VIEWPOINT: 21ST CENTURY COST MANAGEMENT

COST MANAGEMENT: FROM FREDERICK TAYLOR TO THE PRESENT

Robin Cooper

Editors' Note: In the "From the Editors" letter in the first pages of this issue, we listed the springboard questions that formed the starting point for the journal's board members as they wrote their statements on 21st century cost management. We wish to credit Robin Cooper for his assistance in creating those initial questions. We also asked him to write a somewhat longer, introductory opinion piece to establish the specific historical background for these questions, set the initial perspective, and respond to the questions himself. For these reasons, his work appears first in the series; the remaining pieces appear in alphabetical order according to the board members' last names.

Careful analysis of an individual's expected reactions to changes in the assumptions that underlie his or her worldview can provide insights into that person's worldviews—as well as our own—and the limitations that such views impose. Just as Frederick Taylor was captive to his worldview, so are we captives to our own worldviews.

Author's Note: For a much deeper analysis of the role of the scientific management movement on the development of standard costing, see The Effect of Scientific Management on the Development of Standard Cost Systems *by Marc J. Epstein (New York: Arno Press, 1978). Much of the historical materials used to develop this opinion piece are based on that work.*

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THE SCIENTIFIC MANAGEMENT MOVEMENT

Probably no person in history has had more impact on the practice of management accounting—and hence cost management—than Frederick Taylor. Before his scientific management movement, no effective mechanism existed whereby standard costing could emerge. Standard costing requires repetitive manufacturing processes that can be measured accurately each time they are performed.

Repetition is needed for the development of standards to be worthwhile. Accurate measurement is required to develop meaningful standards and compare them to actual performance. Therefore, scientific management and standard costing go hand in hand, and Taylor played a dominant role in the development of both systems.

The four core principles of scientific management are:

- A carefully thought out method of performing a task
- A fair standard time for performing the task
- A means of controlling actual results and comparing them to this predetermined task
- A plan for rewarding those who exceed the standard

Clearly, the step from scientific management to standard costing is a small one. It takes few changes to apply these four principles to standard costing as follows:

- A carefully thought out method of performing a task
- A fair standard *cost* for performing the task

- A means of controlling actual results and comparing them with this predetermined *cost*
- A plan for rewarding those whose *performance differs from* the standard

It is difficult for modern managers to understand the manufacturing practices that were common at the turn of the last century and before the adoption of scientific management. Industry professionals have come to accept the disciplines of mass manufacturing and lean production. In a modern factory, the production processes are expected to be documented and well thought out and the workforce well trained.

At the turn of the 20th century, however, most manufacturing processes were hopelessly inefficient (by modern standards), with no formalized production processes established. Essentially, individual workers did their own thing. Supervisors had developed their own approaches to production based on experience, and each individual approach was idiosyncratic.

The advent of scientific management led to significant increases in productivity; it was not unusual for output to increase by 300% to 400%, with resource consumption remaining the same or being reduced. Such increases in productivity are on par with those achieved by the transition from mass to lean production. Therefore, the formalization of production processes—commonly termed *the scientific management movement*—should be seen as one of the crowning achievements of 20th century manufacturing.

KEY WORKFORCE ASSUMPTIONS

Four key assumptions about the workforce underlie the scientific management movement and are of particular importance from a cost management perspective:

- The workforce is primarily uneducated
- Control must be centralized
- Performance must be constant
- Pay must be based on individual performance

The advent of scientific management led to significant increases in productivity.

These assumptions shaped the manufacturing environment of the Western world for the first 70-odd years of the 20th century. They enabled the U.S. economy to grow to a dominant position in the world. Given this success, it is unsurprising that most managers of that period came to accept the validity of these assumptions—they were embraced as fact or common sense—without giving them much thought.

Each assumption is discussed in greater detail in the following sections.

Managing an Uneducated Workforce. At the turn of the last century, a great number of immigrants flooded into the United States, primarily from Europe. In the middle of this Progressive Era, about one in seven individuals living in the United States was born outside the country. The influx of immigrants was so great that despite the rapid growth of the economy a surplus of labor was always available. Although the majority of the immigrants found employment in factories, they were expected to work long hours for low pay.

The rise of American industry was therefore driven, in part, by the immigration of low-cost workers from outside the country. These immigrants were not educated workers; they typically came from a farming background, with their first manufacturing experience occurring in American factories.

The scientific management movement therefore evolved at a time when the majority of the American workforce was uneducated. This unskilled workforce required that the production process be broken into several simple steps. Subsequently, specialization of skills was one of the important contributions of the scientific management movement.

Ensuring Centralized Control. During the time of the scientific management movement, it was assumed that the workforce should not be required to think. The specialization of the workforce meant that each worker needed only to learn a relatively simple task and repeat it again and again. Consequently, little creative thought was required.

Taylor incorporated this thinking into his whole approach, investing fully in the concept of a central office that controlled all factory activities and ensured that only approved activities were undertaken.

Ensuring Constant Performance. Another assumption during this time was that once the desired level of performance had been identified through time studies, it need never be changed (unless production machines were improved). Taylor, in particular, believed that there was one best way to perform a task. Conse-

quently, the time and motion studies used to develop the standards assumed that there was an optimal way to perform each task and that actual performance was always less than perfect. The aim of variance analysis was to measure the gap between actual and standard performance and to try to minimize that difference.

Providing Individual Pay for Performance. During the Progressive Era, the workforce was commonly paid in one of two ways: the day-work or piece-work plan. In the day-work plan, workers were paid for each day they worked, not for the quantity of their output. Taylor believed that such pay schemes were inherently inefficient and demoralizing for the worker because they failed to reward productivity.

In contrast, Taylor favored the piece-rate approach, whereby the workforce was paid for its productivity. At the turn of the century, however, the way in which many piece-rate plans were administered was problematic. As the productivity of the workforce increased, employers often reduced the amount paid per piece to bring a worker's pay rates back in line. For this reason, the unions of the time were opposed to piece rates and tried to limit the output that a person was expected to produce per day.

Taylor spent a considerable proportion of his effort developing piece-rate schemes that would not lead to reduced rates as productivity increased. He saw the contradiction inherent in encouraging the workforce to be more productive and then punishing them for achieving that objective. He resolved this problem by introducing the differential-rate scheme.

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In this scheme, the piece rate increased with output. A worker who had low productivity would receive little pay (i.e., the piece rate would be low, as would the output). In contrast, a highly productive worker would receive a reasonable pay rate because of the higher piece rate times a greater number of units. Excessive levels of pay were impossible, however, because of the initial low piece rates. As a result, the incentive was for each worker to operate at a higher level of productivity to receive a reasonable level of pay.

THE EMERGENCE OF STANDARD COSTING

As the scientific management movement progressed, it created a demand for more reliable accounting information and it simultaneously created the standards required to provide it. In Taylor's time, management accounting was the responsibility of mechanical engineers, not accountants. At the turn of the 20th century, the accountants were responsible for cost keeping and the mechanical engineers for cost finding. (In modern parlance, cost keeping is financial accounting that revolves around the reporting of firm profitability; cost finding is managerial accounting that revolves around increasing efficiency and reporting product costs and hence profitability.)

The assignment of the prime costs, material, and labor to products created few problems for the engineers of the time. The assignment of the indirect costs, however, was more problematic. At the end of the 18th century, the typical cost system used a single cost pool and allocated it to products on the basis of their labor or prime costs. Because most factories at the time produced essentially only one product, the costing challenge was not that great; and given the lack of product diversity, such simple systems presumably reported accurate product costs.

By the end of the 19th century, however, the expanding economy required factories to produce multiple products, and the resulting increase in complexity created a cost assignment problem. Two technical advances enabled the accurate assignment of indirect costs in more complex settings. The first was a costing method that allowed productive overhead and selling to be differentiated from general and administrative costs; the second was breaking the factory into multiple cost centers. (The first advance was initially documented in England and the second in the United States, both just before the turn of the 20th century.)

By the end of the late 1920s, traditional standard costing was fully developed, as was variance analysis. Published examples of the technique included the use of direct labor and machine-hour cost assignment and a full array of prime variances. Taylor played a significant role in developing standard costing—many of the concepts now taken for granted originated in the factories where he worked.

As the concepts of scientific management and standard costing evolved, the orientation from determining product costs shifted

toward managing efficiency. Consequently, as the ability to measure product costs became more accepted, the second major managerial function of a cost system—cost control—came to dominate. Given the background of the Progressive Era, it is unsurprising that this evolution in which efficiency measurement came to dominate product costing occurred.

CRITIQUING PRESENT-DAY PRACTICES

If the clock were rolled forward to the present, and Taylor could be asked what he thought of modern cost management practice, he might say, that on a technical basis, he fully approved of such advances as activity-based costing (ABC) and target costing. He also would likely suggest, however, that not much progress had been made during the past 80 years. And he would be correct.

The loss of relevance that occurred so soon after 1920, when the mechanical engineers of Taylor's time were replaced by accountants, clearly delayed technical progress in managerial accounting for many decades. The application of cost assignment principles to the indirect costs (as made operational by ABC) would likely strike Taylor as logical and obvious. The focus on activities would not surprise him; it would simply require that he change the term *task* to *activity*. Not an earth-shattering change.

When it comes to practice, however, Taylor would have some real problems. First, he would expect the ABC systems to be true standard cost systems based on time and motion studies or their equivalent. He would have a difficult time accepting the interviewing techniques that are often used to establish activity costs. Such interviews do not address the concept of optimal practice; they simply capture existing practice, and often do so rather poorly. Taylor would reject this approach as shoddy and lacking in discipline.

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In addition, Taylor would be surprised at the lack of variance analysis in a modern ABC system. He would not understand the failure to check current performance against standard and would look on this failure as a regression from the leading-edge practice of his day. Given the backdrop of the Progressive Era, Taylor would find modern approaches to cost control rather difficult to accept.

The concept of control through process design, as opposed to direct employee control, would be alien to him. Today, costs are controlled by designing lean production systems in which all steps are coupled and must be performed perfectly if production is to function. An abstract perfection is not defined first, followed by an attempt to achieve it (with the exception of the impossible to achieve zero defects, zero inventory, and 100% automation targets of the lean enterprise).

The split between activity-based costing (ABC) and activity-based management (ABM) would not surprise Taylor. He would see that as a natural progression (if not a repeat) of the shift in objectives between product costing and efficiency that occurred in his time. He would be surprised, however, at the importance attached to strategic costing (i.e., ABC).

Taylor developed his approaches in a world in which levels of competition were lower and firms produced only a limited range of products. The need for sophisticated profitability analysis would therefore be alien to him, though he would rapidly accept its importance. The concept of mass customization would fascinate him, as would lean production—he would see them both as significant advantages over the production philosophies of his time.

In addition, he would be fascinated by the concept of customer costing and profitability analysis. Taylor would need to adapt to the modern concept of customer service and hence customer diversity. He would probably be fascinated by the reduced importance of products over solutions.

Other than that, Taylor would likely fully approve of the extension of cost management beyond the factory walls. He might have more problems with extending cost management outside the firm walls (as has just begun to be suggested in the current literature). In this case, he would be joined by many of today's managers who are only just beginning to understand that modern competition is often no longer at the firm, but at the alliance, level. In the long run, however, Taylor would definitely adapt and come to accept modern cost management theory.

REVISING ASSUMPTIONS ABOUT THE WORKFORCE

Taylor would take issue with the assumptions about the workforce that define modern cost management. Several of these assumptions are at total odds with Taylor's per-

sonal and deeply held beliefs. The four most important of these are:

- The workforce is highly educated
- The skills of knowledge workers must be leveraged
- The need for continuous improvement (i.e., kaizen) must be accepted
- Pay must be based on group performance

Each of the revised assumptions is explored in greater depth in the following sections.

Managing a Highly Educated Workforce

Intriguingly, the first assumption of a highly educated workforce is, in considerable part, an outcome of Taylor's scientific management movement. The general principles of structured workflow have become so widely known that all accounting students are exposed to them as part of their education. The advent of effective formal education has played a critical role in the development of a knowledgeable workforce.

From Taylor's perspective, the threatening concept would be the general-purpose worker who is able to perform multiple tasks in the factory—he would reject the concept as too demanding of the worker. Taylor would find it difficult to believe that the returns from having a generalist workforce were positive, let alone as great as they are now known to be.

He would be hard-pressed not to see this evolution as a regression toward the anarchy that he fought so hard to overcome. Eventually, he might come to see that the effective generalist worker is actually the highest form of specialist that can be created; but that would take time. Ironically, the codification of the production processes has freed the educated worker from the tyranny of the narrow specialist into the freedom of the generalist.

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Leveraging the Skills of Knowledge Workers

The second assumption that would give Taylor problems is the concept of the knowledge worker. This concept flies in the face of his drive to reduce, to essentially zero, the need for the workers to think for themselves. Taylor would have problems with this assumption because it removes the need for total centralized control. In scientific management, the goal was to reduce the worker to the equivalent of a robot.

The closer the workforce could come to achieving that perfection, the higher its expected productivity. That the workforce actually deals in knowledge, as opposed to discrete tasks, would be difficult for Taylor to accept. The concept of empowerment, which flows directly from the worker being a knowledge worker, would be totally alien to Taylor. It is difficult to predict how he would react to it. Most likely, his initial reaction would be one of disbelief; however, given time, he would probably reject the concept of the knowledge worker as unacceptable.

Accepting the Need for Continuous Improvement

The third assumption of continuous improvement is clearly at odds with Taylor's deep belief that there is one best way to perform a task. Continuous improvement therefore demolishes one of the cornerstones of the scientific management movement. More problematically for Taylor, it makes performance evaluation a subjective, as opposed to an objective, undertaking.

In Taylor's neatly ordered world, each task had a standard time that was required to perform it. Actual performance was below standard, and the objective was to ensure that the workforce operated as close to optimal as possible. In the current environment, however, no task is believed to have an optimal time in which to be completed (unless it is an unobtainable zero).

Instead, the workforce is expected to continually find ways to improve its performance. Consequently, excellent workers find ways to become more efficient; however, to evaluate these workers requires that a standard, subjective rate of improvement be established. In reality, the optimal way to perform a task is subjective; however such subjectivity is not accepted within the doctrine of the scientific management movement. From Taylor's perspective, an uneducated worker could not improve on the work of a highly trained mechanical engineer.

Linking Pay to Group Performance

The final assumption, group pay for performance, would cause Taylor to think hard about our beliefs regarding human motivation. The modern factory is not designed around the individual, but around the team. It is no longer possible to evaluate the performance of the individual without measuring the performance of the team.

Before he could understand the logic behind modern incentive

systems, Taylor would first need to understand the cause of this change (i.e., integrated production flows). He would have little trouble agreeing to the change if (and this is the big if) the team was rewarded using a piece-rate system. Modern pay for performance, however, is typically based on the performance of the firm in the stock market, and any bonuses are awarded for the overall performance of a firm. Even in private firms, a bonus is typically based on overall firm profitability.

Taylor might view the base-pay portion of the overall compensation plan as a longer-term version of the day-rate plan he tried so hard to replace with the differential piece-rate plan. He would see the bonus portion as pay for performance, but at too aggregate a level. He would be concerned with the free-rider problem. Of all the changed assumptions, this last one would be the hardest for him to understand.

LESSONS LEARNED

The history of compensation schemes and the interaction of the unions and management are complex issues in themselves. Underneath it all, however, is an important change in the way the workforce is viewed. In Taylor's time, workers were viewed as interchangeable and of low value (i.e., the outcome of that era's first three assumptions).

Today, the workforce is considered a valuable human asset that must be nurtured. The primary motivational tool has ceased to be termination and, instead, has become self-respect. Managers now rely on an individual's self-respect—and that of the team—to ensure that production levels are maintained.

This psychological, as opposed to financial, approach to workforce motivation reflects a century of evolution of worker-management relations and some fundamental shifts in societal values that revolve around human dignity.

The current worldview, however, is not superior to Taylor's—it is just different and reflects the times in which we live. It is almost impossible to predict the assumptions that will prove fundamental to future worldviews. Consequently, each of us should try to be sensitive to assumptions that underline our current worldviews (four of which were identified previously) and be on guard against allowing these assumptions to impede our own progress and that of others. ■