes, but the QC Circle movement is in Japan, not here.

Causes of trouble may be subsumed under two categories: common (environmental) and special (local). Common causes are called common because they affect equally all workers in a section. They are faults of the system. They stay there until removed by management. Their combined effect can be evaluated. Individual common causes can usually be isolated by experiment. Special cause can be corrected on statistical signal by the production worker himself. They are special because they are specific to a local condition. The operator's judgment by itself without statistical signals is hazardous.

Confusion between common causes and special causes — a failure of management — is one of the most costly mistakes of industry administration, and public administration as well. Confusion between these two causes leads to frustration at all levels and to actual increase in variability and cost of product — exactly contrary to what is needed.

Fortunately, confusion between the two sources of trouble (common or environmental causes, and special causes) can be eliminated with almost unerring accuracy. Simple statistical methods distinguish between the two types of cause, and thus point the finger at the source and at the level of responsibility for action. Simple statistical charts tell the operator when to take action to improve the uniformity of his work, and when to leave it alone. Moreover, the same simple statistical tools can be used to tell management how much of the proportion of defective material is chargeable to common (environmental) causes, correctible only by management.

Thus, with simple data, it is possible and usually not difficult to measure the combined effect of common causes on any operation. This I pointed out in my paper "On Some Statistical Logic in The Management of Quality," which I delivered at the All India Congress on Quality Control held in New Delhi, 17 March 1971.

"We rely on our experience," is the answer that came from the quality manager in a large company recently, when I enquired how they distinguish between the two kinds of trouble (special and environmental) and on what principles. Your own people gave me the same answer, at first.

This answer is self-incriminating — a guarantee that the company will continue to have about the same amount of trouble. There is a better way now. Experience can be cataloged and put to use rationally only by application of statistical theory. One function of statistical methods is to design experiments and to make use of relevant experience in a way that is effective. Any claim to use of experience without a plan based on theory is disquise for rationalization of a decision that has already been made.

In connection with special causes, I find in your company no provision to feed back to the production worker information in a form that would indicate (a) when action on his part would be effective in helping to meet his specifications, and (b) when he should leave his process as it is. Special causes can be detected only with the aid of proper statistical techniques.

The production worker himself may in most cases plot the statistical charts that will tell him whether and when to take action on his work. He must, of course, be taught.

Be it noted, though, that statistical techniques for special causes alone will be ineffective and will fizzle out unless management has taken steps to remove the common (environmental) causes of trouble that make it impossible for the production worker to turn out good work. Failure of management to take this initial step, before teaching the production worker how to detect his own special causes, accounts for failure of the so-called control chart method; it simply will not solve all the problems of quality.

The benefit of this communication with the worker, by which he perceives a genuine attempt on the part of management to show him what his job is, and to hold him responsible for what he himself can govern, and not for the sins of management, is hard to over estimate.

Moreover, there is a further elevation of morale when the worker perceives that management is doing something about common causes, and accepting some of the blame for trouble.

Statistical aids to the production worker will require your company to acquire some statistical knowledge and do a lot of planning.

What is the production worker's job? Is it to turn out no defectives (which makes him responsible, not just for his own work, but for the machinery and for the material that comes to him from previous operations, or is it to run his operation economically? The two aims are too often incompatible. Statistical methods show up this dilemma and provide feasible solution.

There is no excuse today to hand to a worker specifications that he cannot meet, nor to put him in a position where he cannot tell whether he has met them. Your company fails miserably here.

When a process has been brought into a state of statistical control (special causes weeded out), it has a definite capability, expressible as the economic level of quality for that process.

The only specifications with meaning are those fixed by the capability of the process. The specifications that a process in control can meet are obvious. There is no process, no capability, and no meaningful specifications, except in statistical control.

Tighter specifications can be realized only by reduction or removal of some of the common causes of trouble, which means action on the part of management. A production worker, when he has reached statistical control, has put into the process all that he has to offer. It is up to management to provide better uniformity in incoming materials, better uniformity in previous operations, better setting of the machine, better maintenance, change in the process, change in sequencing, or to make some other fundamental change.

In connection with the above paragraph, I find that in spite of the fact that you collect

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a profusion of figures in your company, there are not data on hand for either the problems of special causes or for measurement of the effect of common causes. Costly computers turning out volumes of records is not quality control. Figures fed back to a worker do more harm than good if they are devoid of signals that tell him (a) whether he himself is partly or wholly the cause of trouble discovered in product that passed through his operation, or (b) that the trouble arose from common (environmental) causes, beyond his control. The result is frustration and dissatisfaction of any conscientious worker. Without statistical signals, any attempt on his part to improve his work has the inevitable result of increases in variability and increases in costs.

Your production workers and your management need help that they are not getting. An important step, as I see it, would be for you to take a hard look at your production of figures — your so-called information system. Under more intelligent guidance, you would have far fewer figures but far better information about your processes and their capabilities, more uniformity, and greater output at reduced cost per unit.

I should mention also the costly fallacy held by many people in management that a statistician must know all about a process in order to work on it. All evidence is exactly the contrary. Competent men in every position, from top management to the humblest worker, know all that there is to know about their work except how to improve it. Help toward improvement can come only from outside knowledge.

Management too often supposes that they have solved their problems of quality (by which I mean economic manufacture of product that meets the demands of the market) by establishing a quality control department, and forgetting about it. In a sense, this is a good administration — to delegate responsibility and hold the man responsible to deliver the goods — but it is not working.

Why not? Most quality control departments work in narrow ranges of knowledge, with little concept or ability to understand the full meaning of quality control. Unfortunately, management never knows the difference. To grow up in a factory is not sufficient qualification for work in the statistical control of quality. There is no substitute for knowledge.

No good comes from changing the name of a quality control department to the department of operations research, or to systems analysis, or to some other fancy name.

Management too often turns over to a plant manager the problems of organization for quality. This man, dedicated to the company, wonders daily what his job is. Is it production or quality? He gets blamed for both. He is harassed daily by problems of sanitation, pollution, health, turnover, grievances. He is suspicious of someone from the outside, especially of a statistician, talking a new language, someone not raised in the manufacturing business. He has no time for foolishness. He expects authoritative pronouncements and quick results. He has difficulty to accustom himself to the unassuming, deliberate, scholarly approach of the statistician. The thought is horrifying to him, that he, the plant manager, is responsible for a certain amount of the trouble that plagues the plant, and that only he or someone higher up can make the necessary changes in the environment. He should, of course, undergo first of all a course of indoctrination at headquarters, with a chance to understand what quality control is and what his part in it will be.

Most men working in so-called quality control departments would welcome a chance to acquire more knowledge. One way is to send in a top-grade statistician on a regular basis for guidance. Another way is to send selected men in your company to one of the (few) statistical teaching centers, for two years. Your company needs desperately more statistical knowledge.

Statistical methods to improve training and supervision have not been utilized effectively in your company. Statistical evaluation of training and supervision, viewed as a system for improvement of skills and of operations, is an important part of quality control.

Perhaps the greatest problem (hardest to solve, I mean) is the perennially increasing shortage of competent statisticians that are interested in problems of industry. This shortage exists all over the world. Profound knowledge of statistical theory is necessary in quality control. Unfortunately, it takes around ten years beyond college, spent in study and internship under a master, to produce a competent statistician, and too few of the competent ones go into industry. This is partly the fault of management. A competent statistician will not stay in a place where he cannot work effectively and which fails to challenge his ability. The shortage of statisticians will continue. Meanwhile, companies must treat statistical knowledge as a rare and vital resource.

I find in my experience that management hardly ever provides organization and competent staff to carry on and develop control of quality on an economic scale. No one in quality control, however competent, can step in and work effectively in the absence of directive from the top. Proper organization and competence do not necessarily increase the budget for quality control. Management, in most instances, is already paying out enough money and more for proper organization and competence, but not getting their money's worth, getting tons of machine-sheets full of meaningless figures — getting rooked, I'd say, and blissfully at that. Your company is no exception.

I hold the conviction that here, as in Japan, it will be necessary for management to devote many hours to quality control, on a continuing basis, to learn something about the techniques, as management must hold themselves responsible for the problems of poor design, high costs, and quality, and must learn enough to judge the work of subordinates on these problems. No one is too important in a company, or paid too much money, to get some tutoring in statistical methods so that he can see better what the problems of the company are, and how his quality control people are doing.

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Washington