the DANGER of relying on accounting numbers ALONE

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In businesses of all types, whether they deal in manufacturing or services, the most urgent need is to eliminate all management information that encourages people—at any level—to manipulate processes in order to achieve accounting results.[1]

The above quote from Tom Johnson's *Relevance Regained* captures one of Johnson's recurring themes, namely, that accounting-based targets should not be used to control people and processes. While all organizations want to achieve better results, the crucial question becomes "By what methods?" Johnson and other quality advocates are telling us that failure to focus on the right methods can lead to more serious problems.

Brian Joiner, in his poignant book *Fourth Generation Management*, makes the case for process improvement by indicating that there are essentially three ways to get better reported results: (1) improve the system,

(2) distort the system, (3) distort the figures.[2] While the use of accounting information for scorekeeping, resource allocation, and decision analysis can provide vital, necessary information to management, its use for controlling people and processes often results in a failure to understand the capability of a process and, worse, actual distortion of the process itself. The example that we discuss illustrates how a reliance on accounting numbers to control people and processes and to represent the voice of a process led to manipulation of the system and to the company erroneously paying bonuses to those responsible for the process.

The actual case that is the basis of our fictitious example was presented to a graduate managerial accounting class by a student. The student asked to remain anonymous, and we have altered the situation so that the company cannot be identified. The real company did add raw material to another product, and there was unacceptable waste of the raw material. The employees were given an arbitrary accounting goal with a bonus as a reward for reducing the waste. The employees did manipulate the system as presented. The company is now using statistical process control (SPC).

Correcting a Problem in the Wrong Way

A breakfast cereal producer that included fruit in one of its products became concerned because of the apparent waste of fruit. The cereal boxes were to contain 10 ounces of cereal and two ounces of raisins. Management recognized that some waste would occur in the process and allowed a 5% shrinkage—.1 ounces of fruit. Consequently, an average consumption of 2.1 ounces of fruit per box was acceptable. During the previous month, however, the production processes had been using an average of 2.5 ounces of raisins per box. The accounting department discovered the problem in its weekly accounting report, which computed the actual cost and quantity of raisins consumed by taking a physical inventory and comparing the amount of inventory reduction with the standard allowed per box. During the past week 43,200 boxes of cereal had been processed with the consumption of 108,000 ounces of raisins, equaling an average of 2.5 ounces of raisins per box. In an attempt to correct the problem, management offered a bonus to employees if they could reduce the total fruit consumed to an average of 2.1 ounces—a 5% shrinkage. Within a month the problem appeared to have been corrected, and bonuses were distributed. (See figure on the facing page.)

The Business Accounting Report indicated that before the bonus was offered the process was consuming 108,000 ounces of raisins or 2.5 ounces per box, with a total unfavorable variance of 17,200 ounces. After the bonus, the process was consuming 90,720 ounces or 2.1 ounces per box with no variance in excess of the 5% allowed.

Another problem began to appear, however. Market research studies reported that customers seemed dissatisfied with the quantity of raisins found in the cereal. A recently hired internal auditor with a background in process management was asked to observe the process.

Two procedures were relevant to the problem. The first was the acquisition of fruit and its preparation, storage, and transportation to the packaging process. The fruit was transported to the plant in containers and was weighed there. The receipt weight became the basis for payment and computation of the anticipated 5% shrinkage. Following the weigh-in procedure, the fruit went through several cleaning and drying procedures and was then stored in refrigeration units. Finally, when needed for production it was moved from storage by conveyor to the packaging line.

The second procedure was a fully automated packaging line where the fruit and cereal were mixed, packaged, and boxed for shipment. The last stage of this process was to weigh the boxes on a sample basis. If the box content failed to weigh an average of 12 ounces, the boxes were reprocessed in a separate line. The company had not used control charts (statistical process control) at any point in the process, including the final weighing.

Using past data, however, the internal auditor was able to prepare several control charts that indicated that the packaging process had been in statistical control except for the four months that had elapsed since the apparent solution of the fruit problem, the four months immediately prior to his observations. The process control chart revealed that the average box weighed 11.8 ounces and that the process could be expected to vary the box weight from a low of 11.0 ounces to a high of 12.6 ounces. (See figure.)

The internal auditor noted that all boxes sampled up to the four months prior to his involvement had fallen within the upper (UCL) and lower (LCL) limits, indicating that the process was under statistical control.[3] This variation is random or common cause and indicates that the process is behaving in a stable and predictable manner. Therefore, it is possible to determine process capability. When not stable and predictable, the process has no definable capability. Capa-

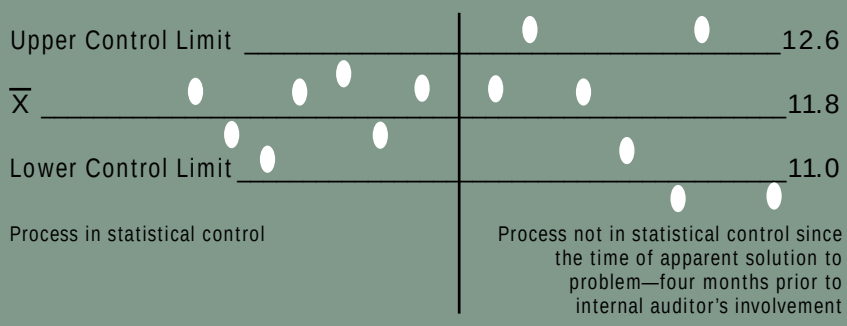
BUSINESS ACCOUNTING REPORT

Raisin Consumption 43,200 Cereal Boxes

	Before Bonus	After Bonus
Beginning inventory	45,360 (ounces)	45,360 (ounces)
Purchases	90,720	90,720
Available	136,080	136,080
Ending inventory	28,080	45,360
Raisins consumed (ounces)	108,000 (ounces)	90,720
Standard allowed:		
43,200 x 2.1(ounces)	90,720	90,720
Variance (in excess of 5%)	17,200	-0-
Raisins consumed per box	(108,000/43,200) 2.5 ounces	(90,720/43,200) 2.1 ounces

STATISTICAL PROCESS CONTROL CHART

Past Data



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bility can be changed only by changing one of the process components that determine the process—people, machines, material, methods, and environment.

While the above process was under statistical control, it still incurred a variance of 17,200 ounces. This variance indicated that the process was unable to meet the standard allowed for raisin consumption and that the only remedy was to attempt to improve the process by changing one of the process components.

Processes can have measured capability and be under statistical control but not produce to desired specifications. But processes cannot be improved until they are under statistical control. During the four months when the process was not in statistical control, its variation became erratic from day to day and week to week.

Donald Wheeler, well known for his writing and consulting experience with understanding variation, has stated:

> *When a process displays a lack of statistical control the pattern of variation will be inconsistent from day-to-day. The variation in the process, and the variation in the product, are said to be due to both common causes and assignable[special] causes. Such a process will be unpredictable....When a process displays a lack of statistical control the control chart will detect the presence of the assignable causes. Each and every signal on a control chart presents an opportunity to gain more insight into the process.*[4]

The points at which the process is not in control represent points in time where other quality tools such as Pareto charts and cause-and-effect diagrams along with the PDCA cycle may be employed in an effort to find a solution to the problems and improve processes.

The auditor next asked that scales be purchased to weigh the fruit on a sample basis prior to and after storage and at the completion of the packaging process. A sample of cereal boxes and fruit was emptied, and the cereal and fruit were weighed separately. This weighing, along with those when the fruit was received, were charted using SPC. He also spent a great deal of time observing the moving of fruit to and through the packaging line. Through this analysis of both the fruit operation and the cereal operation, he concluded that the problem was with the fruit process, not the packaging process.

After further examination, the auditor discovered that the packaging machines had been adjusted so that less fruit was being added to each box; however, the adjustment appeared to occur erratically. He discovered that when the packaging process was being expedited, the machines were being materially adjusted so that far less than two ounces of raisins were added. This was usually during a time when there appeared to be much less chance that the boxes would be weighed—that is, when expediting an order. During the remaining times the machines were also being adjusted but not as significantly. The auditor was convinced that the adjustments were being made to hide the actual fruit loss.

When he computed the loss using statistical process control charts at various points in the process, he determined that the raisin loss still existed at about the same percentage as previously calculated. The accounting report compared the amount of raisins received with the amount of raisins being consumed by the process but did not measure the quantity of raisins being placed into the boxes. He was able to show that approximately 17,200 ounces of the 90,720 ounces of raisins reported as being consumed were not being placed into the boxes but were being lost at various points in the process. He suspected that the process managers were adjusting the machines at various times in order to compensate for the loss, and as a consequence the reported accounting variance was eliminated.

He was able to confirm his suspicions through discussions with the process managers. Prior to the weekly production runs, they had calculated the amount of fruit needed for packaging by multiplying the number of boxes to be processed by the allowable fruit per box and deducting what it appeared would be lost by the process. For this situation they had multiplied 43,200 boxes times the 2.1 ounces allowed to obtain 90,720 allowable total ounces and deducted the previous variance of 17,200 ounces to arrive at 73,520 ounces.

Next, they attempted to adjust the machines so that a total of 73,520 ounces would be placed in the 43,200 boxes. The process managers knew that the accounting report did not reflect the ounces placed in the boxes. There had been some effort to weigh the boxes; however, when orders needed to be expedited they did not always follow through with the weighing procedures. The auditor was able to determine that this practice had started about four months prior to his involvement, at about the time when the SPC charts indicated that the process was not in statistical control.

He became convinced that the actual fruit loss problem was with the fruit and the fruit processing procedures prior to packaging. There were problems with too much roughage when the fruit was received from

the supplier, and the cleaning procedures were allowing too much fruit to be destroyed. Finally, there was some loss of fruit on the conveyor that had not previously been noted that was due to wear on the belt. Each of these problems was not individually significant, but, when added together, they represented the major source of the loss.

Lessons Learned

This example illustrates many of the potential problems that can arise when management does not understand processes, process capability, and variation and instead relies on accounting reports that do not reflect the complete process. Management did not realize that, prior to the four months of manipulation by the employees, the process had been under statistical control and that under current conditions it was not capable of meeting the specifications of an average of 2.1 ounces of consumed fruit per box. The variance the process was incurring (17,200 ounces or 2.5 ounces per box) was a random variation and a result of the process components. The variance could be reduced only by changing one of the components of the process—methods, people, material, machines, or environment.

The auditor concluded that this problem started because the firm's method of comparing its actual raisin consumption and cost with the accounting budget, while accurately indicating the amount of fruit consumed by the process and the corresponding loss, did not represent the capability of either the fruit processing or packaging systems. Because the firm relied solely on accounting data to manage the system, process managers were able to manipulate the accounting reports by manipulating the system. Furthermore, the accounting reports did not provide any indication as to the source of the problem or how to correct it.

Because management did not understand its processes and how accounting reports relate to the process, it had given process managers an accounting goal to reduce fruit waste without providing a means to determine the potential sources of the problem. In their frustration the process managers reduced the fruit consumption of the process by reducing the quantity of fruit being added to each box and temporarily satisfied management. At the same time they earned a bonus for a job well done.

The preceding case shows that, while cost targets are established in an effort to control costs, what is often not understood is that these goals are purely arbitrary unless set in the context of a process's capability. As a consequence, efforts to achieve targets that are beyond the capability of a given process often result in tampering or manipulation of a system or distortion of the figures.

The use of accounting data is essential in assessing the financial impact of quality initiatives, which usually are focused on improving operational measures. However, accounting control of people and processes must be replaced by SPC if management hopes to understand the capability of existing processes.

Finally, accounting data, while appropriate for costing processes, cannot provide management with the requisite information needed even to begin process improvement initiatives. Before improvement initiatives can be assessed realistically, it is essential that processes be brought into statistical control in which the only variation present is common cause or random variation. For example, in the case presented, the accounting system led management to believe that a special cause existed when in reality the process was in statistical control. Efforts to reduce common cause variation require changes in the process inputs, that is, system changes. If a process is out of control through the presence of special causes, then efforts should be directed at removing the special causes to bring the system into control. In short, the accounting system sent a false signal that resulted in inappropriate and detrimental management actions. It is time to refocus management accounting practice so that we stop trying to control and influence behavior with accounting targets. It is time to replace accounting control of processes with statistical process control. ■

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1 Thomas H. Johnson, *Relevance Regained*, The Free Press, New York, 1992.

2 Brian Joiner, *Fourth Generation Management*, McGraw-Hill, New York, 1994, p. 9.

3 There are many points within three standard deviations where the process is not in control. For a complete discussion of SPC, we recommend the book *Understanding Variation, the Key to Managing Chaos* by Donald Wheeler, SPC Press, Inc., Knoxville, Tenn., 1993.

4 Donald Wheeler, *Understanding Variation, the Key to Managing Chaos*, SPC Press, Inc., Knoxville, Tenn., 1993, pp. 128, 130.