PART I The concept

1 The usual suspects

Your parents always wanted you to be a doctor. So, imagine that you are one, an orthopedic surgeon, in fact, specializing in knee and hip replacements. Life is good. The aging baby boomers will continue to need new knees and hips, assuring that you will always be in demand. Nevertheless, you know that healthcare's percentage of the gross domestic product cannot keep increasing, and that both the private insurance companies and the public system will surely be tightening up on their compensation for your surgical procedures.

How are you going to cut costs so that your annual income can be maintained? There are not a lot of options. The knee and hip implants themselves are billed separately by the hospital. The surgical instruments that you use are owned by the medical device company that supplies you with your knee and hip implants. You've got your surgical team to pay and the staff in your office. There are office expenses and insurance premiums, but your costs are overwhelmingly personnel costs and they aren't going down.

That leaves the option of adding to your revenues, and the easiest way to do that is to perform more operations in a week. But, you only have so much time in a day, especially only so much time when you are fit for holding a scalpel. You simply have to become more productive in the operating room; you have to do more operations in the same amount of time. But, how?

Productivity. It matters. In fact, over the long haul, it's about the only thing that matters.[1] It is the bedrock of our standard of living. When productivity increases, when we can get more output from the same resources, incomes can rise with no worries about inflation. Generations can live better than their predecessors. Poverty

can be reduced and people can enjoy more arts and leisure. When productivity stalls, this march of progress comes to a halt.

Most of us no longer live on the farm, thanks to the advances made in that most productive sector of most rich nations' economies, agriculture. Just a small percentage of us can produce all the food that we consume, and then some, and do it so cheaply that the fraction of our incomes spent on food continues to decline. Many people bemoan the loss of jobs in manufacturing, often attributing the reduction to outsourcing. Yet, productivity advance is, by far, the more important explanation. In a country such as the United States, the value of manufactured products, in constant dollars, continues to climb. It is the great productivity of the manufacturing sector that explains why that increased value can be produced by fewer and fewer employees.[2]

The breadth and diversity of the service sector in the industrialized countries and the fact that most of us work in the service sector can be directly linked to the higher productivity of agriculture and manufacturing. But, high productivity is not limited to agriculture and manufacturing. Some service businesses exhibit a productivity that outshines their competitors and has been instrumental to their growth.[3] The push for greater and greater productivity is a constant business theme.

Only for a few selected services is productivity increase more a fond wish than a relentless mandate. It is an unfortunate, but inescapable, fact that some services will always be at the bottom of the productivity ladder. The costs of these services will not benefit much from productivity gains and thus their prices will stay high for consumers. For such services, it is hard for labor to be any more productive than it has been. The price of symphony tickets and Broadway and West End plays, for example, will continue to climb. After all, it will always take a full orchestra to play Beethoven and a significant cast to stage Shakespeare. And, the Minute Waltz won't get any shorter. Happily, these are the exceptions and not the rule.

The recent recession has underscored the importance of productivity for all of us. Countless companies whose productivity had slipped could not weather the prolonged downturn. Major companies across the globe, many of them banks, had to be bailed out by government. Some of their operations were divided into "good" and "bad," and they were forced to jettison assets and people in order to be saved. Those companies that had paid attention to their operations fared much better, and it is those companies that have been best positioned to reap the rewards of economic expansion, at whatever rate it comes.

Productivity – getting more output from a given set of inputs – is a noble calling.* Yet, for something so important, productivity is not as well understood as it needs to be. Of course, we know that the quantity of output, and thus the productivity of any process, depends on a host of things, many related to the engineering of the process: the technology used, how much capital equipment is applied to the task, the quality of materials used, the quality of the process itself, the product design, the efficient allocation/scheduling of resources, the education and training of the workforce, worker effort, and … management. However, the precise impacts of these factors are not well known. They are not well known because disentangling the various impacts is very difficult to do. For this reason, economists have traditionally treated productivity as a residual. That is, when the growth of output is stripped of the growth due to the factors of production, typically labor and capital, what is left is assumed to be the growth of productivity. Treating productivity as a residual, however,

* The most common measure of productivity is labor productivity, defined as output per worker-hour. It is the easiest measure to gather data for and the most consistent. It is the measure that governments usually report. One could also consider machine productivity (output per machine-hour), which is a measure that makes sense for processes with little labor input and considerable machine input. Likewise, one can think of material productivity (output per unit of material input). A summary measure of productivity, total factor productivity (output per unit of a composite input of labor, capital, materials, and energy), can be calculated, although typically with some difficulty. Although it has theoretical appeal, it is not routinely calculated and does not lend itself well to managerial interpretation.

is fraught with problems of measurement, and heroic assumptions are typically needed in order to interpret the results cleanly.[4]

Of course, managers – and orthopedic surgeons – cannot treat productivity as a residual. Managers are under constant pressure to unlock the secrets to productivity growth at their companies and to keep productivity growing year in and year out. It is for these harried managers, searching for any way to boost productivity, and those who sympathize with them, that this book was written. It is devoted to explaining how managers can fulfill their obligations to get the most out of company processes of all kinds, from the processes that fabricate and deliver a company's products and services to the processes that create new products or keep track of the company's cash. Getting the most out of a set of resources is not easy. With uninspired management, even a well-conceived engineering of the process can fall well short of expectations. Unfortunately, companies fall victim to uninspired management more frequently than they should. And, to make matters worse, the path to enhanced productivity contains many traps and pitfalls into which managers over the years have inadvertently fallen.

TRAPS AND PITFALLS

Before we can move on to what really matters for productivity, it makes sense to confront these traps and pitfalls. For me, they make up my list of the "usual suspects." They describe plausible policies for productivity gain, but in the end, they are not the sure, satisfying steps to take to keep productivity growing. They can work sometimes, but they do not provide the most fruitful ways to think about productivity.

No. 1. Chopping heads

When costs are deemed too high, the frequent management reaction is that "heads have to roll." It's a seductive notion. People's wages and salaries are certainly a highly visible cost. And, it's relatively

easy to order an across-the-board cut of 10 percent to a company's departmental budgets. Managers at lower levels, closer to the real action, can figure out who is "excess" and how the work can be reapportioned.

It can work, but chopping heads is certainly a blunt instrument. It does not ensure that a process is accomplished any differently. The same inefficiencies that got the company into trouble could still persist. And, after a while in many companies, the people let go months ago come creeping back, perhaps as consultants, perhaps in new jobs that get approved once sales start to climb again. Nothing really gets "fixed" and morale within the company can take a hit.[5]

There are variations on this theme. Organization charts get examined carefully and are redrawn. Spans of control are widened. Some functions are centralized. But, too often, not much is done that removes cost for the long term.

And, what is our orthopedic surgeon to do? Which heads roll? Nurses and staff in the operating room? Office staff? It's not at all clear.

No. 2. Automation

Automation, or, more generally, capital-for-labor substitution, is a classic means of seeking productivity gain. Equipment, often of the latest vintage, is installed and various workers, typically direct labor wage earners, are eliminated as a result. The engineering justifications can be persuasive, as presumably high-cost direct labor and the overhead that applies to that direct labor are removed.

Automation surely can improve productivity, but it is not a surefire way to do so. The traps with automation can be subtle. First, of course, the direct labor that was targeted in the capital appropriation request may not be removed but may instead simply be shifted elsewhere. The advertised capital-for-labor substitution thus may not actually occur. Even if the direct labor itself is removed, however, the overhead attached to it may not be. In many companies, overhead is allocated to a product via its direct labor component,

and the overhead allocated may be easily 300 percent or more of the direct labor cost. What does such an overhead allocation consist of? A lot of it is engineering of various types – product design, industrial and process engineering, quality control and testing – plus supervision, space, logistics, and utilities, among other things. Do the expenditures for these things really tie to the quantity of direct labor used in the process? Certainly not now, if they ever did. Much of the engineering in a company is completely divorced from the labor content found in its products. It is far-fetched to think that reducing direct labor via automation will, at the same time, reduce this overhead expense. New equipment is simply not going to reduce many other costs, particularly the personnel component of overhead. What is more, automation can itself be more costly and more inflexible than anticipated. And, automation may, in fact, trigger expense elsewhere, expense that was ignored by the capital appropriation request that ushered the automation into the company.

These foregoing arguments act to diminish the impact that capital-for-labor substitution may have on the company's cost saving. An even more damning criticism is that, in some instances, capital-for-labor substitution, and even automation, may not have much impact on productivity itself. I have too often heard plant managers lamenting the purchase of some new piece of equipment – "I don't know why they made me purchase this thing," or words to that effect. More often than not, the new equipment was not integrated well with the rest of the production process, and it showed with increased levels of inventory.

We have all seen instances where automation was regarded as the company's silver bullet for cost reduction and/or quality improvement but where the reality was painfully short of that vision. The best known example is probably the $40–45 billion that General Motors spent in the 1980s, under Chairman Roger Smith, to catch up with the Japanese, much of it devoted to robotics and other factory automation. The catch-up never happened, expenses only grew, and there were a myriad of better uses for the money. In

fact, GM's former CFO noted in the mid-1980s that the money the company poured into automation could have purchased both Toyota and Nissan at the then prevailing stock prices.[6]

But, mistakes with automation occur all the time. It is hard to be disciplined when it comes to something new and shiny. And, here again, what is our orthopedic surgeon to do? There are new medical instruments developed all the time, but a knee replacement operation is not going to be automated any time soon.

No. 3. Efficiency measures

For many companies, the daily measure used to proxy productivity – the metric that is managed – is an efficiency measure. Labor efficiency, the ratio of actual labor input to some preset standard labor input, is common. If a worker's actual time beats the standard, labor efficiency tops 100 percent. An allied metric is machine or capacity utilization that looks at actual time in use as a fraction of the total time available. The presumption is that higher levels of efficiency, either of labor or of equipment, aids productivity.

Let's examine machine utilization. The trouble with such a measure is that the company does not get paid when any one machine is used. Rather, the company gets paid when the service is delivered or when the factory ships its products. What happens with a single machine, no matter what its cost, is irrelevant, unless that machine is the bottleneck for the entire operation. If it is, then, we need to lavish attention on it. Tracking machine or capacity utilization does not help us for productivity; it only helps us if we are interested in adding new capacity or, perhaps, shedding old capacity. Indeed, for many types of production process, machine utilization should be low. Job shops, for example, typically run low machine utilization rates on many machines as a matter of course. Indeed, it is only for the high-volume, continuous flow operation that, in essence, operates as one big machine, that machine utilization makes much sense as a measure of the factory's performance.

Similarly, the labor efficiency measure is a flawed one, if productivity is the goal. Whether a labor efficiency measure is high or low depends critically on the preset labor standard. If the standard is set looser than it should be, labor efficiency is artificially high. Whatever the labor efficiency measure is, however, it need not be related to the ratio of output to input (productivity). Labor efficiency does not tell us if the task being measured is well designed and adds true value to the product. For some people such a measure does not make much sense at all. Should our orthopedic surgeon be subject to a labor efficiency measure? What would it really tell us?

Consider the following evidence from one of my past studies. Over a 30-month time period, labor efficiency data were gathered for five factories of the same company by its accounting department. Also gathered were the factories' plant-wide productivity measures (good, classic output per unit of labor input measures). Of the 29 month-to-month changes during that 30-month period, the times when the labor efficiency measure and the productivity measure moved together were counted, as were the times when the two measures moved in opposite directions, that is, when labor efficiency went up and productivity went down or vice versa. If labor efficiency were really a good way to get at productivity gains and to lower costs, then one should expect that whenever labor efficiency went up, productivity would follow and that when it went down, productivity would drop. In reality, for much of the time, that wasn't the case for the five factories. The percentage of time when there were mismatches in the direction of change varied from 28% of the time, at the low end, to 62% of the time, at the high end. Specifically, for the five factories, mismatch percentages of 28%, 31%, 38%, 45%, and 62% occurred. Labor efficiency and productivity are not highly correlated.[7]

Related to the issue of labor efficiency is time and motion study, the creation of Frederick Taylor (the time study portion) and Frank Gilbreth (the motion study portion) from roughly a century ago.[8] Time and motion study is one of the tools of industrial

engineering and a principal means by which a labor standard can get set. While there is nothing inherently wrong with the careful (or, as Taylor would have put it, the "scientific") study of a worker's job to determine the time standard that should be attached to it, in practice, doing this well is anything but easy. Having a job "rated" is not something that workers relish and securing worker cooperation for something that might end up cutting a worker's pay can be difficult. Trying to compensate for any "dogging it" that a worker engages in can be very subjective. Moreover, unless the job has been well studied to eliminate any non-value-added movement, setting a time standard may enshrine waste in the process. Time and motion study can also lead to a concentration on the "trees" (i.e., individual jobs) and a neglect of the "forest" (i.e., whether the entire process, as conceived, is the best way to operate). Time and motion study itself is thus no panacea for productivity woes.

Efficiency measures are but the most visible of the host of problems stemming from reliance on traditional accounting systems for productivity improvement. If costs are to be reduced, pulling out the income statement or the balance sheet is almost an instinctive reaction for so many managers. Perusal of labor cost, or materials purchased, or overhead can lead to actions such as investment in automation or beating up on vendors. These won't get a company very far. Accounting is always after-the-fact. What is needed is real-time assessment of what to do and how to do it. Resist the urge to look at the accounting numbers as a source of inspiration; the answer doesn't lie there.

No. 4. Economies of scale

It is so tempting for managers in larger companies to think that their costs are low, and thus their productivity high, simply because they are large and thereby enjoy economies of scale. The fact that there are diseconomies of scale that rival the better-known economies of scale eludes them. These managers look to the fixed costs that can be spread across the significant volume